

SIGNA Voyager

Operator Manual



SIGNA Voyager
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Strong Magnetic Field



The magnet produces a strong magnetic field. The MR magnet is always on even when the system is not acquiring scan data. For details, [Security zone](#).

Figure 2-1: Security zone warning sign



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Applicable Regulations and Standards

Medical Device Directive

These products conform with the requirements of council directive 93/42/EEC concerning medical devices, when they bear the following CE Mark of Conformity. The year of CE marking given is 2016.



EAC label



Table 3-1: EAC label (CU TR 020 / 2011)

Name	Description
"Eurasian Conformity" mark; the single conformity mark for circulation of products on the markets of member states of Customs Union.	This product passed all conformity assessment (approval) procedures that correspond to the requirements of applicable technical regulations of the Customs Union.

Ukrainian mark of conformity



Authorized Representative in Malaysia

Authorized representative: GE Healthcare Sdn Bhd

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Regulatory Markings-UDI Label

Every medical device has a unique marking for identification. The UDI marking appears on the device labeling.

The following figures are only examples of a UDI marking. The device may have a linear barcode as in Example of a UDI linear barcode, or a DataMatrix code as in Example of a UDI DataMatrix code, or only alphanumeric identifiers with no barcode. Also the identifiers vary per product.

Figure 3-1: Example of a UDI linear barcode



Figure 3-2: Example of a UDI DataMatrix code



Manufacturer:

GE HEALTHCARE (TIANJIN) COMPANY LIMITED
NO.266 JINGSAN ROAD, TIANJIN AIRPORT ECONOMIC AREA,
TIANJIN, P.R.CHINA 300308

Manufacturing Site 1:

GE HEALTHCARE (TIANJIN) COMPANY LIMITED
NO.266 JINGSAN ROAD, TIANJIN AIRPORT ECONOMIC AREA,
TIANJIN, P.R.CHINA 300308

Manufacturing Site 2:

GE Healthcare Manufacturing LLC
3001 West Radio Drive
Florence, SC 29501 USA

For the specific manufacturing site for your system, please refer to the rating plate attached on your system cabinet.

Medical Device Directive

These products conform with the requirements of council directive 93/42/EEC concerning medical devices, when they bear the following CE Mark of Conformity (see coil manuals for the year of CE marking given.):



Manufacturer of compatible GE accessory MR coils

GE Healthcare Coils / USA Instruments
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This equipment generates, uses, and can radiate radio frequency energy. The equipment may cause radio frequency interference with other medical and non-medical devices and radio communications. To provide reasonable protection against such interference, the:

GE MR Systems

comply with emissions limits for (Group 2, Class A) Medical Devices as stated in IEC 60601-1-2. However, there is no guarantee that interference will not occur in a particular installation.



If this equipment is found to cause interference (which may be determined by turning the equipment on and off), the user (or qualified service personnel) should attempt to correct the problem by one or more of the following measures:

- reorient or relocate the affected devices;
- increase the separation between equipment and the affected device;
- power the equipment from a source different from that of the affected device; and/or
- consult the point of purchase or service representative for further suggestions.

The manufacturer is not responsible for any interference caused by using interconnect cables that are not recommended or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

Do not use devices that transmit RF Signals (cellular phones, transceivers, or radio controlled products) in the vicinity of this equipment as they may cause performance outside the published specifications. Keep the power to these types of devices turned off when near this equipment.

The medical staff in charge of this equipment is required to instruct technicians, patients, and other people who may be around this equipment to fully comply with the above requirement.

Immunity/Emissions Exceptions: Note the exceptions from the EMC test results. Check with the business EMC engineer for this information.

In accordance with the international safety standard IEC 60601-1, this system is:

- a Class I device



WARNING

To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

- acceptable for Continuous Operation
- having ordinary protection against ingress of water (IPX0)
- type B and BF applied parts
- is not for use in the presence of flammable anesthetics.

Equipment disposal

A WEEE passport report is available from a GE representative upon request.



CAUTION

This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

Indications for use

The SIGNA Voyager is a whole body magnetic resonance scanner designed to support high resolution, high signal-to-noise ratio, and short scan time imaging. The SIGNA Voyager is indicated for use as a diagnostic imaging device to produce axial, sagittal, coronal, and oblique images, spectroscopic images and/or spectra, dynamic images, and parametric maps of the internal structures and organs of the entire body. Body structures for evaluation include, but are not limited to: head, neck, TMJ, spine, breast, heart, abdomen, pelvis, joints, prostate, blood vessels, and musculoskeletal regions of the body. Depending on the region of interest being imaged, contrast agents may be used.

The images produced by the SIGNA Voyager reflect the spatial distribution and/or molecular environment of nuclei exhibiting magnetic resonance. These images and/or spectra when interpreted by a trained physician yield information that may assist in diagnosis.



WARNING

Read the *full prescribing information* on the contrast media label before use of contrast media. Use contrast media only in accordance with Indications and Usage as described in full prescribing information.

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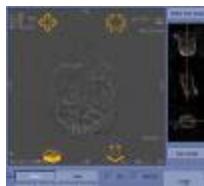
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Quick guides introduction

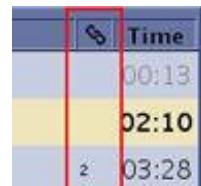
Click the icons to link to the step-by-step quick guide.



Flouro Trigger



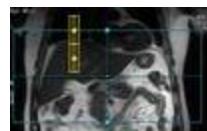
Auto Protocol Optimization



Linking



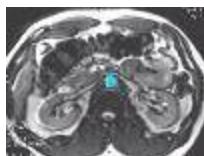
Navigator



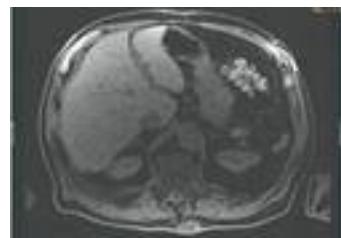
Auto Navigator Tracker placement



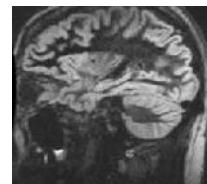
MAGiC



Smart Prep



DISCO



Cube DIR

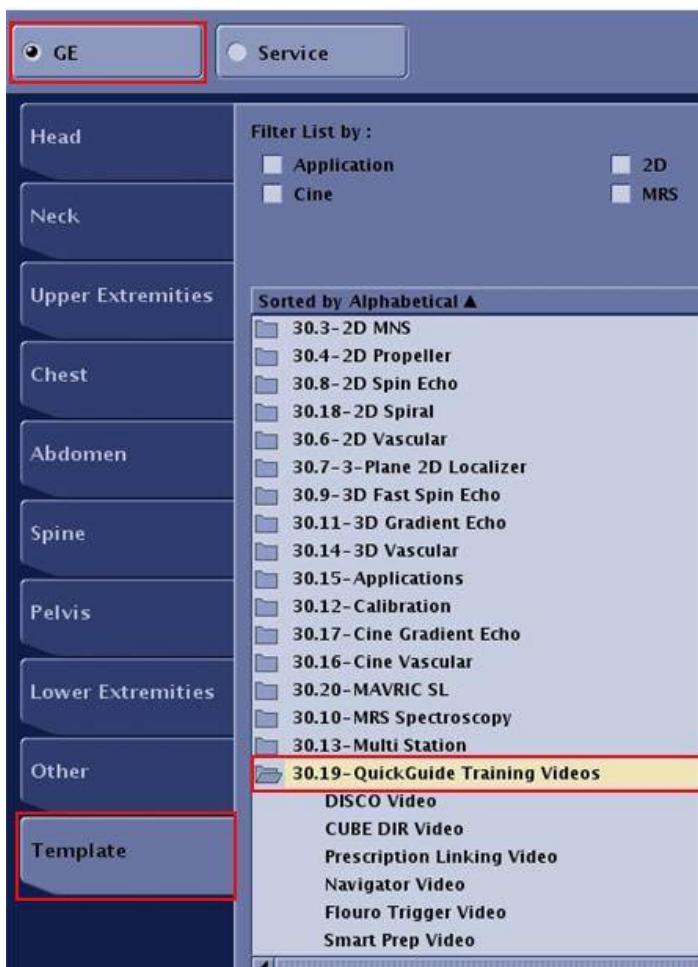
QUICK GUIDES

Access videos from MR system procedure

Use these steps to launch a video from the Protocol Notes on your MR system and to copy/paste a protocol from the GE protocol note to your own protocol note. The video series is not optimized for scanning, therefore only use the video series to launch the video.

1. To view the Protocol screen in scan, from the Workflow Manager, click **Add a task > Add a Sequence**.
2. Click **GE** to view the GE library.
3. Click the **Template** tab.
4. Click **Quick Guide Training Videos** to view the list of available videos.

Figure 5-1: Protocol screen



5. Click the desired video series.
6. Click the arrow to move the video to the multi-protocol basket.
7. Click **Accept**.
8. From the Workflow Manager, select the video series and click **Setup**.
9. Click the **Protocol Notes** tab in the lower right corner of the system screen.

10. Click the link in the Protocol Notes to launch the video.
 - The Mozilla browser opens and the video is launched. If the browser is already open, a new tab appears on the browser and the video is launched.
 - For video viewing details, see [View a movie procedure](#).
11. To copy/paste the link to your own protocol, follow these steps:
 - a. Left-click and drag the link to highlight or select it.
 - b. With the link highlighted, press **Ctrl + C** to copy the link.
 - c. Navigate to the desired protocol note.
 - d. Place the cursor in the location where you want the link and press **Ctrl + V** to paste the link.

Related topics

[Quick guides introduction](#)

QUICK GUIDES

Auto Protocol Optimization step-by-step picture guide procedure

An Auto Protocol Optimization video can be viewed from the Protocol Notes. For details, see [Access videos from MR system procedure](#).

Select a breath hold series



1. From the Workflow Manager, select a breath hold series compatible with Auto Protocol optimization.
 - 3D applications: LAVA, LAVA-Flex, Dual Echo, FRFSE with MRCP Imaging Option, IDEAL IQ, DISCO
 - 2D applications: Fast SPGR, Dual Echo, FIESTA, SSFSE, FRFSE, FSE, DWI EPI
2. Click **Setup**.

Setup graphic Rx scan locations



1. From the Scan Parameter's screen, click **GRx**.
2. Setup the scan locations on the localizer images.

Setup Auto Protocol Optimization

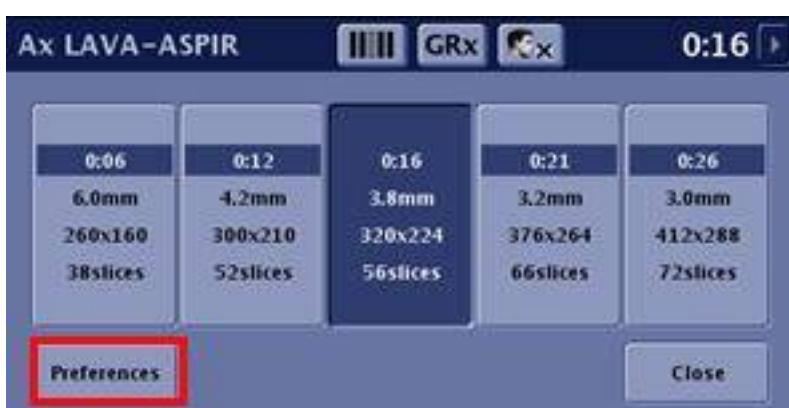


1. From the Scan Parameter screen, click **Auto Protocol Optimization** icon.

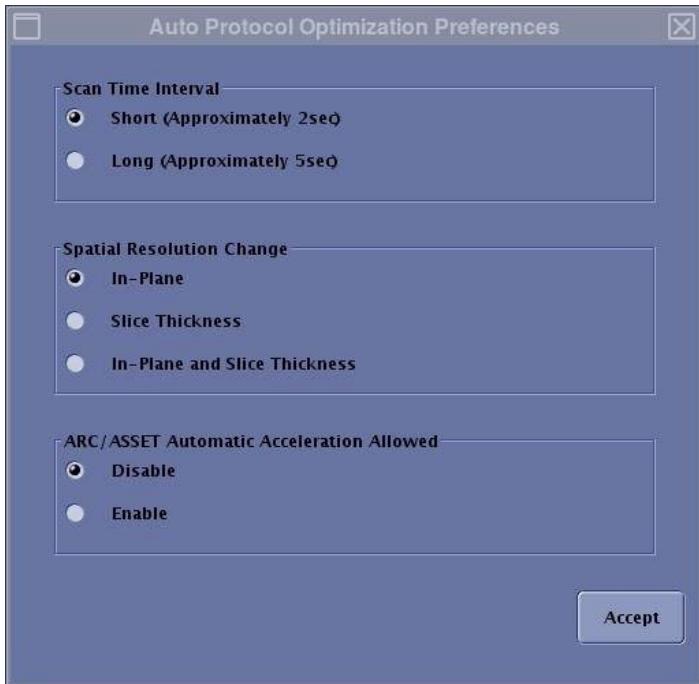
- The button is activated once all parameters are filled and **Save Rx** button is activated.
 - The scan time or breath hold time must be less than 30 seconds before the button is activated.
 - Base conditions that enable Auto Protocol Optimization, please see operator manual in details.
- From the Auto Protocol Optimization screen, review the content of each button and click the option that best meets the clinical needs.
 - The middle button represents the original parameters of the protocol.
 - The buttons left of center represent shorter scan time protocol.
 - The buttons right of center represent longer scan time protocol.
 - Click the Auto Protocol Optimization button that best meets the clinical needs.
 - Optional: Click **Close** to check which scan parameters have changed based on your Auto Protocol.
 - Click **Save Rx > Scan**.

Optional: Auto Protocol Optimization Preferences

Prior to scanning the series, consider viewing the Auto Protocol Optimization Preferences.



- From the Auto Protocol Optimization screen, click **Preferences**.



2. From the Protocol Optimization Preferences screen, select the best rules to create the protocols.
 - **Scan time interval:** determines the differences in scan time or breath hold time between the optimized buttons.
 - **Spatial Resolution Change:** Slice Thickness, Spacing, and number of slices from the original protocol are kept on each button when In-Plane is selected. Frequency and Phase Matrix are kept when Slice Thickness is selected. All of those parameters will be modified when In-Plane and Slice Thickness is selected
 - **ARC/ASSET Automatic Acceleration Allowed:** When Disable is selected, the system does not control acceleration factor. When Enable is selected, the system controls the Acceleration factor.
3. Click **Accept** to close the Protocol Optimization Preferences screen.
 - The selections are kept as a part of the protocol information when the protocol is saved.

For more information about Auto Protocol Optimization, see [Auto Protocol Optimization procedure](#).

QUICK GUIDES

Cube DIR step-by-step picture guide procedure

A Cube DIR video can be viewed from the Protocol Notes. For details, see [Access videos from MR system procedure](#).

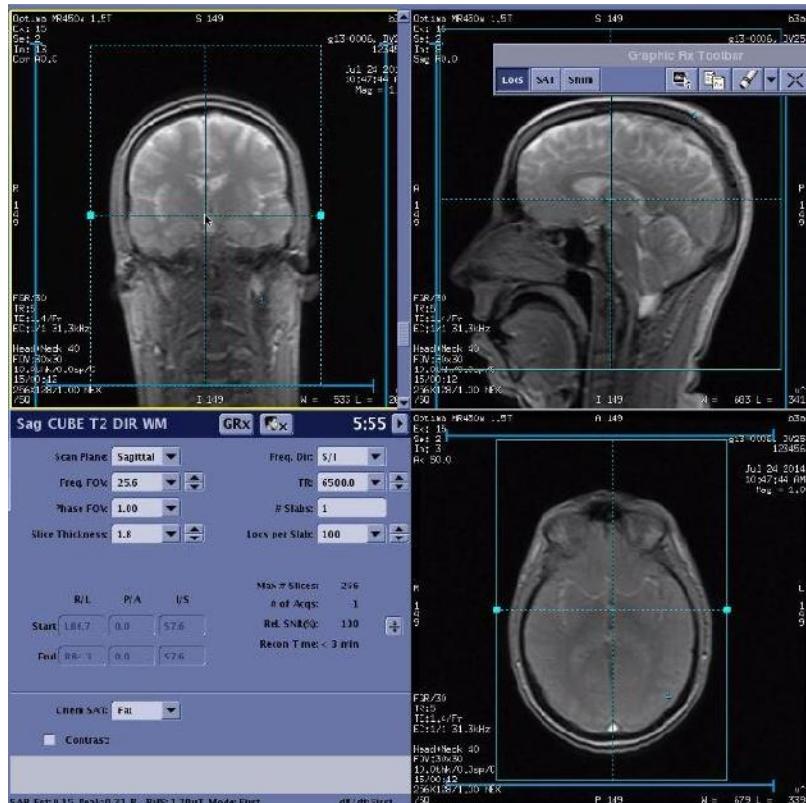
Select Cube DIR



1. Select Cube T2 DIR on the Task.
2. Click **Setup**.

Position 3D slab

Position the 3D slab over the localizer images.



Adjust values

1. To view additional tabs, click the *arrow in the upper right corner*



2. Click the **Advanced** tab.



- Use **Fat Saturation Efficiency** to control the amount of fat that is saturated when either Fat SAT or Classic Fat SAT are selected from the Scan Parameters area.

3. Click the **Details** tab.



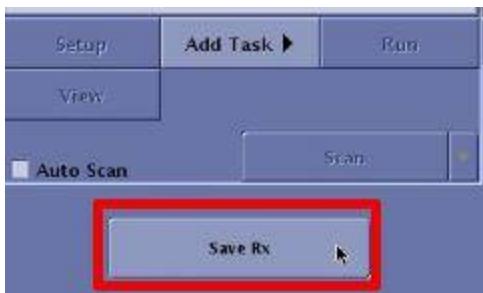
Cube DIR applies inversion recovery pulses to achieve signal suppression from two different tissues. There are three IR¹ scan parameters on the Details screen.

- **Tissue T1** options: White Matter, Grey Matter or a number you enter in the text field.
- **Inv. Time**: Enter a value or select **Auto** to suppress CSF.
- **TI2**: enter a value to suppress the second tissue.

¹Inversion Recovery

Save and Scan

1. Click **Save Rx**.



2. Click **Scan**.



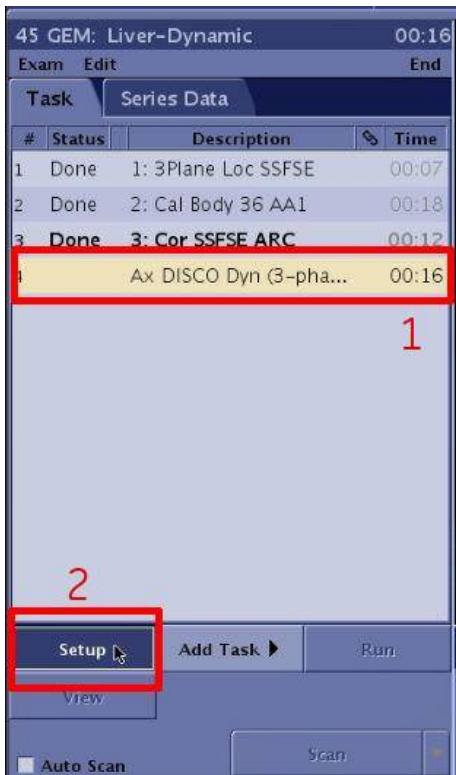
For more information about Cube DIR, see [Cube DIR considerations](#).

QUICK GUIDES

DISCO step-by-step picture guide procedure

A DISCO video can be viewed from the Protocol Notes. For details, see [Access videos from MR system procedure](#).

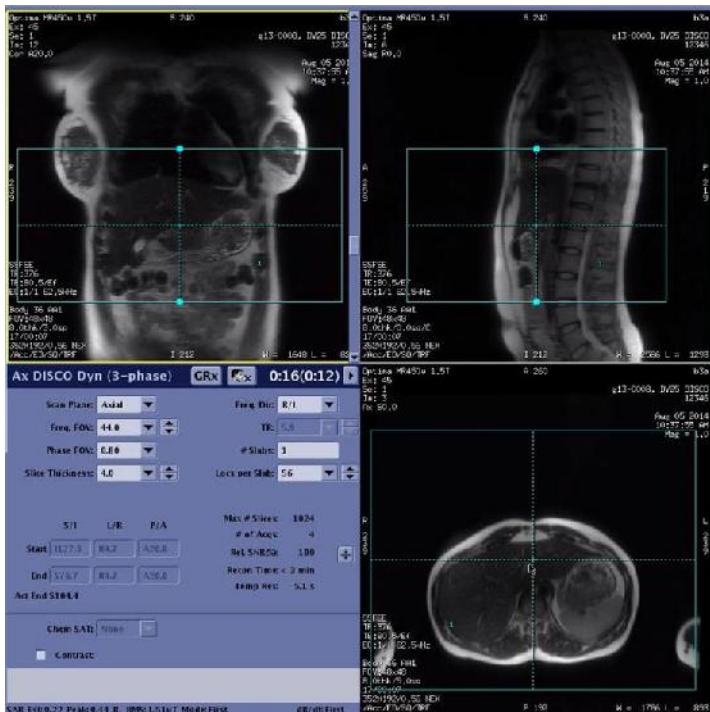
Select series



1. From the Task tab, select a DISCO series.
2. Click Setup.

Position 3D slab

Position the 3D slab over the localizer images.

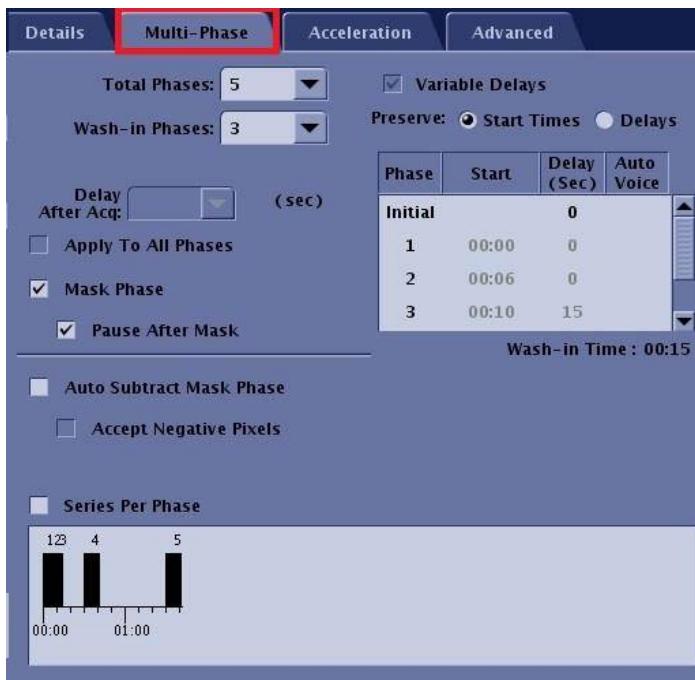


Define and check parameters

1. To view additional tabs, click *arrow in the upper right corner*

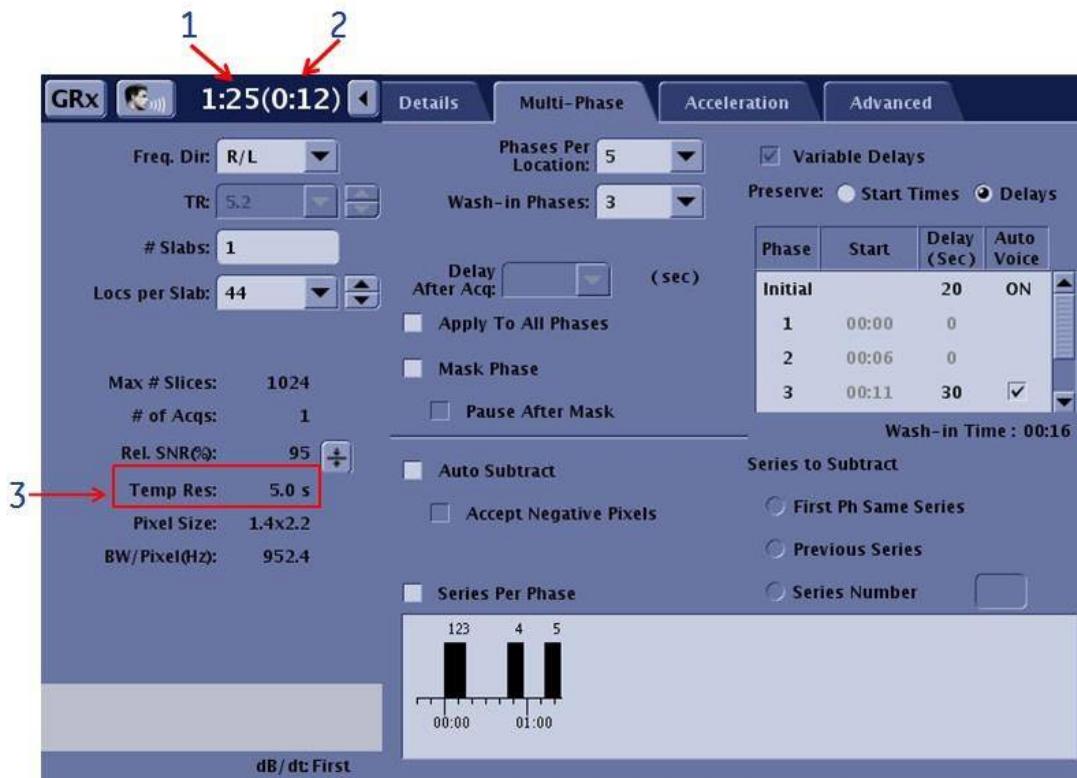


2. Click the **Multi-Phase** and make selections.



- The **Total Phases** value does not include the mask phase.
- The number of **Wash-in Phases** are the phases from the time of injection to the completion of contrast uptake in the area of interest.
- Variable Delays** is forced On for DISCO.
- Preserve** options determine if the start time is kept or the delay time is kept for each phase when the scan time is changed.
- Select **Mask Phase** to create a mask phase and select **Pause after Mask** to pause the scan after the mask phase.
- If desired, click the **Series Per Phase** option to generate each phase in a separate series.

3. Note the time and temporal resolution.

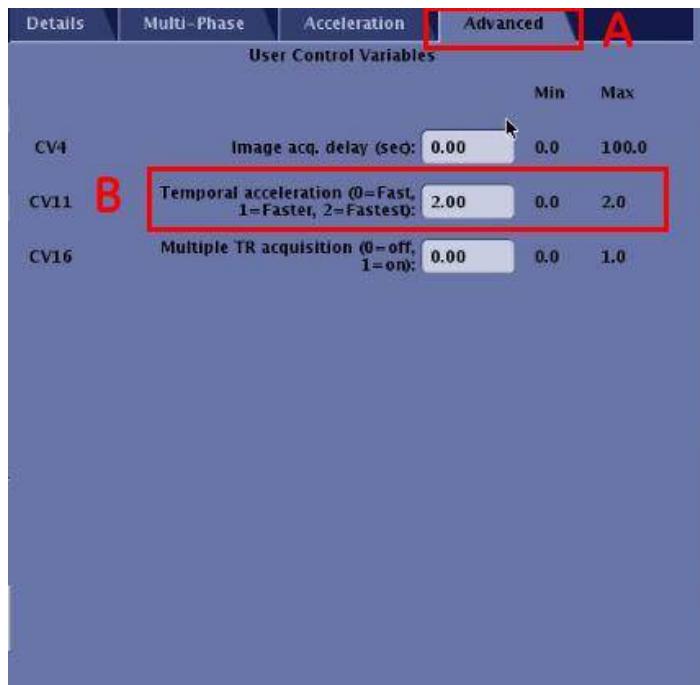


- The first time (1) is the total time excluding Mask.
- The second time (2) is the duration for Mask or non-wash-in phases.
- Temp Res (3) is the temporal resolution for wash-in phases.

4. A-Click the **Advanced** tab.

B- Enter a value for Fast, Faster, or Fastest to adjust the scan time or temporal resolution.

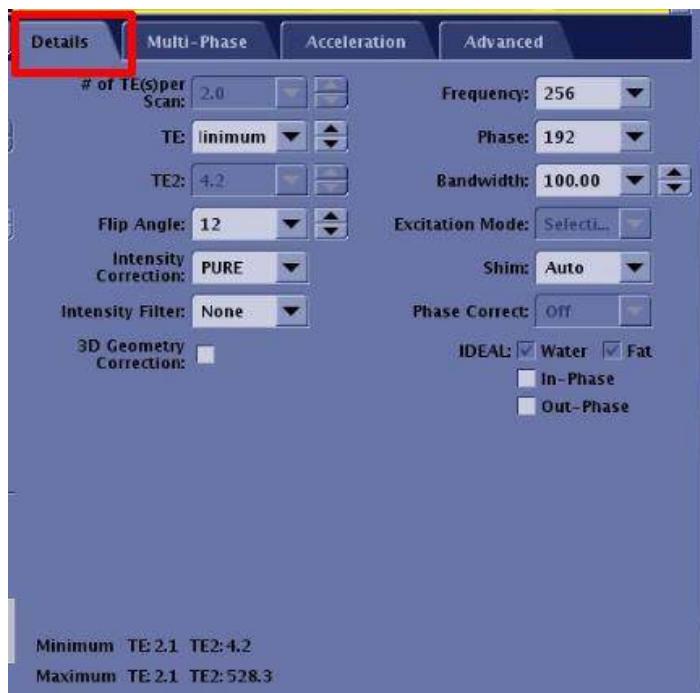
Figure 5-2: Example of User CV Advanced tab



- The Temp Res is how fast each phase is acquired.



5. Click the **Details** tab and confirm that protocol scan parameters are correct.

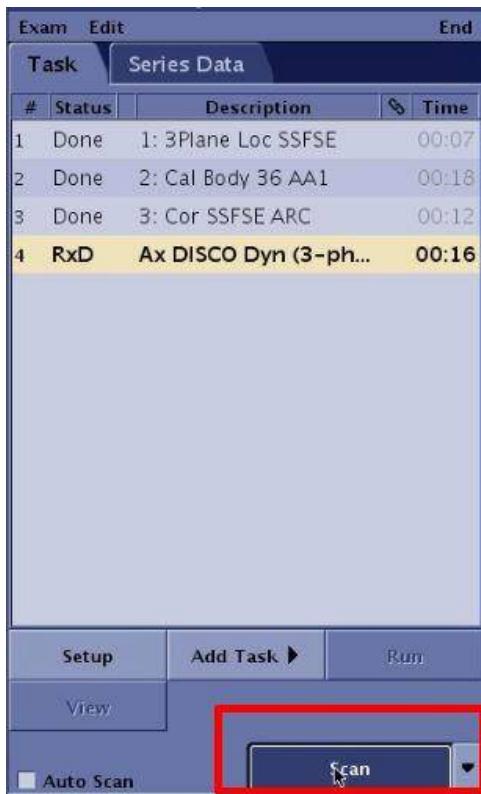
Figure 5-3: Example of Details tab

Save and Scan

1. Click **Save Rx**.



2. Click **Scan**.



3. Observe the Auto View scan time countdown as each phase is collected.

- A - Mask phase is acquired.
- B - Scanner pauses
- C - Dynamic series is acquired



For more information about DISCO, see [Acquire a DISCO scan](#).

QUICK GUIDES

MAGiC post process step-by-step picture guide procedure

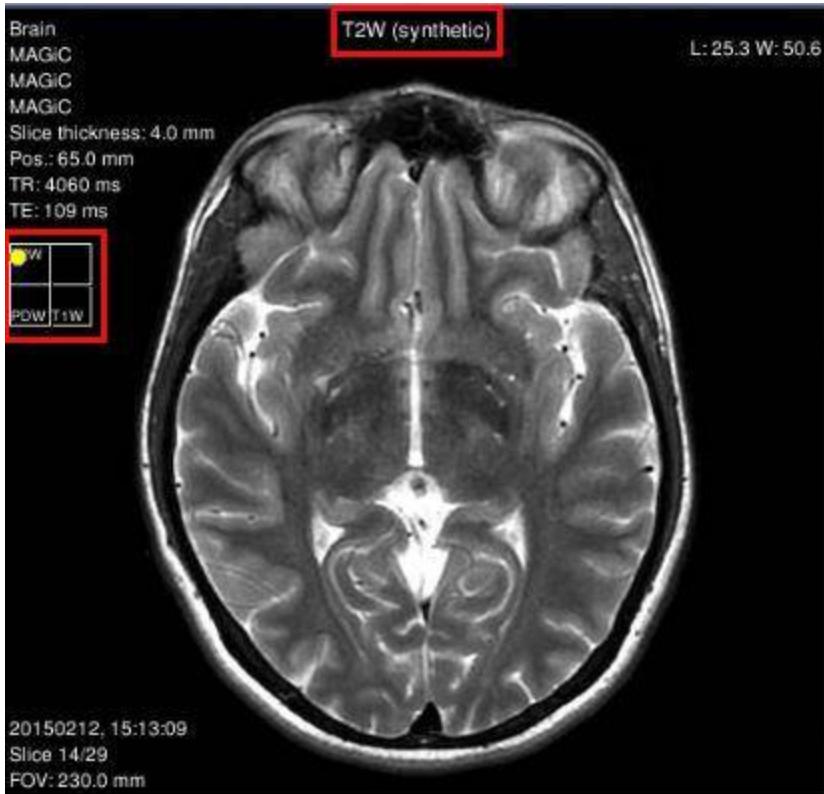
A Magic post process video can be viewed from the Protocol Notes. For details, see [Access videos from MR system procedure](#).

Launch MAGiC post process application

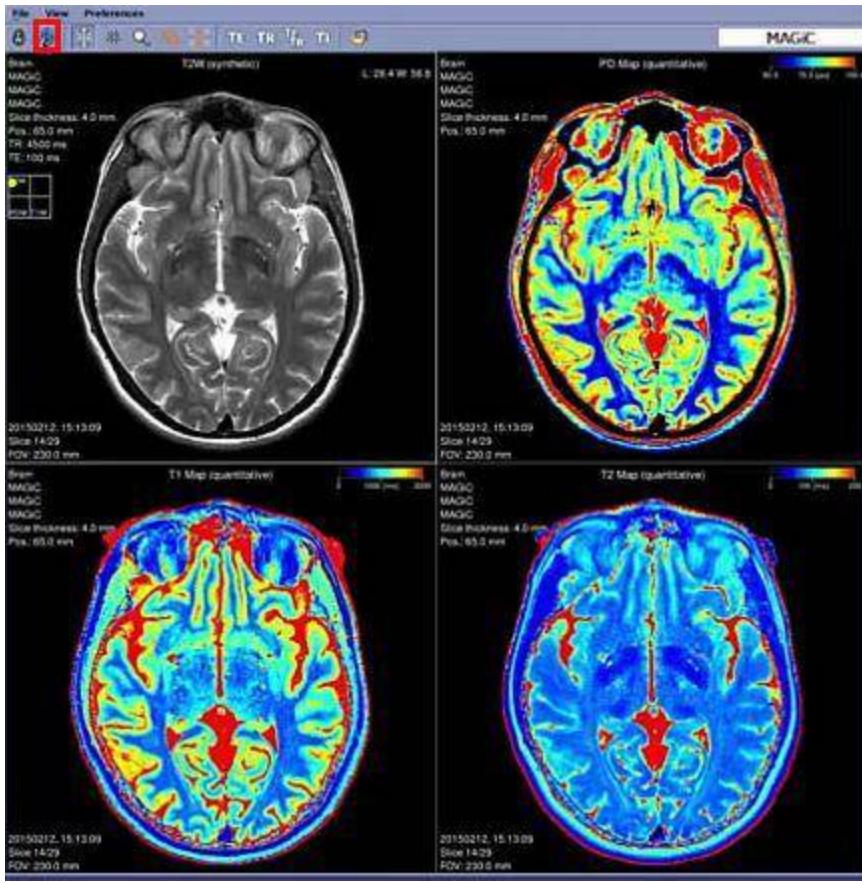


1. From the Patient List, select a prospective **MAGiC series** or **QMaps series**.
2. From the Session Apps list, click **MAGIC**.

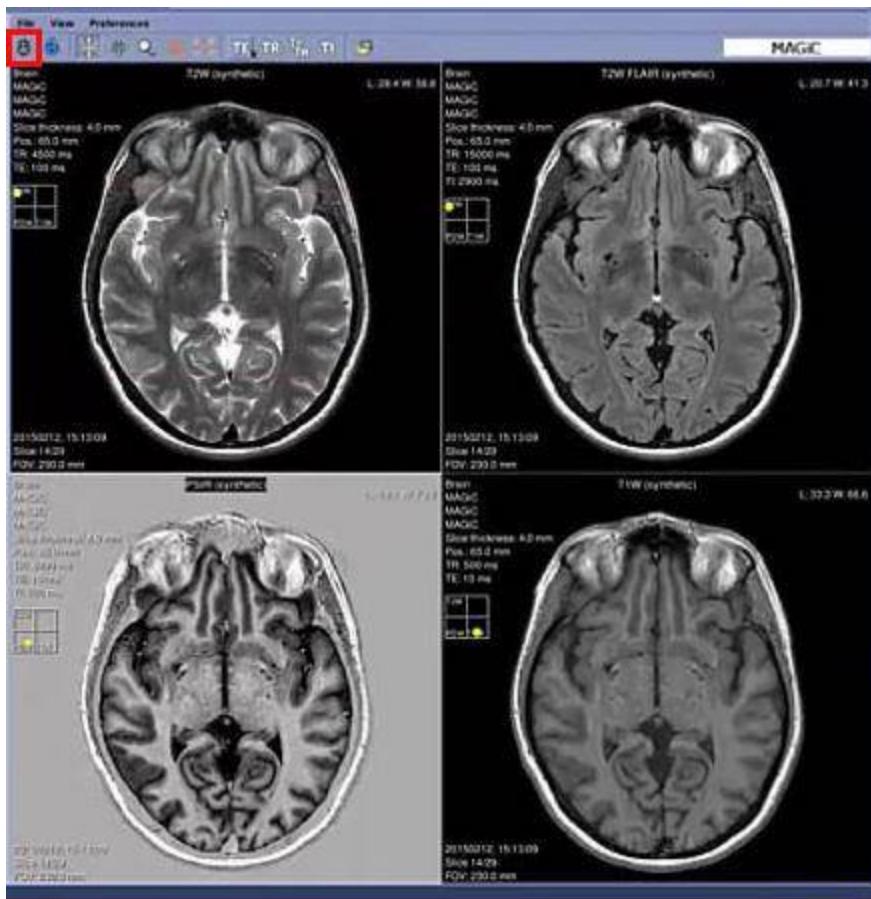
MAGiC review session



1. From the MAGiC review session, note the Contrast navigation window that indicates the image contrast weight: T1-weighted, T2-weighted or PD-weighted contrast.



2. Click the **Quantification Layout icon**  to change the viewports to display T1-map, T2-map, PD-map, and T2W synthetic contrast weighted images.



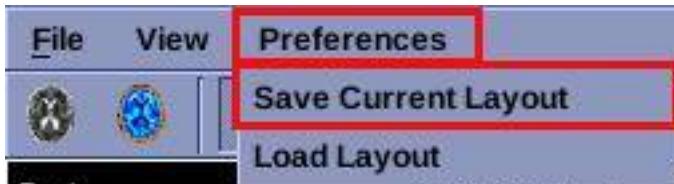
3. Click the **Contrast Layout icon** to change the viewports to display MAGiC contrast weighted images.

Manipulate MAGiC images

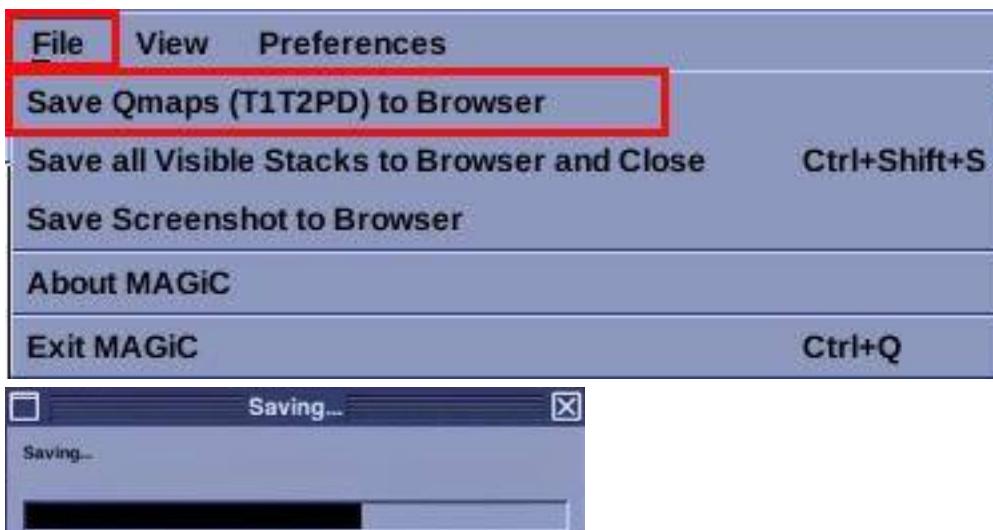


1. Click the **TE icon**  and left-click and drag to adjust the TE.
2. Click the **TR icon**  and left-click and drag to adjust the TR.
3. Click the **TE/TR icon**  and left-click and drag to adjust the TE and TR simultaneously.
4. Click the **TI icon**  and left-click and drag to adjust the TI.
5. Click the **TI/TI icon**  to simultaneously adjust TI and TI2, left-click and drag horizontally to adjust TI vertically to adjust TI2.

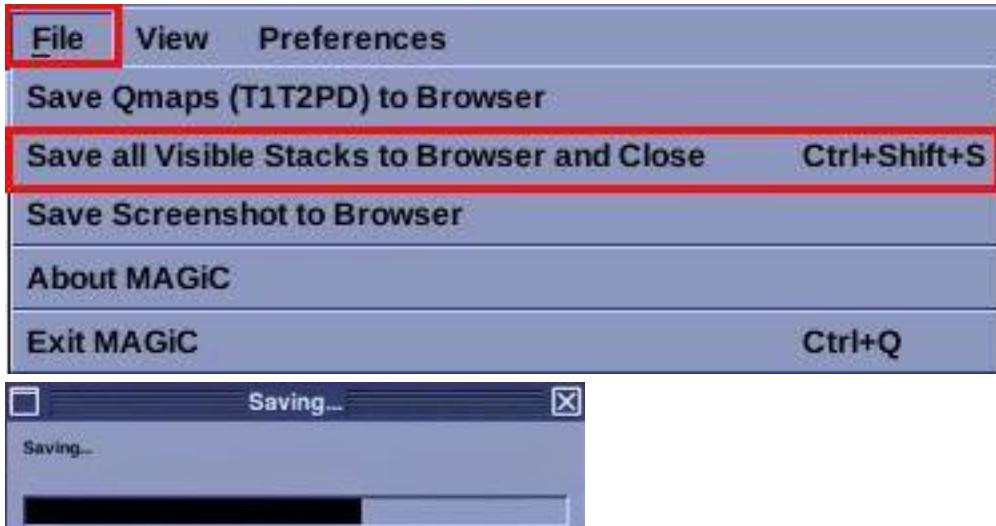
Save procedures



1. From the menu bar, click **Preferences > Save Current Layout** to save the layout for future viewing.

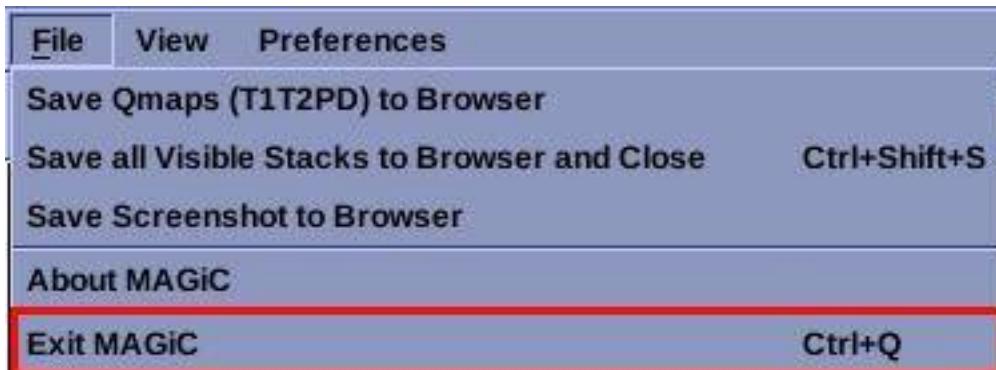


2. From the menu bar, click ***File > Save Qmaps (T1T2PD) to Browser*** to save the quantitative maps in a DICOM format to the patient list.
 - A bar displays indicating the save progress.



3. From the menu bar, click ***File > Save all Visible Stacks to Browser and Close***.
 - All visible viewports with synthetic image series are saved in DICOM format to the patient list and then the MAGiC post process screen closes.
 - A bar displays indicating the save progress.

Exit MAGiC post processing



1. From the menu bar, click ***File > Exit MAGiC***.

For more information about MAGiC, see:

- [MAGiC: scan procedure](#)
- [MAGiC post process procedure](#)
- [MAGiC post process icon procedures](#)
- [MAGiC post process menu considerations](#)
- [MAGiC: post process right-click procedures](#)

QUICK GUIDES

Fluoro Trigger step-by-step picture guide procedure

A Fluoro Trigger video can be viewed from the Protocol Notes. For details, see [Access videos from MR system procedure](#).

Open Fluoro Trigger

Position the 3D slab over the area of interest. In this example, the slab is oriented to the aorta in the sagittal plane.



1. Click on *Imaging Options*.
2. Select *Fluoro Trigger*.
3. Click *Accept*.

Set User Control Variables

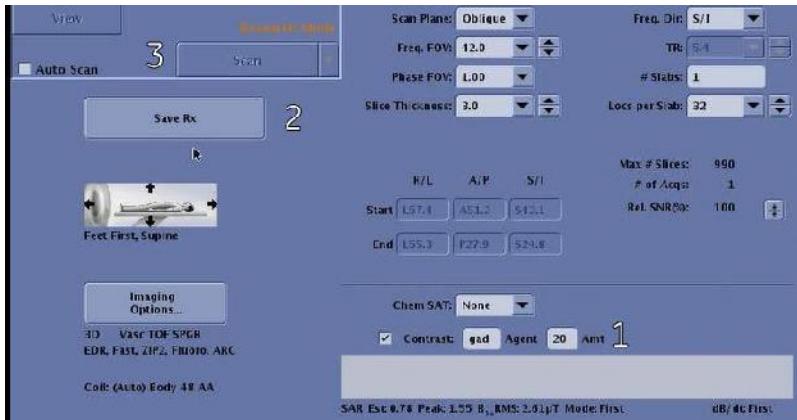


1. To view additional tabs, click the *arrow in the upper right corner*



2. Click **Advanced** tab.
3. Set image acquisition delay. This time may be used to give the patient breathing instructions.
4. K space filling options are user CV11 through CV14. Parameters depend on the anatomy to be scanned.

Contrast, Save, Scan



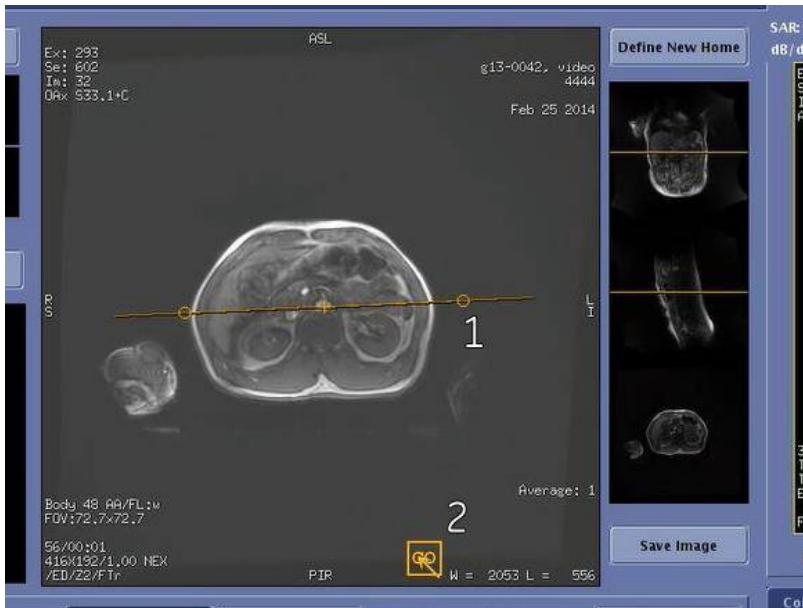
1. Enter contrast amount used.
2. Click **Save Rx**.
3. Click **Scan**.

Define aorta

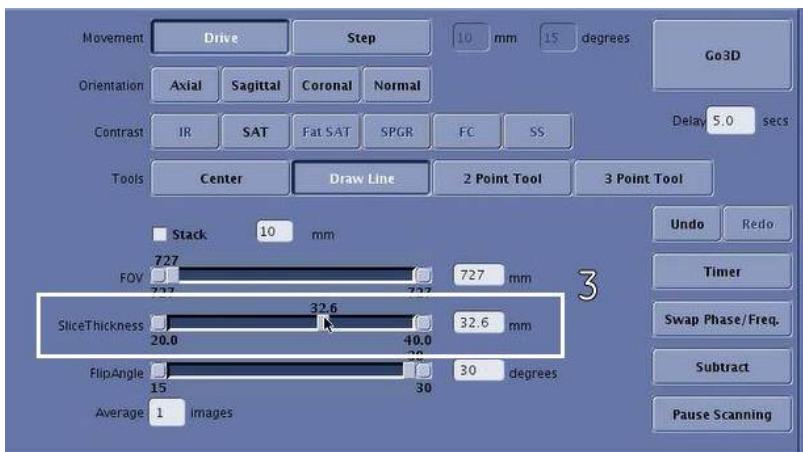
Click **Draw Line**. Prescribe a cut plane by drawing a line on the image that becomes that plane.



1. Place the line across the center of the aorta.
2. Click **GO**.



3. Adjust the slice thickness to better visualize the vessel.



Visualize Contrast



1. Click **Subtract** to eliminate background tissue and view contrast arrival more robustly.
2. Once contrast is visualized, click **Go3D**. If an image acquisition delay has been specified, the scanner will become quiet for that duration of time. The image acquisition delay can be changed on the fly in the Fluoro Trigger screen.

For more information about Fluoro Trigger, see [Acquire a Real Time scan with Fluoro Trigger](#).

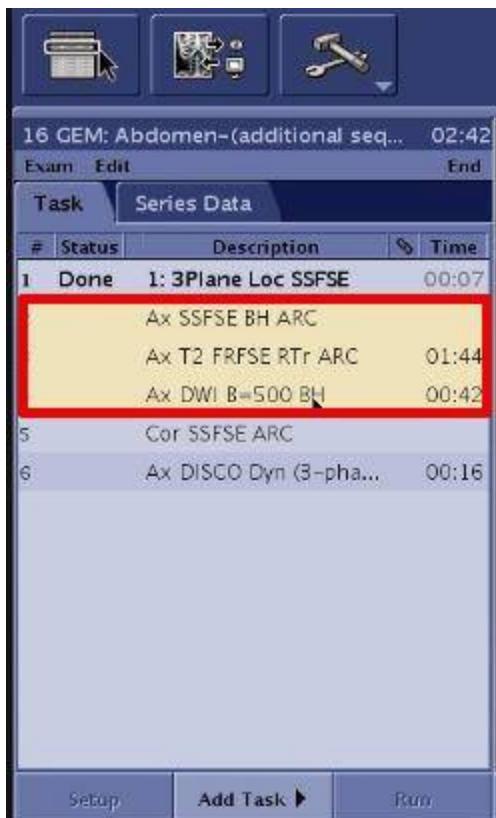
QUICK GUIDES

Linking step-by-step picture guide procedure

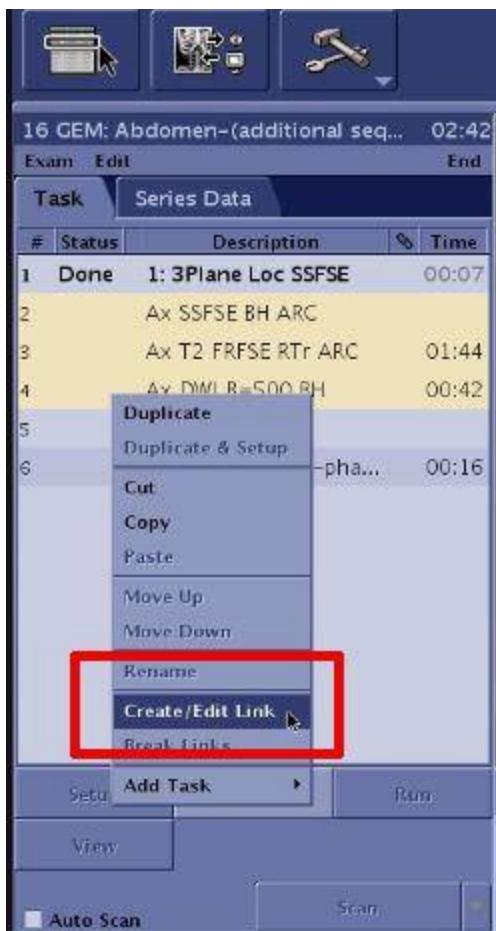
An Linking video can be viewed from the Protocol Notes. For details, see [Access videos from MR system procedure](#).

Select series to link

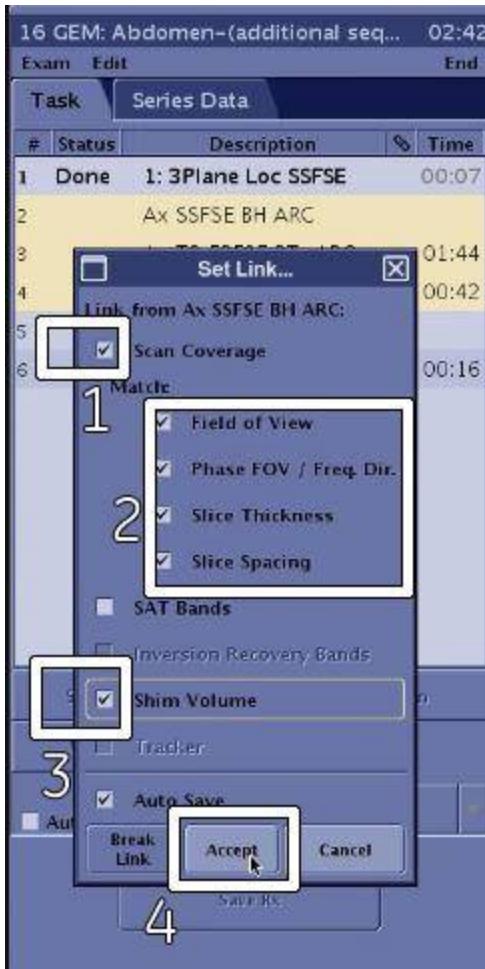
1. From the Task tab, select the series you want to link.



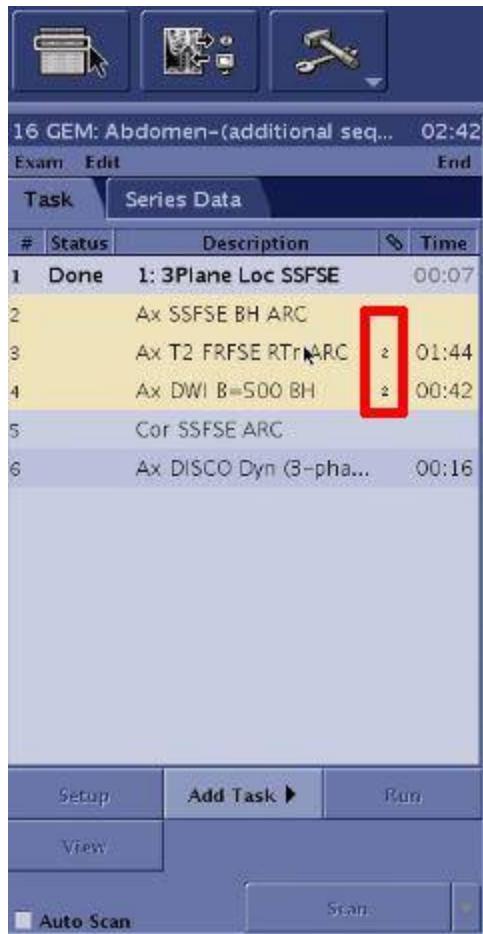
2. From the Task tab, right click and select **Create/Edit Link**.



Establish parameters to be linked

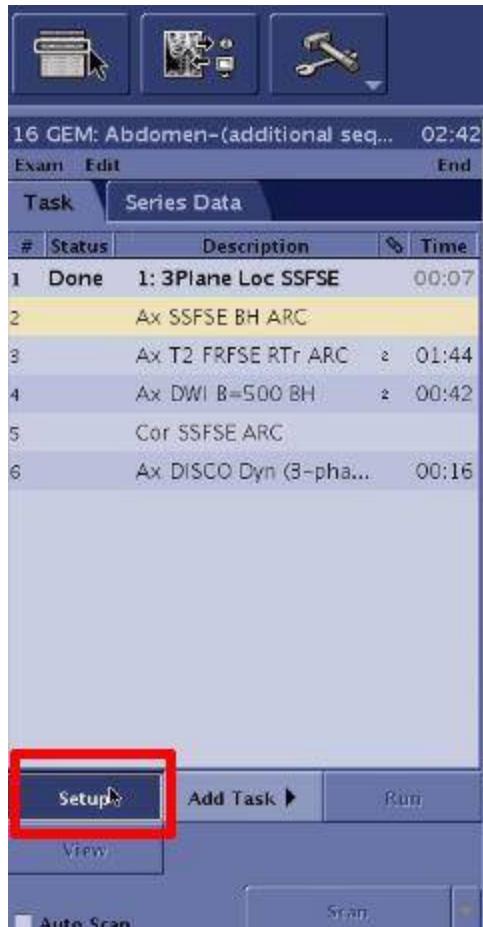


1. Check the **Scan Coverage** box
2. Check the boxes next to the parameters you want to match.
3. Check the **Shim Volume** box.
4. Click **Accept**.
5. The series to which the original series is linked appear in the chain link column.

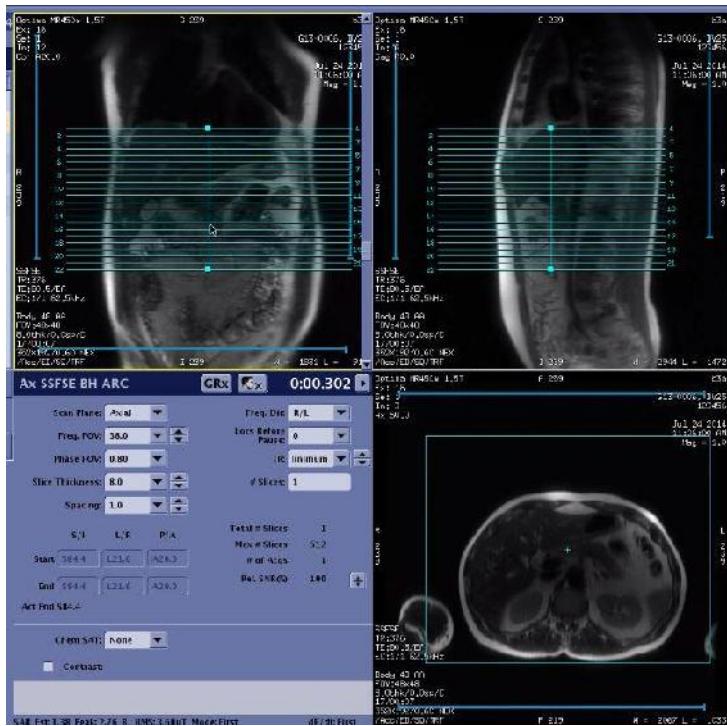


Setup links and scan

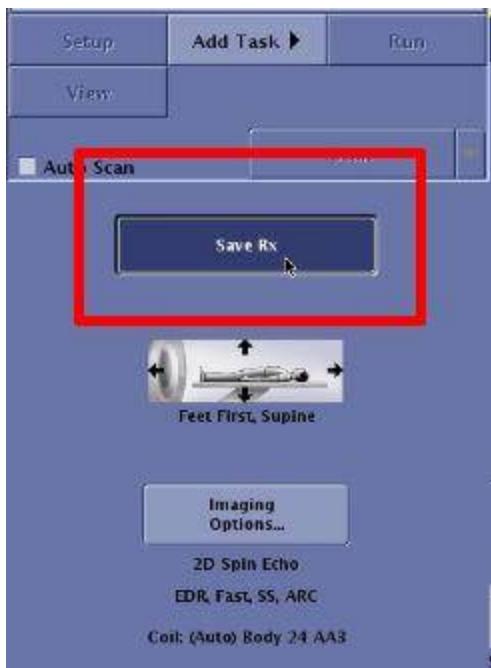
1. Click **Setup**.



2. Define slice locations and number of slices.



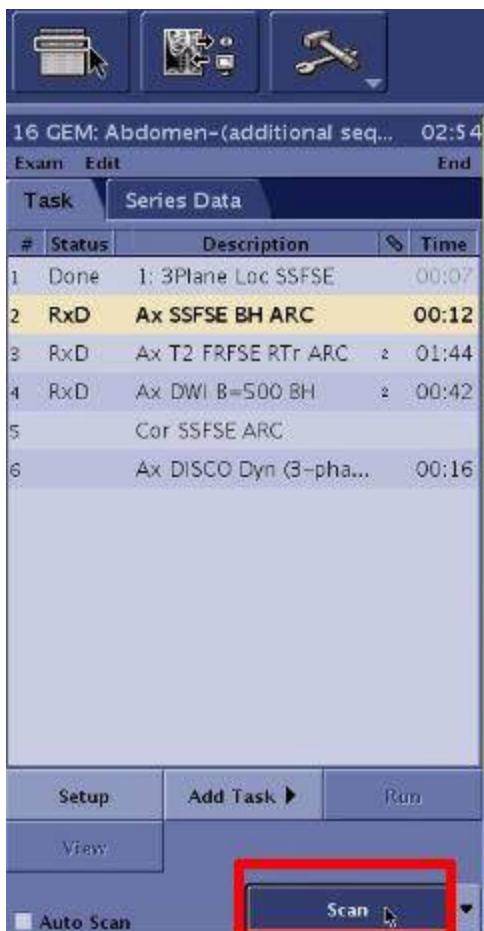
3. Click Save Rx.



4. Note progress bar. When progress bar completes, series are in RxD state.



5. Click **Scan**.



For more information about Linking, see [Link series procedure](#).

QUICK GUIDES

Auto Navigator Tracker step-by-step picture guide procedure

An Auto Navigator Tracker video can be viewed from the Protocol Notes. For details, see [Access videos from MR system procedure](#).

Select a localizer task



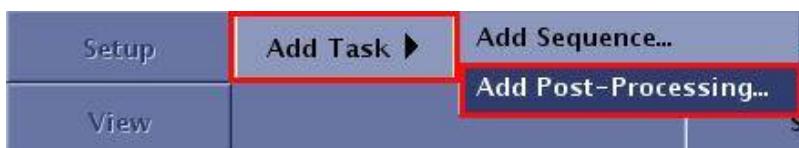
1. From the Workflow Manager, select a 3 Plane Localizer SSFSE task that you want to use with Auto Navigator Tracker.
2. Click **Setup**.

Select a localizer Breath Hold option

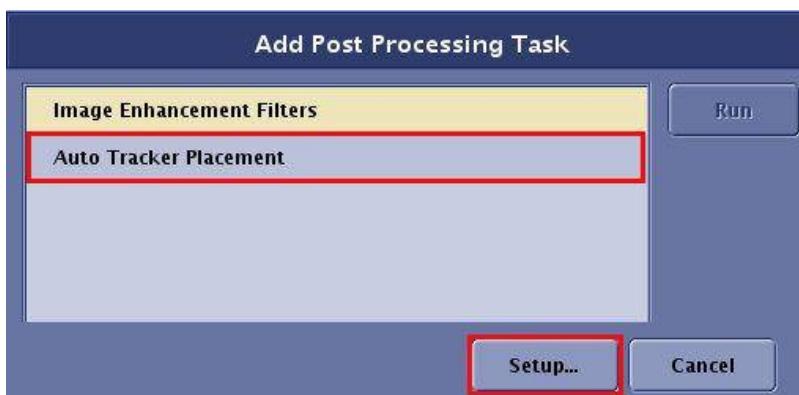


1. From the SSFSE Localizer scan parameter screen, select a **Breath Hold** option that will match the Localizer scan.
 - When Auto Voice is turned on, the Breath Hold box automatically fills and becomes grayed out.

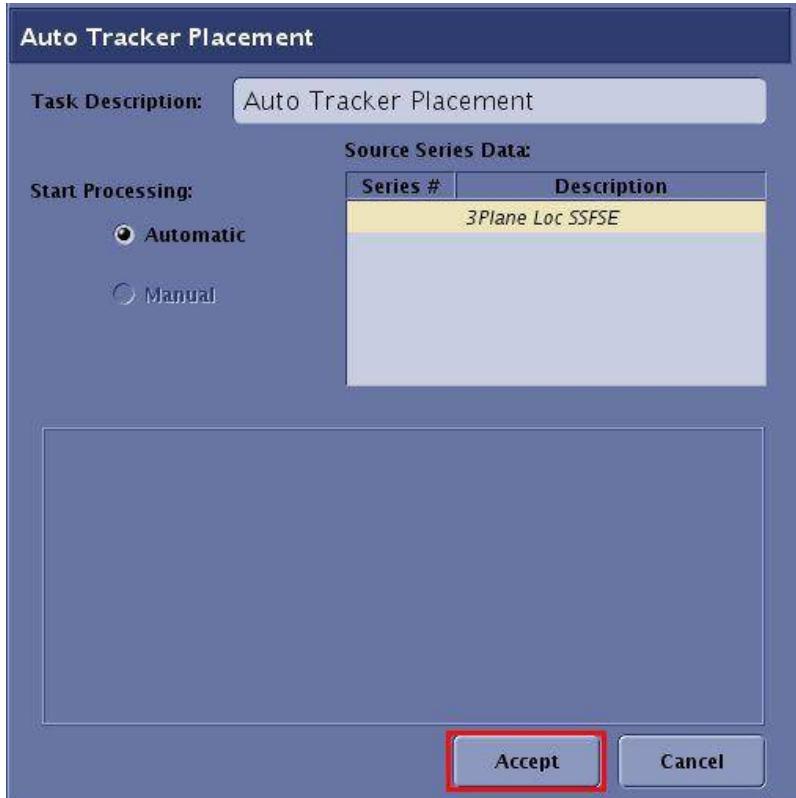
Select Post Processing



1. From the Workflow Manager, click **Add Task > Add Post Processing**.

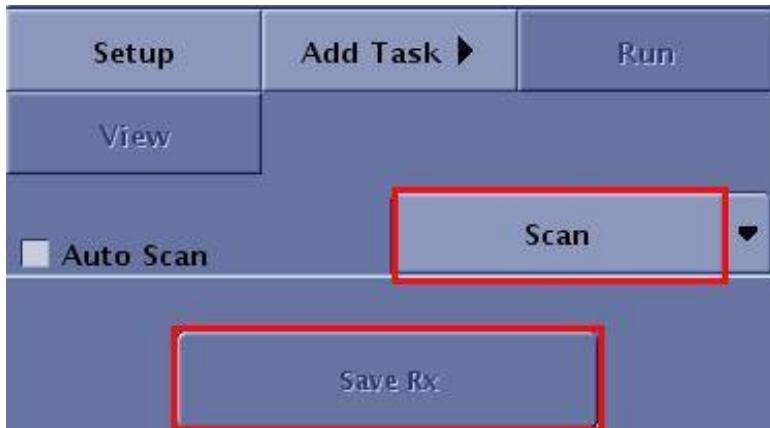


2. From the Post Processing Task screen,
 - a. Click **Auto Tracker Placement**.
 - b. Click **Setup**.



3. From the Auto Tracker Placement screen, click **Accept**.

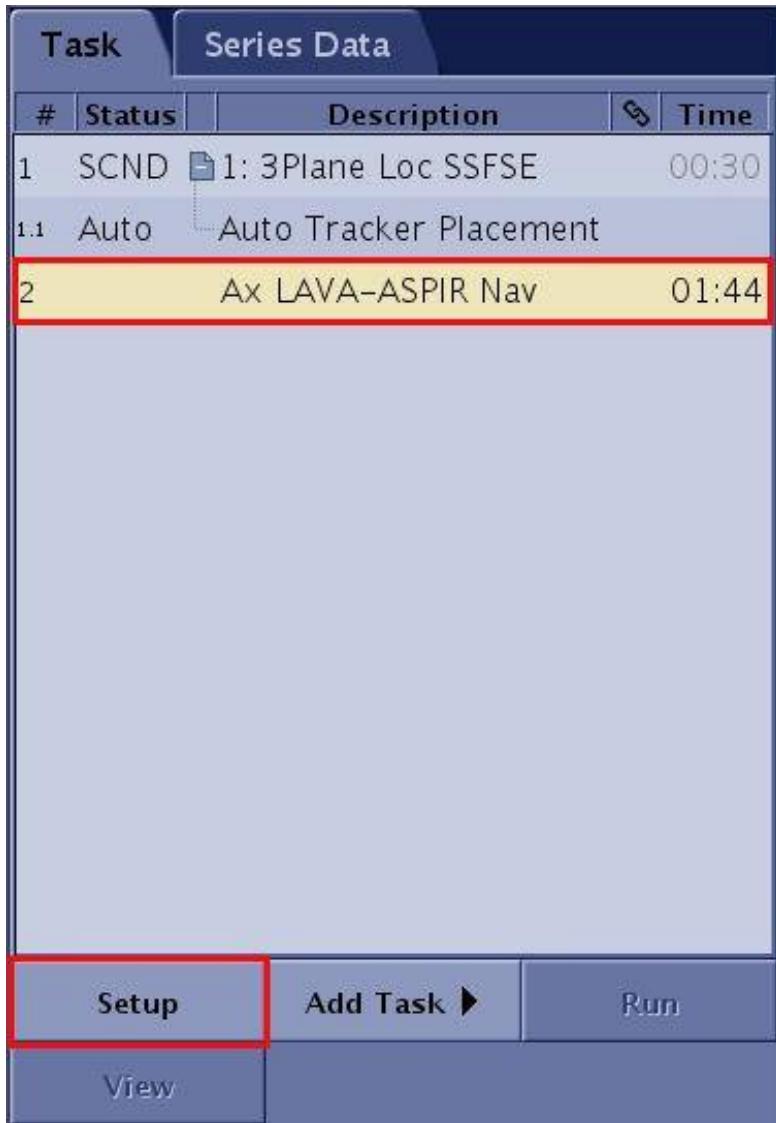
Save and Start localizer scan



From the Workflow Manager, click **Save Rx > Scan**.

- When the scan is finished, Auto Tracker Placement is automatically started

Setup a Navigator scan



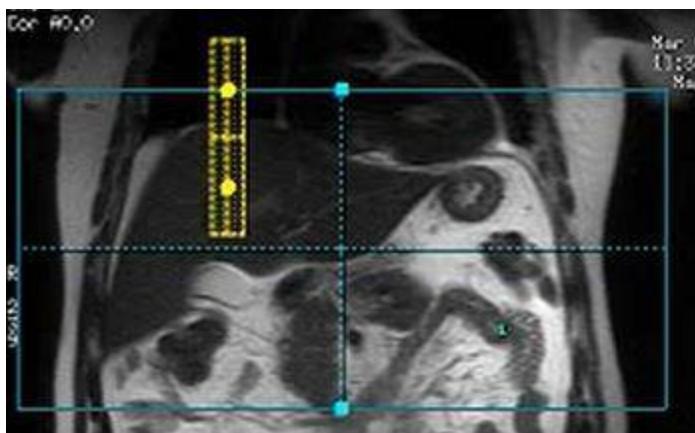
1. From the Workflow Manager, select a Navigator task.
2. Click **Setup**.



3. From the Scan parameters screen click **GRx** and setup the scan locations.

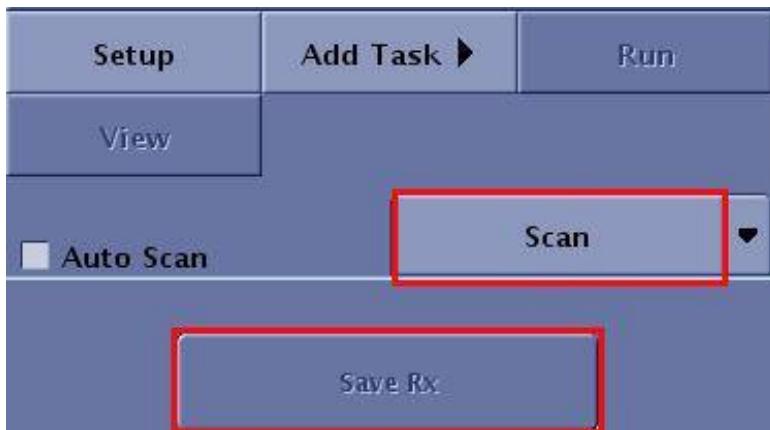


4. From the GRx toolbar:
 - a. Click **Tracker**.
 - b. Click the **Auto Tracker** option and note the location of the tracker on the coronal localizer image.



- Optional: if desired, click **Hide tracker** option to toggle the tracker on/off the localizer image.

Save and start the scan



From the Workflow Manager, click **Save Rx > Scan**.

For more information about Navigator, see:

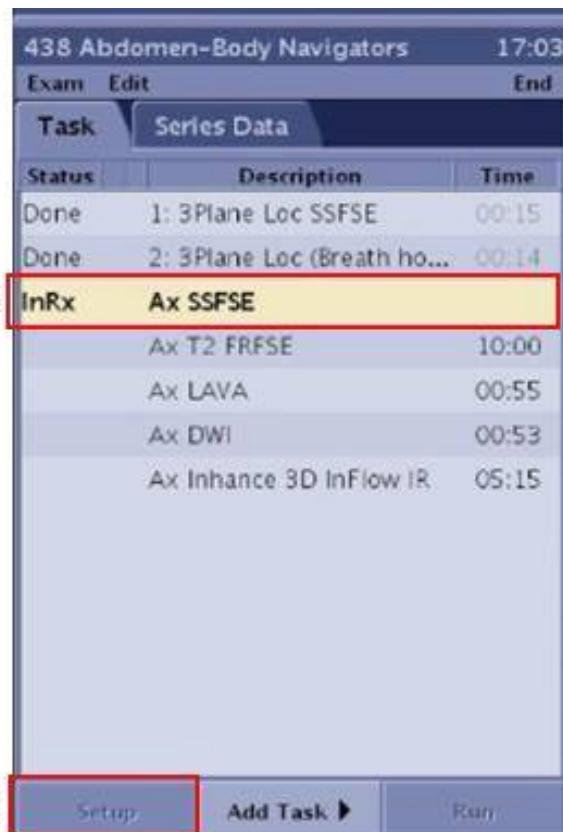
- [Auto Navigator tracker placement procedure](#)
- [Navigator considerations](#)
- [Acquire a body Navigator scan](#)
- [Acquire a coronary Navigator scan](#)

QUICK GUIDES

Navigator step-by-step picture guide procedure

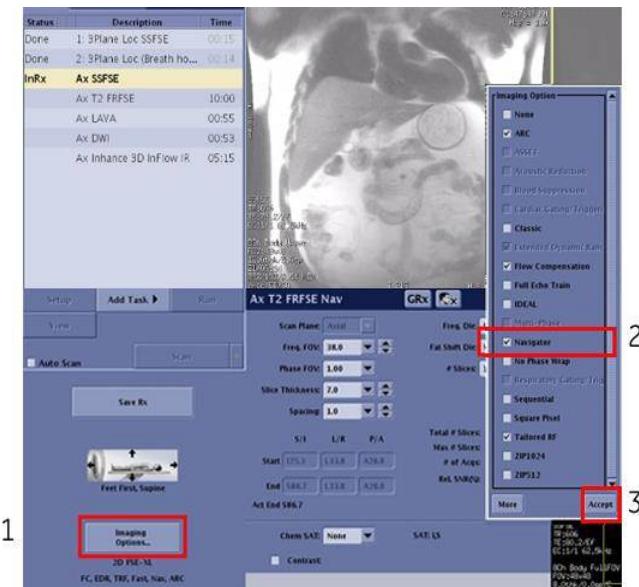
A Navigator video can be viewed from the Protocol Notes. For details, see [Access videos from MR system procedure](#).

Select a task



1. From the Workflow Manager, select a task that you want to use with Navigator.
2. Click **Setup**.

Select Navigator



1. Click ***Imaging Options***.
2. Click ***Navigator***.
3. Click ***Accept***.

Select the Tracker GRx tool

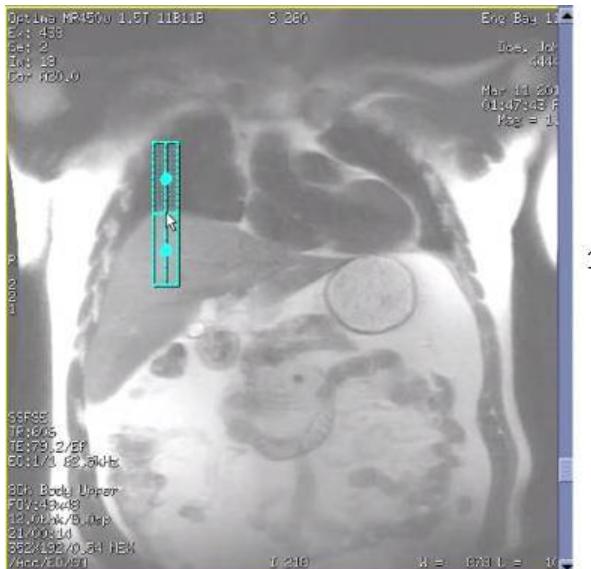
From the Graphic Rx toolbar, click ***Tracker***.



Position the Tracker

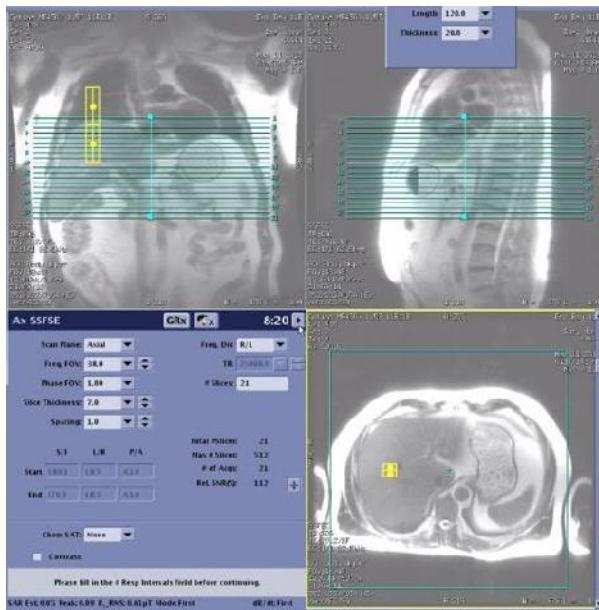
Use a breathhold localizer acquired at expiration.

1. From the coronal image, place the tracker on the dome of the liver.
2. From the axial image, place the tracker in the middle of the liver in the anterior/posterior direction.

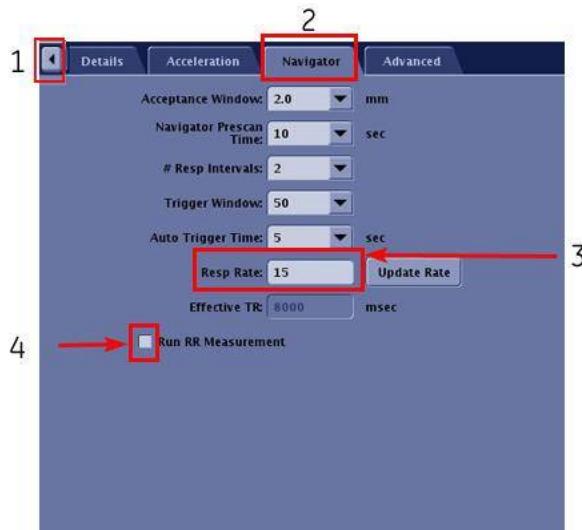


Deposit slices

Place the cursor on the image and click to deposit the Graphic Rx lines.



Define the Navigator parameters



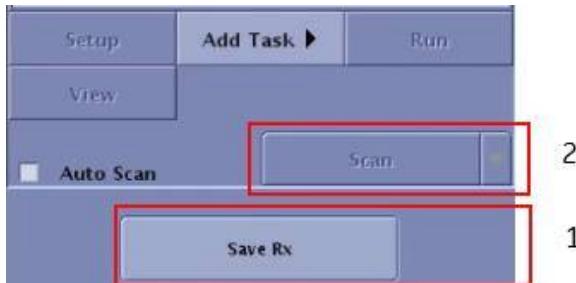
1. To view additional tabs, click the *arrow in the upper right corner*



2. Click the ***Navigator*** tab.

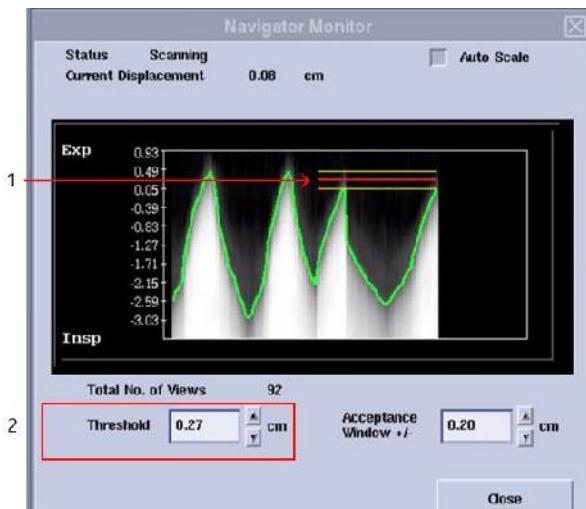
3. Enter a Resp Rate value if the bellows are not in use.
 4. Run RR measurement tool to find the correct respiratory rate for each patient.
-

Scan



1. Click **Save Rx**.
 2. Click **Scan**.
-

Observe/adjust Waveform



1. Observe the respiratory waveform to see if the peak expiration occurs at the red threshold line.
2. Adjust the threshold as needed.

View images

View images as they appear in AutoView area.



For more information about Navigator, see:

- [Navigator considerations](#)
- [Acquire a body Navigator scan](#)
- [Acquire a coronary Navigator scan](#)

QUICK GUIDES

SmartPrep step-by-step picture guide procedure

A SmartPrep video can be viewed from the Protocol Notes. For details, see [Access videos from MR system procedure](#).

Open Tracker



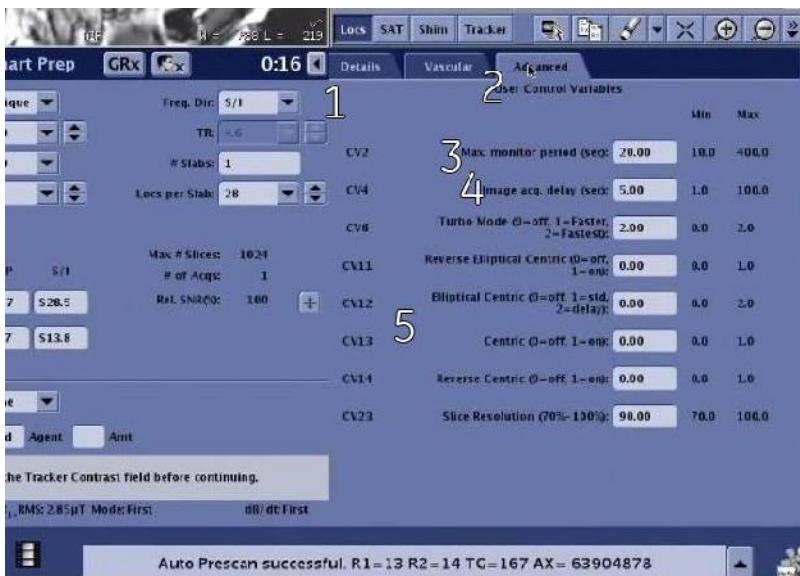
1. From the Graphic Rx Toolbar, click **Tracker**.
2. Set Tracker size to 20.0 by 20.0.

Position Tracker

Place Tracker in the center of the vessel.



Set User Control Variables



1. To view additional tabs, click the *arrow in the upper right corner*

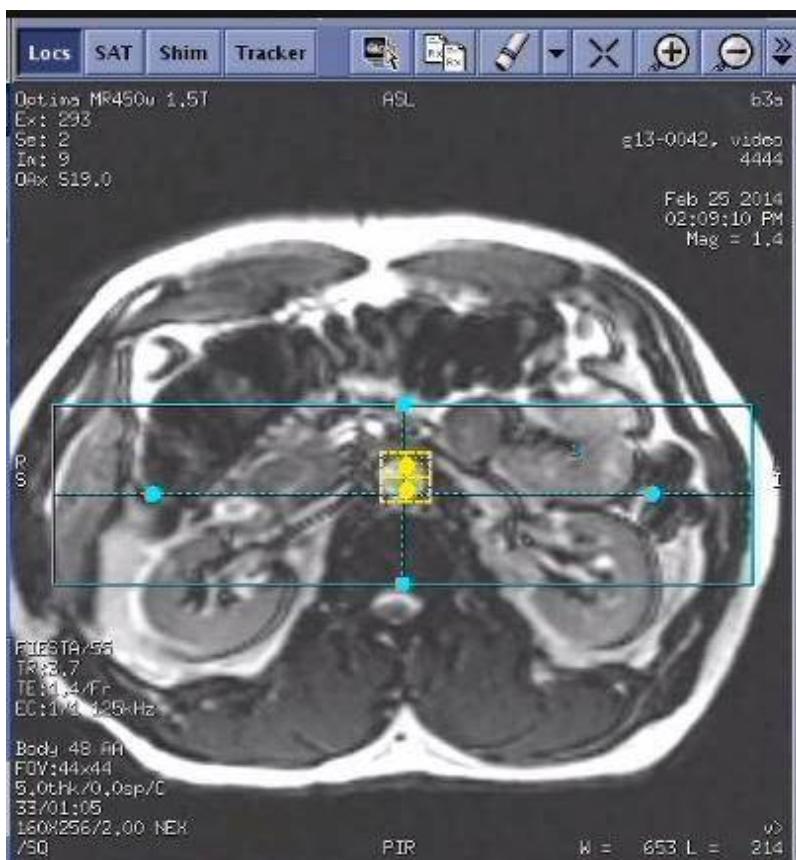


2. Click the **Advanced** tab.

3. Set the **Max. monitor** period (this is the backup scanning time).
4. Set the **Image acquisition delay** time (this time may be used to give the patient breathing instructions).
5. K space filling options are user CV11 through CV14. Information entered here will depend on the anatomy to be scanned.

Prescribe the imaging volume

1. Prescribe the 3D volume by placing the cursor over the desired image and click to deposit the volume. Prescribe any even number of slices to balance coverage with scan time



2. The tracker should be contained completely inside the imaging volume to avoid SmartPrep failing to detect the bolus.

Fill in Contrast amount

Fill in a contrast amount of 20 cc or higher.



Save Rx and Scan

1. Click **Save RX**.



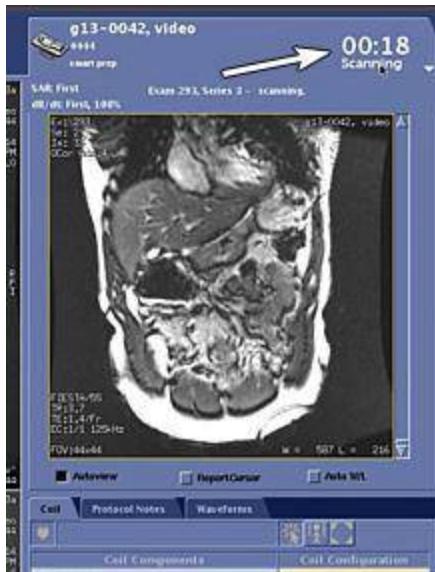
2. Click **Scan**.



System acquires baseline data.



Max. monitor begins to count down. This time may be used to give the patient breathing instructions.



The scanner will continue to count down until the bolus is detected. The scanner will go quiet for the amount of time built into image acquisition delay.

For more information about SmartPrep, see:

- [Prepare the patient for a SmartPrep scan procedure](#)
- [Acquire a localizer for a SmartPrep scan procedure](#)
- [Set up the SmartPrep series procedure](#)
- [Scan the SmartPrep series procedure](#)

Chapter 1: Read me first

Before using your system, familiarize yourself with the purpose and design of this manual and an overview of the following topics.

- [About this manual](#)
- [About MR Scanner](#)
- [Feature list](#)
- [Online help](#)
- [System User Interface](#)
- [Sessions](#)
- [Preferences](#)
- [Data Privacy](#)

About this manual

This section explains the purpose and design of this operator manual. It is an introduction to the manual, providing information on the purpose, prerequisite skills, organization, format, and graphic conventions that identify the visual symbols used throughout the manual.



The manual does not identify components or features that are standard or purchasable options. **Therefore, if a feature or component included in the manual is not on your system, it is either not available on your system configuration or your site has not purchased the option.**

Safety information

Please refer to the [MR Safety chapter](#). The MR Safety chapter describes the safety information you and the physicians must understand thoroughly before you begin to use the system. If you need additional training, seek assistance from qualified GE personnel.

The equipment is intended for use by qualified personnel only.

This manual should be kept with the equipment and should be readily available at all times. It is important for you to periodically review the procedures and safety precautions. **It is important to read and understand the contents of this manual before attempting to use this product.**

Federal Law restricts this device to sale, distribution, and use by or on the order of a physician.

Safety notices

The following safety notices are used to emphasize certain safety instructions. This manual uses the international symbol along with the danger, warning, or caution message. This section also describes the purpose of an Important notice and a Note.



DANGER

Danger is used to identify conditions or actions for which a specific hazard is known to exist that will cause severe personal injury, death, or substantial property damage if the instructions are ignored.



WARNING

Warning is used to identify conditions or actions for which a specific hazard is known to exist that may cause severe personal injury, death, or substantial property damage if the instructions are ignored.



CAUTION

Caution is used to identify conditions or actions for which a potential hazard may exist that will or can cause minor personal injury or property damage if the instructions are ignored.



Coil CAUTION

Coil Caution is used to identify conditions or actions for which a potential hazard of crossing or looping coil cables may exist that will or can cause minor personal injury or property damage if the instructions are ignored.



Pinch Point CAUTION

Pinch Point Caution is used to identify conditions or actions that will or can cause personal injury.



Important indicates information where adherence to procedures is crucial or where your comprehension is necessary to apply a concept or effectively use the product.



Note provides additional information that is helpful to you. It may emphasize certain information regarding special tools or techniques, items to check before proceeding, or factors to consider about a concept or task.



Troubleshooting tips provide information that allow you to investigate the resolution of some type of problem, locate the difficulty, and make adjustments to solve the problem.

Purpose of this manual

This manual is written for health care professionals (namely, the MR technologist) to provide the necessary information relating to the proper operation of this system. The manual is intended to teach you the system components and features necessary to use your MR system to its maximum potential. It is not intended to teach magnetic resonance imaging or to make any type of clinical diagnosis.

This operator manual should be kept with the equipment at all times. It is important for you to periodically review the procedures and safety precautions. It is important for you to read and understand the contents of this manual before attempting to use this product.

This operator manual is originally written in English.

Prerequisite skills

This manual is not intended to teach the principles of magnetic resonance imaging. It is necessary for you to have sufficient knowledge to competently perform the various diagnostic imaging procedures within your modality. This knowledge is gained through a variety of educational methods, including clinical working experience, hospital-based programs, or classes offered by many college and university Radiologic Technology diagnostic imaging programs.

User profile

MR worker

MR workers are generally Radiology technologists.

MR Professional

MR Professional are generally Radiologists who use the results from an MR exam to influence patient management.

Service Engineer

A Service Engineer may be an employee of GEHC, third party service group, or an employee of the customer in-house systems support department. They may be dedicated to a specific clinic or geographic area.

Pop-up windows

Pop-up message windows require an acknowledgment. Respond to the message and continue on with the workflow. Note that most procedures in the manual do not identify pop-up messages since the appearance of a message varies based on the workflow.

If there are multiple floating window on the screen, click on the window title to bring it in front or close the window in front to access the windows that is behind it.

Graphic conventions and legends

This manual uses special conventions for images and legends to make it easier for you to work with the information. The table below describes the conventions used when working with menus, buttons, text boxes, and keyboard keys.

Table 1-1: Graphic conventions

Example	Description
UI conventions	Blue text indicates a link to another topic.
Select	Select an option in a check box or radial button and selecting a tab.
Press Enter	Press a hard key on the keyboard.
Press and hold Shift	Press and holding down a hard key on the keyboard.
Click Viewer	A button label or Interface button name that you actively click. If there is a reference to a button label that is not actively clicked, it is not displayed as bold or italic.
In the Spacing field...	The name of field in which you can select or type text.
Type supine in the Patient Position text box	Text you enter into a field box followed by pressing the Enter key on the keyboard.
Select Sort > Sort by date	The pathway of selecting option(s) in a pull-down menu.
Ctrl X simultaneously	Press and hold the Control button on the keyboard and simultaneously press the X button on the keyboard. Ctrl is the

Example	Description
	abbreviation used for the Control keyboard button, and ALT is the abbreviation used for the Alternative keyboard.
"message"	A system message prompt is in quotations.
Cancel/Close	Cancel/Close typically closes a screen without executing the changes on the screen. The instructions to Cancel/Close are typically not included in procedures in this manual.

Table 1-2: Mouse controls conventions

Operator manual instruction	Mouse action
Click	Click the left mouse button to select a button or icon.
Right-click	Click the right mouse button.
Middle-click	Click the middle mouse button.
Click and drag	Click and hold the left mouse button down while dragging the cursor to the desired location.
Right-click and drag	Click and hold the right mouse button down while dragging the cursor to the desired location.
Middle-click and drag	Click and hold the middle mouse button down while dragging the cursor to the desired location.
Double-click	Click the left mouse button twice in rapid succession.
Triple-click	Click the left mouse button three times in rapid succession.

About MR Scanner concept

The About MR Scanner feature displays useful safety information that may be useful for determining if MR Conditional requirements are met for certain implants and other devices. Available information includes:

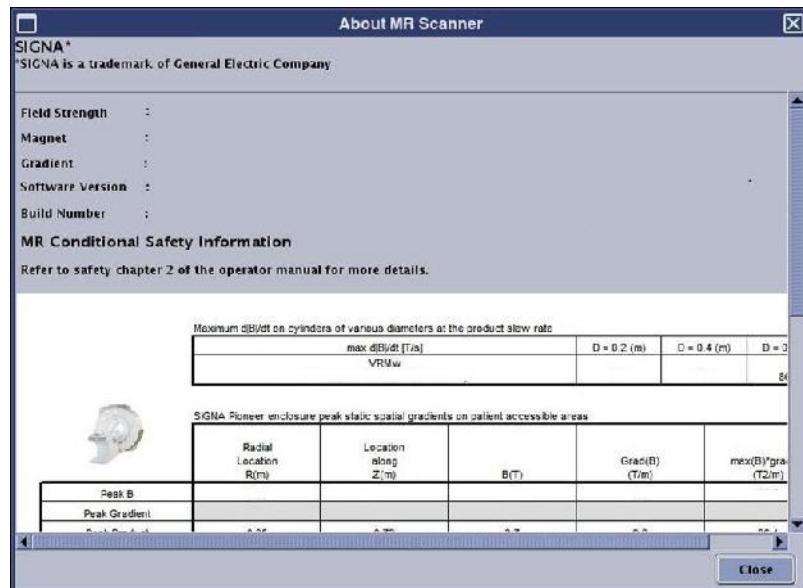
- magnetic field strength (B0)
- maximum spatial gradient (rate of change with distance) of the static magnetic field
- nominal frequency range per nuclei
- maximum gradient output on cylinders with diameters of 0.2 m, 0.4 m, and bore diameter minus 0.1 m (for transverse magnets the “bore diameter” is the magnet gap).

Considerations

- Specific Energy limit exams are limited to 14,400 joules (4 W/kg for one hour (3600 s). After a suitable rest period (perhaps 2 hours) patient scanning may be resumed. A physician may override the specific energy limit for medical reasons.
- B1rms is the root mean square value of the radio frequency (RF) magnetic field for a given protocol. It is useful to determine how aggressive a protocol may be in terms of RF intensity.

Use these steps to view the About MR Scanner screen, which provides details about your MR scanner. The contents of the screen varies based on your MR system.

Figure 1-1: Example of an About MR Scanner screen



1. From the header area of the screen, click **Tools icon arrow** and select **About MR Scanner**.
 - The About MR Scanner screen displays.
2. Click and drag the slider to view all the contents on the screen.
3. To close the screen, from the About MR Scanner screen, click **Close**.

Table 1-3 (below) shows the types of configurations.

Table 1-3: System configuration types

Types	Software Version	Magnet
Type I	PX26.0, PX26.2	LCCW
Type II	VX28	IPM, LCCW

Related topics

[Read me first orientation](#)

Electronic Operator Manual

This device is delivered with an electronic Operator Manual.

Figure 1-2: Symbol indicating that the Instruction For Use (Operator Manual) is supplied in electronic format



The operator manual is available in an **Online Help** format from a CD that is either installed on your GE system or accessed from a personal computer.

A paper copy of Online Help can be ordered at no additional cost. Please send a request to your Sales or Service representative. They will transfer your request to CEMEURDIST@med.ge.com .In application of the EU Commission Regulation on electronic instructions for use of medical devices, in European Union, your request should be treated within 7 days.

The latest version of the Instructions for Use is available on Internet at:

<https://www.gehealthcare.com/documentationlibrary>

on the home page enter **6339225** (Operator Manual part number root) in the search window and launch the search.



Go to your paper *Booklet for electronic Operator Manual Instructions* (6339325-199) for more information on detailed regulations and standards applicable to your system, as well as the manufacturer information.

Table 1-4: Language codes

Code	Language	Code	Language	Code	Language	Code	Language
BG	Bulgarian	CS	Czech	DA	Danish	DE	German
EL	Greek	EN	English	ES	Spanish	ET	Estonian
FI	Finnish	FR	French	HR	Croatian	HU	Hungarian
ID	Indonesian	IT	Italian	JA	Japanese	KK	Kazakh
KO	Korean	LT	Lithuanian	LV	Latvian	NL	Dutch
NO	Norwegian	PL	Polish	PT-PT	Portuguese	PT-BR	Brazilian Portuguese
RO	Romanian	RU	Russian	SK	Slovakian	SR	Serbian
SV	Swedish	TR	Turkish	UK	Ukrainian	VN	Vietnamese
ZH-CN	Chinese						

Feature List

Note that the optional features listed in these tables may not be available in all markets.



The table contents are subject to change with a limited degree of variability based on system configuration. Go to [About function](#) to know your system configuration.

PSD list

3-Plane family

3-Plane PSD Family	Description
FGRE IR Prep Standard	The FGRE IR Prep Localizer produces T1-weighted images from three planes that can be used in Graphic Rx to define slices, SAT bands, and tracker pulse locations while visualizing their exact position in all three planes.
FGRE Standard	The FGRE Localizer produces T2*-weighted images from three planes that can be used in Graphic Rx to define slices, SAT bands, and tracker pulse locations while visualizing their exact position in all three planes.
FIESTA Standard	The FIESTA Localizer produces images with high T2/T1 ratios from three planes that can be used in Graphic Rx to define slices, SAT bands, and tracker pulse locations while visualizing their exact position in all three planes.
SSFSE Standard	The SSFSE Localizer produces T2-weighted images from three planes that can be used in Graphic Rx to define slices, SAT bands, and tracker locations while visualizing their exact position in all three planes.

EPI family

EPI PSD Family	Description
DW EPI Standard	DW EPI is a single shot EPI pulse sequence designed to create images that differentiate tissues with restricted diffusion from tissues with normal diffusion.
eDWI Optional	eDWI is an enhanced version of Diffusion Weighted imaging that allows multiple b-values within a single acquisition, Smart NEX, and 3 in 1 and Tetrahedral imaging techniques.
MAGiC DWI (Synthetic DWI) Optional	Synthesize b-value diffusion weighted images using scanned DWI data.
DW EPI Tensor Optional	DW EPI Tensor or DTI is a technique that produces image contrast proportional to the local diffusion coefficient of water. Both the diffusion coefficient and its directional dependence can be measured using DTI. Data can then be used to image the directional dependence of the local diffusion coefficient in the tissue.
FLAIR EPI Standard	FLAIR EPI is designed to minimize the signal from CSF on a T2-weighted EPI sequence. Use the FLAIR EPI sequence for brain imaging to minimize signal from CSF. The sequences can be acquired in a single-shot or multi-shot mode.
GRE EPI Standard	Use Gradient Echo EPI for: task activation studies when acquired with Multi Phase, imaging of the brain to produce cerebral-blood volume maps to aid in diagnosis of recurrent tumor versus edema in post- therapy patients.

EPI PSD Family	Description
SE EPI Standard	SE EPI is typically used to acquire T2-weighted scans. It can also be combined with the IR Prepared Imaging Option to acquire T1-weighted or IR images.

FSE family

FSE PSD Family	Description
FRFSE Standard	Use 2D FRFSE for: PD- and T2-weighted acquisitions of the spine, abdominal breath hold images and head and joint images .
FSE IR Standard	Use FSE-IR: to suppress the signal from fat in abdominal and extremity images, when you desire a more uniform fat suppression for large FOV or off-center FOV, FSE-IR is an excellent alternative to FSE Fat SAT.
FSE Standard	FSE is used to acquire T1-, PD-, and T2-weighted image contrast.
FSE Double/Triple IR Standard	Triple IR with fat suppression for very black blood Double IR uses an FSE pulse sequence and Triple IR uses an FSE-IR sequence. Both are acquired by selecting the Blood Suppression Imaging Option. Double and Triple IR scans are used to visualize cardiac anatomy, myocardial wall masses, valve leaflets, and black blood. Use a single RR interval for a more T1-weighted appearance, carotid imaging, and very black blood imaging.
SSFSE Standard	SSFSE and SSFSE-IR use an RF pulse design that allows for significantly short ESP and a 0.5 NEX technique that acquires a data set within a single RF excitation period.
SSFSE-IR Standard	SSFSE and SSFSE-IR use an RF pulse design that allows for significantly short ESP and a 0.5 NEX technique that acquires a data set within a single RF excitation period.
T1 FLAIR Standard	T1 FLAIR is designed to scan the same number of slices as the T1-weighted Spin Echo sequence, and in the same or shorter scan time, achieve better tissue contrast-to-noise as well as signal-to-noise ratios.
T2 FLAIR Standard	T2 FLAIR results in bright signal suppressed from CSF on T2-weighted image structures adjacent to fluid filled structures, therefore becoming more apparent.
3D FLAIR Standard	FLAIR acquired in 3D mode.
Cube Optional	Cube T2 and T2 FLAIR and DIR have a unique acquisition and reconstruction technique that allows for high resolution imaging in all three dimensions with the goal of acquiring isotropic voxels (all voxel dimensions, height, width, and depth, are equal).

GRE family

GRE PSD Family	Description
2D FIESTA Standard	It accentuates the contrast of spins with high T2/T1 ratios (such as cerebral-spinal fluid, water, and fat) while suppressing signal from tissues with low T2/T1 ratios (such as muscle and myocardium).

GRE PSD Family	Description
2D Fat SAT FIESTA Standard	2D Fat Sat FIESTA is 2D Fiesta with SPECIAL turned on.
3D FIESTA Standard	3D FIESTA can be used for whole body imaging and can be used in clinical applications that benefit from the differentiation of contrast between tissues of low T2/T1 ratios (low signal intensity) and high T2/T1 ratios (high signal intensity).
3D FIESTA with fat SAT Standard	3D FIESTA with Fat Saturation is primarily used for coronary artery imaging. Water and fat contrast is accentuated, while muscle and myocardial tissues are suppressed.
3D FIESTA-C Standard	FIESTA-C can be used in any clinical application that calls for relatively high spatial resolution and the differentiation of contrast between tissues of low T2/T1 ratio (low signal intensity) and high T2/T1 ratios (high signal intensity), for example inter-vertebral discs, hydrocephalus obstructions, biliary tree dilatation, cholangio-pancreatography, and IAC applications.
Fast GRE (2D and 3D) Standard	Fast GRE sequences are used to produce T2-weighted images. Tissues with short T2 are dark and tissues with long T2 are bright. In the brain, CSF produces the brightest signal on moderate to late TE images.
Fast SPGR (2D and 3D) Standard	Fast SPGR sequences are used to produce T1-weighting in images where tissues with short T1 are bright and tissues with long T1 are dark. In the brain, white matter is brighter than gray matter and CSF is dark.
GRE (dual echo) Standard	High resolution dual echo 3D FGRE/FSPGR sequence. It allows the acquisition of the first out-of-phase TE and the first in-phase TE within a single breathhold in Axial and coronal scan planes. This technique uses ARC parallel imaging technique
GRE (2D and 3D) Standard	GRE scans acquire T2*-weighted image contrast. Sequential GRE acquisitions eliminate cross-talk because all data is obtained one slice at a time.
SPGR (2D and 3D) Standard	SPGR is used to acquire T1-weighted contrast images. Sequential SPGR acquisitions eliminate cross-talk because all data is obtained one slice at a time.
FGRE Time Course Optional	FGRE Time Course is a cardiac application that is very similar to the MR-echo Time Course application. It is activated by selecting a Fast GRE PSD with the following Imaging Options: Multi-phase, Cardiac Gating/Triggering, IR Prepared and ASSET. This application means that there is need to switch between MR-Echo and the standard scan user interface to acquire the time course scans.
2D FGRE with IR Prep (2D MDE) Optional	Fast GRE with IR-Prep and gating result in a delayed enhancement capability.
3D FGRE with IR Prep (3D MDE) Optional	3D Fast GRE with IR Prepared uses a non-slice selective IR pulse that allows for multiple locations to be acquired within a single breath hold. IR-Prep requires a Prep Time to be entered in the Scan Parameters area - choose a value that best suppresses myocardium.
3D FIESTA with Fat SAT and cardiac gating Standard	3D FIESTA with Fat SAT is primarily used for coronary artery imaging. Water and fat contrast is accentuated, while muscle and myocardial tissues are suppressed.

GRE PSD Family	Description
LAVA Standard	LAVA (Liver Acquisition with Volume Acceleration) is a 3D SPGR acquisition that automatically uses a Partial Kz filling technique and a segmented SPECIAL technique. LAVA is used for abdominal scanning, in particular, liver imaging. It can be combined with Imaging Option Flex for a LAVA-Flex scan.
MERGE Standard	MERGE (Multi-Echo Recombined Gradient Echo) is a 2D fast GRE pulse sequence that acquires multiple echoes at several different TEs and then averages those echoes to form a single T2*-weighted image. Used primarily in C-spine.
SWAN Optional	SWAN pulse sequence is a high-resolution 3D, T2* multi -echo gradient echo sequence that produces echo-combined images (sum across images with different TE's) to achieve higher T2* weighting. SWAN is a neuro application.
Multi-echo FGRE/FSPGR Optional	Multi-echo FGRE/FSPGR is used to acquire images to analyze iron-load for blood-transfused patients, in the clinical management of patients with iron overload diseases such as Thalassemia, in liver and myocardium examinations. These images can be post processed in ReadyView to measure the relaxation time variants using the R2Starmap application.
3D FGRE/FSPGR dual echo Standard	This is a high resolution dual echo 3D FRGRE/FSPGR sequence. It allows the acquisition of the first out-of-phase TE and the first in-phase TE within a single breathhold in Axial and coronal scan planes. This technique uses ARC parallel imaging technique
VIBRANT Optional	VIBRANT is a 3D bilateral breast application. It can be combined with Imaging Option Flex for a VIBRANT-Flex scan.

SE family

SE PSD Family	Description
SE Standard	Spin Echo sequences are used to acquire images with T1-, PD-, or T2- weighted contrast in all anatomical areas.
IR Standard	Use Inversion Recovery sequences produce T1-weighted or fat-suppressed images, particularly in abdomen or extremities. This sequence is also used for very heavily weighted T1 brain images.

Spiral family

SPIRAL PSD Family	Description
Hi-Res SPIRAL Optional	Hi-res Spiral obtains high resolution images in ultra-fast scan times. This sequence is well suited for obtaining images of the coronary arteries.
Realtime SPIRAL Optional	Real Time Spiral can be used for the quick localization of anatomy lying in double-oblique planes and in areas where motion can be a problem, such as the coronary arteries.

Vascular family

Vascular PSD Family	Description
2D Phase Contrast	Phase Contrast imaging is an optional 2D and 3D imaging technique that relies

Vascular PSD Family	Description
Standard	on velocity-induced phase shifts to distinguish flowing blood from stationary tissues.
2D Phase Contrast Fast Standard	<p>Use Fast 2D Phase Contrast for:</p> <ul style="list-style-type: none"> • cardiac gated multi-phase data set within a breath hold time frame (Fast Card part) and quantitative data analysis (Phase Contrast part) • imaging with Flow Analysis, to provide the ability to quantify flow in the great vessels, carotids, and extremity vasculature • imaging as a localizer for gated TOF acquisitions when looking for peak flow in READY View
2D Phase Contrast with Cine Mode Standard	<p>Use FastCINE PC:</p> <ul style="list-style-type: none"> • to determine blood flow direction • to estimate flow velocity • for quantitative analysis in Flow Analysis software
3D Phase Contrast Standard	Phase Contrast imaging is an optional 2D and 3D imaging technique that relies on velocity-induced phase shifts to distinguish flowing blood from stationary tissues.
2D TOF-GRE Standard	TOF images are created by repeatedly exciting a predefined volume of anatomy until the stationary tissue is partially saturated and the signal from the tissue is suppressed.
2D TOF-GRE Fast Standard	Like TOF, Fast TOF imaging is based on conventional Gradient Echo scanning with flow compensation. This imaging technique relies primarily on flow-related enhancements to distinguish moving from stationary spins in creating MRA. The 2D Fast TOF sequence can be acquired with a Fast GRE or a Fast SPGR.
2D TOF-SPGR Standard	<p>Use 2D TOF-GRE and TOF-SPGR sequences to:</p> <ul style="list-style-type: none"> • demonstrate the carotid bifurcation or venous anatomy • evaluate suspected basilar artery occlusive disease • Image pelvic and lower extremity vasculature • map cortical veins • evaluate suspected intra-cranial venous thrombosis
2D TOF-SPGR Fast Standard	Like TOF, Fast TOF imaging is based on conventional Gradient Echo scanning with flow compensation. This imaging technique relies primarily on flow-related enhancements to distinguish moving from stationary spins in creating MRA. The 2D Fast TOF sequence can be acquired with a Fast GRE or a Fast SPGR.
3D TOF-GRE Standard	3D TOF uses a volume acquisition to obtain image data and can be acquired with a GRE or SPGR pulse.
3D TOF-GRE Fast Standard	Use Fast 3D TOF-GRE and Fast TOF-SPGR with SmartPrep to acquire signal change over time to evaluate vascular disease.
3D TOF-SPGR Standard	3D TOF uses a volume acquisition to obtain image data and can be acquired with a GRE or SPGR pulse.
3D TOF-SPGR Fast Standard	Use Fast 3D TOF-GRE and Fast TOF-SPGR with SmartPrep to acquire signal change over time to evaluate vascular disease.
FastCard GRE	Fast Card is a fast, 2D, GRE or SPGR sequence that acquires multiple phases of

Vascular PSD Family	Description
Standard	the cardiac cycle at single or multiple locations.
FastCard SPGR Standard	<p>Use Fast Card for:</p> <ul style="list-style-type: none"> breath-hold cardiac imaging (Fast Card GRE makes blood brighter and SPGR makes the myocardium brighter) removing motion in pediatric studies by using Fast Card with multiple NEX coronary artery imaging when used with Fat SAT cross-sectional studies of the cardiac chambers or the aortic arch evaluating cardiac function and valve assessment
FastCINE Standard	FastCINE uses a k-space segmenting technique that reconstructs all phase steps regardless of when they are acquired within the cardiac cycle. This allows for complete imaging of the RR interval allowing better visualization of end diastolic events.
FastCINE PC Standard	FastCINE PC combines Phase Contrast and the Cine scan mode to enable data acquisition throughout the entire cardiac cycle. The RR Interval is monitored and the information is used to retrospectively sort the data before reconstruction. Images are reconstructed using CINE interpolation that compensates for differences within the cardiac cycle.
Inhance 3D Velocity Optional	Inhance 3D Velocity is a modified 3D Phase Contrast PSD. It is designed to acquire contrast-free angiography images with excellent background suppression at a shorter scan time in comparison to 3D PC.
Inhance Inflow Optional	Inhance Inflow is designed to acquire angiography images of arteries that flow in a relatively straight line such as the femoral, popliteal and carotid arteries.
Inhance 3D Inflow IR Optional	Use Inhance 3D Inflow IR to acquire contrast-free angiographic images with excellent background suppression that are free of venous contamination. Inhance Inflow IR can also be used to image venous vasculature. This can be achieved by placing IR bands to suppress upstream arterial flow.
Inhance DeltaFlow Optional	Inhance Delta-Flow is a non-contrast MRA technique that relies on arterial flow differences between systolic and diastolic phases. The data is acquired with two interleaved, 3D FSE gated (PG or ECG) scans: one in systolic and one in diastolic phase. Systolic images are subtracted from the diastolic images to create an arterial only image data set.

Spectroscopy family

Spectroscopy PSD Family	Description
PROBE - PRESS CSI single voxel Optional	A version of the PRESS sequence that acquires a double spin echo from a localized volume. You can prescribe the volume manually or graphically.
PROBE 2D CSI Optional	A 2D CSI acquisition allows you to increase the spatial coverage and spatial resolution of a spectroscopy data acquisition relative to single voxel acquisitions.
PROBE 3D CSI	With PRESS 3D CSI, phase encoding gradients are applied along three

Spectroscopy PSD Family	Description
Optional	orthogonal axes to acquire data that, after processing, produces a 3D array of spectra. Long scan times are an inherent disadvantage of this technique, as are the small, practical number of phase encoding steps along each dimension. The clear advantages are increasing SNR and spatial coverage in the third dimension.
PROBE SVQ (PRESS and STEAM) Optional	PROBE-P is a version of the PRESS (Point RESolved Spectroscopy) sequence that acquires a spin echo from a localized volume defined by the intersection of three orthogonal slices.
PROSE Optional	PROSE is a spectroscopy sequence that has been optimized for the acquisition of spectra from the prostate gland.

PROPELLER family

PROPELLER PSD Family	Description
Brain DWI Standard	PROPELLER Brain DWI is used for high resolution head imaging where DWI is traditionally used. It is particularly useful in areas of high susceptibility relative to standard EPI methods. PROPELLER Brain DWI does not reduce motion artifact.
Brain T2 Standard	PROPELLER Brain T2 improves SNR and CNR compared to traditional FSE with comparable scan time and it reduces motion artifact.
Brain T2 FLAIR Standard	PROPELLER Brain T2 FLAIR reduces patient motion artifact compared to traditional T2 FLAIR with comparable scan time.
T1 FLAIR Standard	T1 FLAIR is a PROPELLER PSD that produces T1-weighted images with null CSF signal and optimal gray/white matter contrast. It is typically used to acquire T1-weighted image contrast for patients with uncontrollable motion.
T2 Body Optional	T2 Body is a respiratory triggered PROPELLER PSD that produces T2-weighted liver images with reduced motion artifacts from vessel flow and patient breathing. It is typically used for axial T2 fat SAT liver exams.
PROPELLER Standard	PROPELLER is a generic PSD that can be used in musculoskeletal areas with any coil.

Imaging Options

Imaging Options	Description
ARC Standard	ARC is a data-driven parallel imaging technique that synthesizes missing data from neighboring source data in all three imaging dimensions: slice, phase and frequency. Fewer calibration lines are required and reconstruction accuracy and speed is improved resulting in highly accelerated MR data acquisition with improved image quality and reduced artifacts.
ASSET Standard	Use ASSET to scan faster with brain, abdomen, chest, fMRI, extremities and breath hold angiography imaging. You can also use it to decrease artifacts with EPI sequences and to decrease blurring with FSE sequences.
Blood Suppression	Use Blood Suppression to obtain "black blood" cardiac images and reduce

Imaging Options	Description
Standard	flow-related ghosting.
Cardiac Comp (CCOMP)	Use CCOMP for breath-hold abdominal images to reduce pulsatile flow artifact.
Standard	
Cardiac Gating/Triggering	Cardiac Gating/Triggering is used for: imaging the heart's structure and function, imaging in the thorax, and Cine-PC arteriography to examine flow.
Standard	
Classic	Use Classic to reduce the contribution of off-resonant signals to spin-echo images.
Standard	
DE Prepared	Use DE Prepared to apply a 90/180/90° RF DE preparation pulse to produce more T2-weighted contrast with 2D, sequential Fast GRE sequences.
Standard	
Extended Dynamic Range	Use Extended Dynamic Range to improve SNR in applications such as 3D scans.
Standard	
Flex Optional	Use Flex (a two-point Dixon method) to acquire in-phase and out-of-phase echoes resulting in water only and fat only images.
Flow Compensation Standard	Use Flow Compensation to reduce motion artifacts when slow-moving blood and CSF are flowing in the direction of the applied FC gradient.
Fluoro Trigger Standard	Use Fluoro Trigger to detect the arrival of a contrast bolus in MRA exams.
Full Echo Train Standard	The Full Echo Train method completes all echo trains for Effective TE1 before Effective TE2 is initiated. The phase encoding process is altered to place the central phase encodings at the selected Effective TE1 or TE2.
IDEAL Optional	IDEAL (Iterative Decomposition of Water and Fat With Echo Asymmetry and Least-Squares Estimation) uses a three-point Dixon method to acquire multiple echoes resulting in water only, fat only, fat and water in-phase, and fat and water out-of-phase processed images.
IR Prepared Standard	Use IR Prepared to enhance T1-weighting and to suppress signals from selective tissues.
Mag Transfer Standard	Use Magnetization Transfer to suppress brain parenchyma signal relative to contrast-laden blood.
Multi-Phase Standard	Use Multi-Phase to prescribe a series of consecutive scans (or phases) separated by configurable start times or delays. It is compatible with a wide range of pulse sequences and imaging options.
Multi-Station (SmartStep) Standard	Use Multi Station an alternative to QuickSTEP. It provides automatic table movement and switching of coils between stations for peripheral vascular run-offs. It allows you to prescan at multiple stations to optimize image quality and it properly annotates image locations based on the landmark.
MRCP Standard	Use MRCP to acquire heavily T2-weighted images, such as MRCP or myelogram.
Body Navigator	Use Navigator to perform a navigated, free-breathing, liver and renal imaging

Imaging Options	Description
Optional	acquisition.
No Phase Wrap Standard	Use No Phase Wrap to prevent wraparound artifacts when anatomy is outside the FOV in the phase direction.
Phase Sensitive Optional	Use with 2D, FGRE and Cardiac Gating to acquire PSMDE ¹ cardiac images.
PROMO Optional	PROMO ² is an Imaging Option used to prospectively correct for patient motion when acquiring 3D Cube and Cube T2 FLAIR images.
Real Time Standard	Use Real Time to acquire an interactive scan that allows you to: <ul style="list-style-type: none"> ● localize complex anatomy that lies in double oblique planes ● navigate through the patient anatomy for rapid visualization ● monitor temporal physiological events, including patient breathing, kinematic studies, and bolus activity ● determine the boundaries of a desired imaging region, which can then be passed to a subsequent image application (another batch series in the Workflow Manager) ● initiate an MRA scan when you combine it with Fluoro Trigger ● perform a kinematic study ● detect Patent Foremen Ovale when you combine it with IR Prepared
Respiratory Compensation Standard	Use Respiratory Compensation to reduce phase ghosting from breathing motion when scanning in the chest or abdomen.
Respiratory Gating/Triggering Standard	Use Respiratory/Gating Triggering to reduce breathing artifacts by synchronizing the acquisition with the respiratory cycle. It can be used to acquire PD- or T2-weighted images.
Sequential Standard	Use Sequential with breath-hold abdominal or chest scans, quick localizers, and 2D TOF vascular sequences to prevent cross-talk.
SmartPrep Standard	Use the SmartPrep tracking pulse to increase the accuracy of synchronizing image acquisition with the arrival of a contrast bolus to acquire images.
Spatial Spectral RF (SSRF) Standard	Use SSRF to reduce signal from fat by selectively exciting a narrow range of chemical shifts at the prescribed location through the application of a series of very short RF pulses.
Square Pixel Standard	Use Square Pixel to provide a square pixel within a rectangular FOV when you select asymmetrical matrix values. The pixel size is determined by the FOV divided by the frequency matrix.
T2 Prep Standard	Use T2 Prep to apply a sequence of non-slice selective 90° and 180° RF pulses to suppress cardiac muscle tissue and therefore, increase the contrast between coronary vessels and background tissue.

¹Phase Sensitive Myocardial Delayed Enhancement²PROspective MOTion correction

Imaging Options	Description
Tailored RF Standard	Use Tailored RF to stabilize the echo amplitudes in the FSE sequences (Spin Echo and Inversion Recovery). Tailored RF produces images with the following characteristics: less blurring, slightly less SNR, flatter contrast for T2 weighted images, and slightly more slices per TR.
ZIP 512 ZIP 1024 Standard	Use ZIP as an optional reconstruction technique to create the appearance of increased in-plane resolution. Zero-filling enhances the apparent image resolution, it does not create resolution.
ZIP x 2 ZIP x 4 Standard	Use slice ZIP to create the appearance of increased through-plane resolution.

Application list

One-click applications	Description
3DASL (Arterial Spin Labeling) Optional	Use 3DASL to acquire a non-invasive whole brain scan for CBF measurements. It uses a 3D Spiral FSE pulse sequence with Extended Dynamic Range to acquire a set of images (PW and PD) which post-process into CBF image maps.
3D Heart Optional	3D Heart is an improvement to 3 PSD used to acquire coronary vessels: 3D gated Fiesta, 3D gated Fast GRE/SPGR and 3D myocardium delayed enhancement (Fast GRE with IR-Prep and cardiac gated imaging options).
BRAVO (BRain VOlume) Standard	Use BRAVO to acquire a high-resolution, T1-weighted sequence for fMRI.
BREASE (BREAst Spectroscopy Examination) Optional	Use BREASE to acquire a spectrum for breast spectroscopy. The spectrum is displayed in the Viewer.
COSMIC (Coherent Oscillatory State acquisition for the Manipulation of Imaging Contrast) Standard	Use COSMIC to acquire a 3D axial Cervical-spine sequence. Only the 16-, 8-, and 4-channel Spine phased array coils are compatible with COSMIC.
CineIR Optional	Use CineIR to select the optimal TI to visualize normal or viable myocardium versus myocardium with an infarct.
DISCO Optional	Use DISCO (DIfferential Subsampling with Cartesian Ordering) to acquire improved temporal resolution images in comparison to multi-phase non-view-shared T1 weighted sequences.

One-click applications	Description
MAGIC Optional	MAGIC ¹ is both an acquisition and post processing application. Based on the MAGIC MDME images the MAGIC post-processing generates quantitative maps of the T1 and T2 relaxation times and Proton Density (PD) of the imaged tissue.
MR ECHO Optional	The MR-Echo application is for cardiac real time prescription and acquisition. MR-Echo real time is particularly useful in patients with irregular heart beats and with patients who cannot perform a breath-hold acquisition.
MAVRIC SL Optional	MAVRIC SL is a one-click application that uses a multi-spectral 3D imaging technique to help reduce susceptibility artifacts caused by the presence of MR conditional metallic implants.
MR-Touch Optional	MR-Touch is a Phase Contrast (PC) application that generates an image contrast related to the shear stiffness of soft tissue. MR-Touch is a single touch application that sensitively images the propagation characteristics of acoustic shear waves generated in the tissue of interest. A liver exam is an example of where the application is used.
QuickStep Optional	QuickStep is a multi-station, multi-phase acquisition technique that minimizes the set-up and acquisition time for lower extremity run-off examinations. The acquisition technique eliminates the need for a localizer scan and employs efficient prescription methods including an auto volume prescription system with specific coils, which reduces the exam time to approximately 6 to 8 minutes.
Silenz Optional	Silent Scan (Silenz) is a one-click application neurological data acquisition and reconstruction technique. It is designed to significantly reduce the acoustic noise generated during an MR examination. For compatible systems, see Silent: scan procedures .
T1MAP-SPGR T1MAP-FIESTA Optional	T1MAP is used to acquire scans that sample the T1 recovery curve at multiple inversions times that allow the application to measure T1 using curve fitting methods.
T2 Map (Cardiac) Optional	T2 Map is used cardiac images that can be processed in READY View to produce T2 color maps.
T2 Map (Cartigram) Optional	T2 MAP is used to noninvasively detect changes in the collagen component of the extracellular matrix of cartilage. T2 MAP acquires multiple scans at each location; each set of scans has a unique TE resulting in a set of gray scale images that represent different T2 weighting.
TRICKS (Time Resolved Imaging of Contrast Kinetics) Optional	TRICKS is a CEMRA multi-phase, single station, acquisition technique to visualize dynamic processes, such as the passage of blood with contrast agent through the peripheral vascular system. It eliminates the need for a timed or automatic triggering of contrast.
IDEAL IQ	IDEAL IQ expands on the IDEAL technique to produce triglyceride fat

¹MAGnetic resonance image Compilation

One-click applications	Description
Optional	IDEAL IQ acquisition.
MUSE#	MUSE1 is used to acquire high resolution, multi-shot DWI/DTI scans
Optional	

Post Processing

Post Processing	Description
ADC and eADC maps in READY View Standard	These READY View parametric maps The ADC algorithm subtracts the T2 information from the DWI image. The Ratio (eADC) map is a relative inverse of the ADC map.
BOLD Correlation Coefficients in READY View Standard	The correlation coefficient algorithm returns a value, on a pixel-by-pixel basis, that characterizes similarity between the temporal variations in time course data and a user-specified reference pattern.
BrainStat in READY View Standard	The BrainStat algorithms provide accurate spatial resolution for brain tissue viability given by hemodynamic parameters: BV (Blood Volume relative), BF (Blood Flow relative), TTP (Time to Peak), MTT SVD (Mean Transit Time with standard deviation). These hemodynamic parameters can provide unique information on tissue changes and improve delineation of vascular-deficient or vascular-rich regions in normal and abnormal anatomy.
FiberTrak in READY View Optional	FiberTrak is an optional feature with Diffusion Tensor, that allows you to display white matter tracks.
MAGiC Optional	MAGiC post-processes a single scan to create Qmaps and several conventional contrast weighted images such as T1W, T2W, PDW, FLAIR. The image contrast is controlled by virtual scanner settings of TE, TR and TI that can be adjusted after the scan has been completed. The resulting contrast-weighted images can be viewed in real-time.
Fusion in READY View Standard	Fusion is a READY View feature that allows you to fuse and overlay high-resolution anatomical images with computed functional maps.
MR-Touch in READY View Optional	MR-Touch READY View application allows you to draw ROIs on an MR Touch image and to view the wave images in a movie mode. You can fuse magnitude, wave or elastogram images with the original or user selected series and then display two images types side-by-side as you draw an ROI over the desired area.
R2 Starmap in READY View Optional	The R2 Star feature uses a water proton transverse relaxation rates (R2) technique. The R2 Star values vary with tissue characteristics such as iron concentration.
SER and MR Standard algorithms in READY View Standard	The SER and MR Standard READY View applications allow you to use SER or Standard MR for analyzing T1-contrast changes in the breast and use MR Standard to analyze T2 contrast changes in the brain. SE-EPI is used rather than GRE-EPI because it results in fewer artifacts.
Spectro in READY View	The READY View Brain and Prostate MR spectroscopy protocols are used to

Post Processing	Description
Standard	display functional maps for metabolites and metabolite ratios in the brain and prostate.
T2 Map (Cartogram) in READY View Optional	The T2Map READY View application displays the T2 Map acquisition, where the T2 relaxation time color map is coded to capture T2 values from the TE range of the acquired images. Blue and green reflect the longer T2 values, yellow the intermediate T2 values, and red and orange the shorter T2 values.
CADStream™ Optional	Breast images can be viewed with CADstream 5.5. from an AW system or from the system console. CADstream is comprised of a CADstream server and software that is installed on the operator console and AW Volume Share 7 or later.
Flow Analysis Optional	The Flow Analysis feature allows automatic segmentation of 2D FastCine Phase Contrast and Cine Phase Contrast (PC) images with through plane encoding, to calculate flow and velocity information at various points in the cardiac cycle.
Cardiac VX AW Optional	Cardiac VX is the newest version of cardiac reporting and analysis available on an AW system.  Before a report is distributed, always preview the report to ensure content accuracy.
SAGE 7 Optional	Sage is a spectroscopy tool.
MR General Review (Volume Viewer): MRA, Reformat, 3D Standard	3D, MRA, and Reformat are Volume Viewer applications that allow you to view : <ul style="list-style-type: none"> • a 3D view is different in that it displays an image of the 3D model (which may consist of one or more 3D objects), and that you can manipulate this 3D model. • an MRA view, which is projection images from a 2D stack or 3D volume of MRA images and allows you to view the data from different angles. • a Reformat view, which is allows you to define and display cross-sections of a 2D stack or 3D volume of image data that are oriented differently from the original acquisition images.

Other

Feature	Description
PURE Standard	PURE is designed to reduce coil intensity variations through a calibration process. PURE is an intensity correction scan option selected from the Details tab that can only be used with compatible coils. PURE requires that a calibration scan be acquired prior to the PURE scan.
SCENIC or SCIC Standard#	SCIC and SCENIC are designed to improve the quality of images acquired using surface coils. They automatically corrects the low spatial frequency intensity modulations. They use different methods to reduce coil intensity variations, and SCENIC is the latest version based on a calibration process.
ConnectPro Standard	ConnectPro is a feature that allows your MR system to connect to a HIS/RIS system.
SPECIAL	SPECIAL uses an inversion pulse transmitted at the frequency of fat and

Feature	Description
Standard	timed to the null point of fat. This results in a signal produced from protons bound in water and a decreased signal from nuclei precessing at the frequency of fat.
Cardiac Tagging Optional	Cardiac tagging is available with FastCard. Stripe tagging is typically used for long axis images and grid tagging is used for short axis images.
Performed Procedure Step Standard	PPS is a feature that allows your MR system to connect to a HIS/RIS system.
RSvP Agent configuration# Standard	Remote Service is deployed on RSvP platform.
Second level controlled mode# Optional	If the system is operating in Research mode, a second-level operating mode can be selected from the Exam dB/dt SAR Limits screen. A password can be set to allow your system to operate in this mode.
Calibration in prescan# Standard	A calibration scan is required to precede a series that includes one or more of the following scan parameters: <ul style="list-style-type: none"> • HyperBand Imaging Option • ASSET Imaging Option • PURE Intensity Correction Filter
AIRx™ # Standard	AIRx uses deep learning algorithms that automatically identify anatomical structures to graphically prescribe a slice range for brain scans based on specified anatomical references.
Auto Coil Select# Standard	Compared with legacy coil selection , auto coil select means that your MR system automatically selects the coils that are currently connected to your system that will best cover the slices graphically prescribed from a 3-plane localizer.
Distortion Correction# Standard	Select Distortion Correction from the Details tab with DWI or DTI acquisitions to estimate and correct for B0- inhomogeneity induced distortion. It is optimized for neuro scans.

New features applicable in the [configuration of type II](#).

ONLINE HELP

Online Help concept

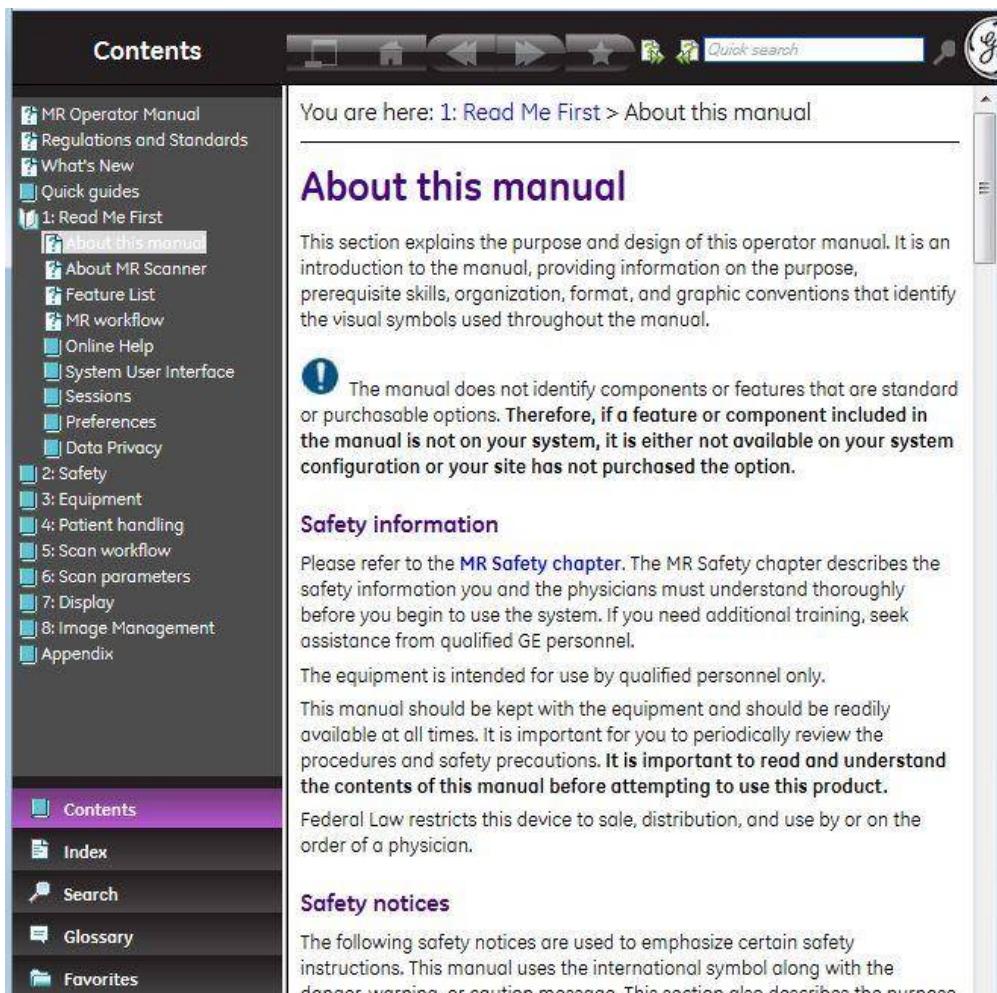
Your manual can be viewed in an Online Help format from a CD/DVD that is formatted for your GE system or as a pdf file from a personal computer.

The Online Help is an HTML document, which allows much of the content to be hyper-linked and allows the use of various display effects.

- Click **blue** text to link to another topic for more information.

Use the **Contents**, **Index**, **Search**, **Glossary** and **Favorites** tabs to navigate to the information you need. If you have linked to another topic, use the back and forward arrow icons to navigate between topics.

Figure 1-3: Online Help on GE system



Use the menu bar icons to navigate in your online help or add a favorite topic to the Favorite tab.

Table 1-5: Online Help GE system icons

Icon	Description
	Toggles navigator pane: Hide/Show.

Icon	Description
	Home returns content pane to the topic that appears when online help is first opened.
	Moves back and forward between selected topics.
	Moves to next or prior topic in the TOC.
	Favorites adds a topic to the Favorites tab.
	Searches for a term only in the currently displayed topic.

PDF file of the manual

Use the bookmarks or the Table of Contents to navigate to the information you need. Simultaneously press **Ctrl + F** to open a search user interface, from which you can type and enter key words for a search.

Figure 1-4: Example of Online Help on PC

The screenshot shows the Microsoft Word ribbon with the 'Bookmarks' tab selected. The left pane is a navigation pane titled 'Bookmarks' containing a tree view of the document structure. The 'Chapter 2: Safety' node is highlighted. The right pane displays the content of 'Chapter 2: Safety'. The title 'Chapter 2: Safety' is at the top. Below it is a detailed list of topics including 'Introductions', 'Safety checklist', 'Magnetic fields', 'Gradient fields', 'Electromagnetic fields', 'Clinical hazards', 'Environment hazards', 'Unintended imaging', 'Patient emergencies', 'Additional icon and display cautions and warnings', 'System maintenance', 'Safety procedures', 'Safety review', 'MRI Compatibility', 'Secure Guidelines', and 'China Notes'. A section titled 'Introduction' follows, with a bulleted list: '• Eliminate Magnet Hazards', '• Respond to Emergencies', '• Check for Oxygen Levels', and '• Handle Contact with Liquid Cryogens'. At the bottom of the right pane, there is a note: 'This chapter contains important safety information that you and the physician must understand thoroughly before using the system.' The footer of the right pane includes the text 'A116247-1F2 (06/2011) Rev 1' and '© 2010 General Electric Company'.

Procedures

[Open/close the manual](#)

[Add a topic to Favorites](#)

[Print a topic](#)

[View a movie](#)

Related topics

[About this manual](#)

ONLINE HELP

Open/close the manual procedure

1. To open the manual on your system, follow these steps.



- a. On your GE system, click the **Online Help icon** located in the footer area of the screen.
 - The default state for the Table of Contents is open.
- b. Click a book to display the topics related to the book title.
- c. To view the Index or Glossary or to perform a search, click the appropriate tab in the lower-left corner of the screen.
- d. To return to the Table of Contents, click **Contents**.
2. To resize the Online Help window, click and drag any edge of the window.
3. To close the Online Help manual, click the **Close** icon in the upper-right corner of the Online Help window.
 - The next time you open help, it will open to the default page, size, and location.
4. To open the manual in a PDF format on a personal computer, follow these steps.
 - a. Load the CD/DVD that contains the manual into the CD/DVD drive of a PC that has a PDF reader application.
 - b. Click **My Computer** on your desktop.
 - c. Navigate to your CD/DVD drive.
 - d. Select the desired operator manual file (language PDF file) and right-click > **Open**.
 - The pdf file title page displays.
 - e. From the bookmark panel, click a chapter to display the related topics.
 - f. Click the topic link to open the desired topic.
 - g. Consider using the PDF search function to navigate to the desired topic. Simultaneously press **Ctrl + F** to open a search user interface, from which you can type and enter key words for a search.

Related topics

[About this manual](#)

[Online Help](#)

ONLINE HELP

Add a topic to Favorites procedure

Use this procedure to add a topic to the Favorites tab in your Online Help. This lets you save links to topics that you may reference frequently.

Online Help on your system

1. Select the topic that you want to add as a Favorite.

2. From the menu bar of your Online Help, click the *Favorites icon* 

- The selected topic displays in the Favorites tab.



To remove a favorite topic, select the checkbox next to the topic to be removed in the Favorite's list and click the red X.

Related topics

[About this manual](#)

[Online Help](#)

ONLINE HELP

Print a topic procedure

Use this procedure to print topics from a Personal Computer displaying a pdf file of your operator manual.

1. [Open the pdf version of the manual on a PC.](#)
2. Navigate to the topic you want to print.
3. From the PDF menu bar, click **File** and navigate to the **Print** selection.
4. From your PDF print window, make the appropriate selections.
5. Click **OK**.

Related topics

[About this manual](#)

[Online Help](#)

ONLINE HELP

View a movie procedure

Movies are only available on the MR system online help. They are not available on the PDF version of the manual.

1. Navigate to a topic that has a movie file. For example, chapter 4: Patient Handling > Padding > [Padding introduction](#).
2. Click the **view movie** link to view the movie.
 - A new browser tab opens in which the move plays.

Figure 1-5: Example of a movie



3. Move the cursor over the movie to view the movie controls at the bottom of the movie.
4. Click the movie **Pause icon** to pause the movie.
5. Click the movie **Play icon** to resume play of the movie.
6. Click and drag the **slider** to scroll to a new movie location.
7. Click the X on the tab to close the movie.

Related topics

[Online Help](#)

ONLINE HELP

Search procedure

Use these steps to search for content in the online help.

1. To search the contents of the entire online help follow these steps.
 - a. From the Navigation pane, click **Search**.

Figure 1-6: Navigation pane



- b. In the search text field, type text that describes what you want to search for and surround the content with quotes. For example, "Safety label".
 - c. Click **Search**.

Figure 1-7: Example of search results with content surrounded by quote marks

Search	
<input type="text" value="Safety label"/> <input type="button" value="Search"/>	
Rank	Title
1	Laser alignment lights
2	Contraindications for use
3	Spatial magnetic field data

- It is important to surround the text with quote marks. If the text has no quote marks, it will widen the search to include topics that have parts of words that are in the search field.

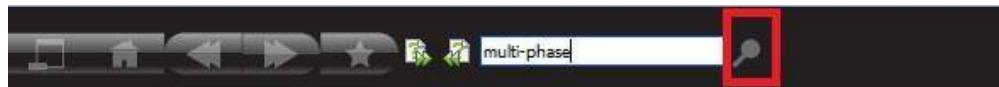
Figure 1-8: Example of search results with content not surrounded by quote marks

The screenshot shows a search interface with a dark header bar containing the word "Search". Below the header is a search bar with the text "Safety label" and a "Search" button. A magnifying glass icon is positioned next to the search button. The main area is a table with two columns: "Rank" and "Title". The "Rank" column is sorted in descending order (indicated by an upward arrow). The "Title" column lists various safety-related topics. The results are as follows:

Rank	Title
1	Product identification labels
2	READY View Safety
3	Laser alignment lights
4	Paradigm: label procedure
5	China RoHS label directive
6	Spatial magnetic field data
7	Contraindications for use
8	About this manual
9	READY View Safety
10	MR safety standards
11	Safety information
12	MR system PM service schedule
13	Regulations and Standards
14	Low SAR mode procedure
15	MAVRIC SL: scan procedure
16	GEM safety concept
17	3DASI : scan procedure

2. To search the contents of the currently displayed topic, follow these steps.
 - a. From the Navigation pane, select any topic from the Contents.
 - b. In the Quick Search text box, type the text you want to search for.
 - c. Click the Search icon.
 - If the text appears within the topic, it is highlighted.

Figure 1-9: Example of Quick Search and the highlighted text



You are here: 6: Scan parameters > Applications > TRICKS: scan procedure

SCAN APPLICATIONS

TRICKS: scan procedure

Use these steps to acquire images with the **TRICKS multi-phase**, single station, acquisition technique.

1. Open a **scan session**.
2. Acquire a **3-Plane localizer**.
3. Acquire a **calibration scan** if you want to use **ASSET** or **PURE**.
4. From the Workflow Manager area, click **Add Task > Add Sequence**.

Related topics

[Online Help concept](#)

USER INTERFACE

System user interface concept

The system screen design has three major areas:

1. **Header:** contains the Worklist Manager, Image Management, and System Management icons and Scan, Protocol, and Review session tabs for changing the work area display.
2. **Work area:** contains the Scan, Display, Tools, or Patient List work area, depending on the icon or session tab selected in the Header area. For details see:
 - [Image Management work area](#)
 - [Scan work area](#)
 - [Viewer work area](#)
 - [READY View work area](#)
 - [MR General Review work area](#)
 - [System Management work area](#)
3. **Footer:** contains system status messages, icons for Reconstruction, Network, Archive, Film, and Disk Space status, and icons to access Hardware, Stopwatch, and Online Help.

Procedures

[Image Management open work area](#)

[Protocol Session open/close](#)

[Review Session open/close](#)

[Scan Session open/close](#)

[Scan workflow](#)

[System Management open work area](#)

[Worklist Manager open work area](#)

Related topics

[Terminology](#)

[Sessions](#)

USER INTERFACE

User interface terminology

Control panels

Control panels are comprised of selectable buttons. Feature applications such as READY View, Volume Viewer, and Viewer all have control panels.

Linking

Linking allows you to connect series or images in scan and volume viewer.

Pull-down menus

A drop-down or pull-down menu capability is indicated by an arrow. For example, all session tabs have drop-down menus.

Screen

Screens or windows are free floating. They typically appear within a workflow and require you to respond before you can move to the next step in the workflow. An example of a screen is the SAR and dB/dt screen that appears in the New Patient workflow.

Session

A session is a workflow activity involving scan, review, and/or protocols. Sessions are identified by tabs displayed in the header or across the top of the screen. The tab always indicates the session type.

Tabs

Tabs are used through-out the user interface to organize applications and features. For example, in the Workflow Manager area of the Scan work area, there are two tabs: Task and Series Data tab. Click a tab to view it's contents.

Figure 1-10: Workflow Manager screen

Exam		Edit	End
Task		Series Data	
#	Status	Description	Time
1	Done	1: LOCALIZER	00:12
2	Done	2: Cal Head 24	00:06
3	Done	3: Sag T1 FLAIR	01:42
4	RxD	Ax T1 FLAIR	01:42
5	RxD	Ax T2 PROPELLER	4 01:03
6	RxD	Ax T2 FLAIR	4 04:12
7	RxD	Ax T1 SE	4 02:33
8		+Ax DWI	01:04
9		----CONTRAST----	00:04
10		Ax T1 SE C+	04:33
11		Cor T1 SE C+	02:24
12		----OPTIONS----	00:04
13		Cor T2 FSE	02:44

Setup	Add Task ►	Run
View		
<input type="checkbox"/> Auto Scan	Scan	▶

Task

A task is a piece of work assigned in the Workflow Manager. The tasks can be scan data or post-processed data tasks.

Workflow

A workflow provides an order in which specific tasks are to be performed. You can find workflows in Procedure folders, such as the [Manual Prescan workflow](#). Another example is the Workflow Manager, used for scan and post-processed data tasks.

Worklist

A worklist displays a list of "to do" tasks. From the Worklist Manager, you can schedule and select patients for scan activities, enter patient demographic information, complete HIS/RIS tasks, and start an exam.

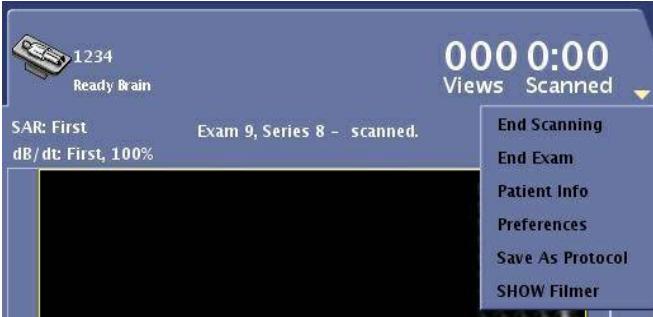
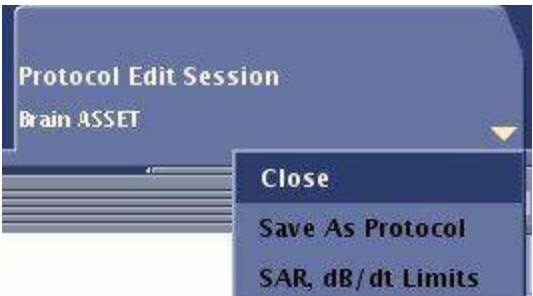
Related topics

[User Interface introduction](#)

USER INTERFACE

Header area

The icons and session tabs in the header area always appear on the screen.

Header area	Work area
	<p>Click Scan Session tab to view the:</p> <ul style="list-style-type: none"> ● Scan work area screen ● Viewer work area displays when Viewer is active in the scan session ● Three scan sessions are allowed (one active and two Scan Done)
	<p>Click Protocol Session tab to view the Protocol work area. One protocol session is allowed.</p>
	<p>Click Review Session tab to view Review work area. Up to two review sessions are allowed if system resources are available.</p>
	<p>Click Worklist Manager icon to display the Worklist Manager work area. The Worklist Manager area is used to:</p> <ul style="list-style-type: none"> ● Schedule patients ● Select patients for scan activities ● Enter patient demographic information ● Complete HIS/RIS tasks ● Start an exam
	<p>Click Image Management icon to display the Image Management work area. The Image Management work area is used to:</p> <ul style="list-style-type: none"> ● Archive/network images

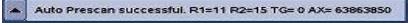
Header area	Work area
	<p>● Select an exam/series/image</p> <p>● Launch an application from the Session Management, Data Management or Tools lists</p> <p>Click Tools icon to display the Tools work area. The Tools work area has multiple tabs that open unique work areas that are used to:</p> <ul style="list-style-type: none"> ● Open a protocol session to create or edit protocols from the Protocol Organize tab ● Initiate a TPS Reset from the Service Desktop Manager tab ● Define multiple system settings from the Guided Install feature on the Service Desktop Manager tab ● Define several system preferences from the System Preferences selection on the Tools pull-down menu ● View error log and write a note to your service representative. For details, see Service Notepad write a message procedure. ● View and select options on the Gating Control screen from the GATING tab ● The menu allows access to additional functions

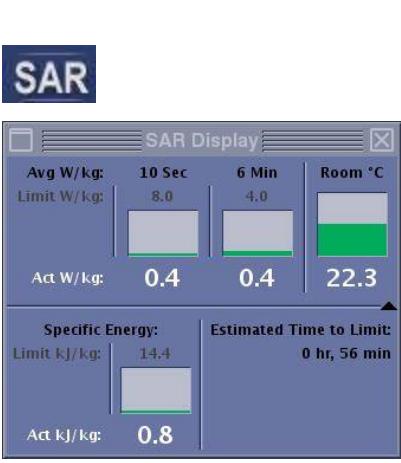
USER INTERFACE

Footer area

The message and icons in the footer area always appear on the screen.



Footer area	Description
 Auto Prescan successful. R1=11 R2=15 TG=0 AX= 63863850	<p>Message area that displays messages regarding the system status. Click the arrow next to the message to display the error log screen.</p> <p>The Scan Parameter area also has a Scan messages area that is related to the series in an INRX state.</p>
	<p>Click the Gating, Fan, Light controls icon to display the Gating Controls screen for:</p> <ul style="list-style-type: none"> ▪ gating ▪ magnet light and fan
 11:43 AM October 4	<p>The current Date and Time is displayed. See Adjust system date/time to change the date or time.</p>
 528/2/6 6/6	<p>The Reconstruction Status area displays the status of the examination, series, and images currently being reconstructed. The most recently reconstructed image is displayed until the next image is ready for reconstruction.</p>
	<p>The Network Status area displays the status of the examination, series, and images currently being networked and the destination location.</p>
	<p>The Archive/Remove Status area displays the status of the examination, series, and images currently being archived to the primary archive device. The Remove Status simply shows "Removing" or "Removed." The individual exams, series or images are not listed.</p>
	<p>The Film Status area displays the status of the examination, series, and images currently being filmed.</p>
 13%	<p>Roll the cursor over the icon to display the disk capacity for 256 and 512 images.</p> <p>The graph displays multiple disk capacity states:</p> <ul style="list-style-type: none"> ▪ empty

Footer area	Description																		
	<ul style="list-style-type: none"> ● $\frac{1}{4}$ full ● $\frac{1}{2}$ full ● $\frac{3}{4}$ full ● a red segment when there is insufficient space available for the currently prescribed acquisition. 																		
	Click to open an iLinq window.																		
	Click to open the Stop Watch screen. See Set count down time on Stop Watch .																		
	Click to open the online help window.																		
 <p>The SAR Display window shows the following data:</p> <table border="1"> <thead> <tr> <th>Avg W/kg:</th> <th>10 Sec</th> <th>6 Min</th> <th>Room °C</th> </tr> </thead> <tbody> <tr> <td>Limit W/kg:</td> <td>8.0</td> <td>4.0</td> <td>22.3</td> </tr> <tr> <td>Act W/kg:</td> <td>0.4</td> <td>0.4</td> <td>22.3</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Specific Energy:</th> <th>Estimated Time to Limit:</th> </tr> </thead> <tbody> <tr> <td>Limit kJ/kg:</td> <td>14.4</td> </tr> <tr> <td>Act kJ/kg:</td> <td>0.8</td> </tr> </tbody> </table>	Avg W/kg:	10 Sec	6 Min	Room °C	Limit W/kg:	8.0	4.0	22.3	Act W/kg:	0.4	0.4	22.3	Specific Energy:	Estimated Time to Limit:	Limit kJ/kg:	14.4	Act kJ/kg:	0.8	Click SAR ¹ icon to open the SAR display.
Avg W/kg:	10 Sec	6 Min	Room °C																
Limit W/kg:	8.0	4.0	22.3																
Act W/kg:	0.4	0.4	22.3																
Specific Energy:	Estimated Time to Limit:																		
Limit kJ/kg:	14.4																		
Act kJ/kg:	0.8																		
 	Click e-Reporting icon to launch the e-Reporting tool, from which you can view, export or print a report. The icon displays "i" when there are unread reports.																		

¹Specific Absorption Rate

USER INTERFACE

Work areas introduction

The Work area content changes based on the session or icon selected from the header. Once a session tab or icon has been selected, the work area content can be changed based on your selections. Below is a list of work areas.

AutoView work area

The upper right corner of the screen displays [AutoView](#).

Gating/Protocol Notes work area

There are two tabs in the lower right corner of the screen: [Protocol Notes](#) and Gating. Both are covered when the Details tab is selected from the Scan Parameters area.

Scan related work areas

[Scan work area](#)

[Worklist Manager work area](#)

[Viewer work area](#)

Display related work areas

[Viewer work area](#)

[READY View work area](#)

[MR General Review work area](#)

System Management work areas

[System Management work area](#)

Image Management work areas

[Image Management work area](#)

USER INTERFACE

Worklist Manager work area



Click the **Worklist Manager icon** from the header area of the screen to open the Worklist Manager work area.

Scroll to the bottom of the graphic to view details.

Figure 1-11: Worklist Manager work area



Table 1-6: Worklist Manager image legend

#	Description
1	Screen header area
2	Worklist Manager header area
3	Worklist Manager Patient List
4	New Patient screen
5	New Exam screen
6	New Other Information screen
7	AutoView
8	Gating waveform or Protocol Notes area

Header area

Figure 1-12: Header



Patient Record area

Figure 1-13: Patient Record area: New Patient (1), Edit Patient (2), Duplicate Patient (3), Delete Patient (4)



The **New icon** allows you to enter a new patient into the Worklist Manager. The patient is added to the Patient List once you click **Save** in the Other Information area.



The **Edit icon** opens the currently selected patient in the Worklist Manager so that you can change patient information.



The **Duplicate icon** duplicates the currently selected patient in the Worklist Manager. This feature is typically used to generate a new scan session on a patient that is still listed in the Worklist.



The **Delete icon** removes a patient from the Worklist Manager.

View area

The Patient List contents, by default, is comprised of all patients that have been added to the Worklist but have not been scanned. There are two Status options that change the patient list contents.

- In Progress: expands the Patient List contents to include patient exams that are still in progress. An exam in progress means that the exam has had scanning ended or placed in suspension but it has not been placed in an End Exam state.
- Completed: expands the Patient List contents to include patient exams that have been completed. An exam is completed when End Exam has been selected from the End menu on the Workflow Manager.

Find area

Figure 1-14: Find area pull down menu



The Find menu contains all the patient list menu bar columns. Several of the menu selections require text fields to be completed resulting in a more refined sorted Patient List.

Last Time Refreshed

The last date and time the list was refreshed.

Refresh

Refresh updates the Patient List with the most recent data from the *HIS¹/RIS²* system.

The Refresh arrow opens the Refresh screen.

Search Data

The Search Data button opens the Search Data screen.

Footer area

Figure 1-15: Start Exam button



Start Exam

The Start Exam button starts a new scan session.

Related topics

[Worklist Manager orientation](#)

¹Hospital Information System

²Radiology Information System

USER INTERFACE

Scan work area

Click **Start Exam** on the [Work List Manager](#) to view the scan work area.

Scroll to the bottom of the graphic to see details.

Figure 1-16: Scan work area



Table 1-7: Scan work area image legend

#	Description
1	Workflow Manager: for details, see the Workflow Manager introduction .
2	Scan controls
3	Graphic Rx area The localizer viewports display the images from which you graphically prescribe a series. Images from the localizer series are the default images displayed. Images from other series can be displayed in these three viewports. For details see Select a series for GRx viewport .
4	Scan Parameters area The system default is to have the lower right quadrant viewport display an image. This viewport is overlaid with more scan parameters when you click the arrow on the Scan Parameter menu bar. You can change the system default so that the normal behavior is to display more scan parameters rather than the third localizer image. For details, see the Scan parameter details procedure .
5	AutoViewer area For details see AutoView considerations .
6	Tabs: Waveform display, Protocol Notes area, Coil For detail on Protocol Notes, see the Add an image . For details on Coil tab, see Select a coil procedure .

Related topics

[Scan orientation](#)

USER INTERFACE**Image Management work area**

From the **header area** of the screen, click the **Image Management icon**  to open the Image Management work area.

Scroll to the bottom of the graphic to see details.
The exact content of all the screen areas may vary based on your system configuration.

Figure 1-17: Image Management work area**Table 1-8:** Image Management image legend

#	Description
1	Screen header area
2	Image Management Patient List controls
3	Image Management Patient List
4	Archive/Network destinations
5	Screen footer area
6	Session Apps list
7	Data Apps list
8	Tools
9	Message area
10	AutoView
11	Gating waveform or Protocol Notes area or Coil tab

#	Description
12	SAR screen

Patient List controls

Source menu

The Source menu controls the contents of the Patient List and displays the host databases to which you are currently connected. The host data base names are also visible at the bottom of the Image Management work area. The default source list is the Local data base of your scanner.

Figure 1-18: Source menu



The **Archive device** icon identifies the node as a *DICOM*¹ device that can be used as an archive device. Not all hosts can be used as archive nodes (for example, another MR system cannot be used as an archive node, but a *PACS*² can be used as an archive node). To be a successful archive node, the node must meet certain DICOM requirements so that when the data is transferred from the host system to the node, the DICOM handshake can be successful. This is not necessary for networking images. The same handshake is not required. This icon is assigned if Archive node is selected on the Archive Node Settings area of the Configure Network Hosts screen.

The **Network node** icon indicates that the node is identified as a network and not archive node. The network icon is assigned if Archive node is *not* selected on the Archive Node Settings area of the Configure Network Hosts screen.

Filter menu

The **Filter icon** opens the Filter Data screen.

The **Eraser icon** removes the filter and display all of the exams in the active remote Patient List.

Refresh

The **Refresh icon** updates the currently active data base that is listed next to Source.

Patient List

The Patient List contains the information in the following order:

¹Digital Imaging and COmmunications in Medicine

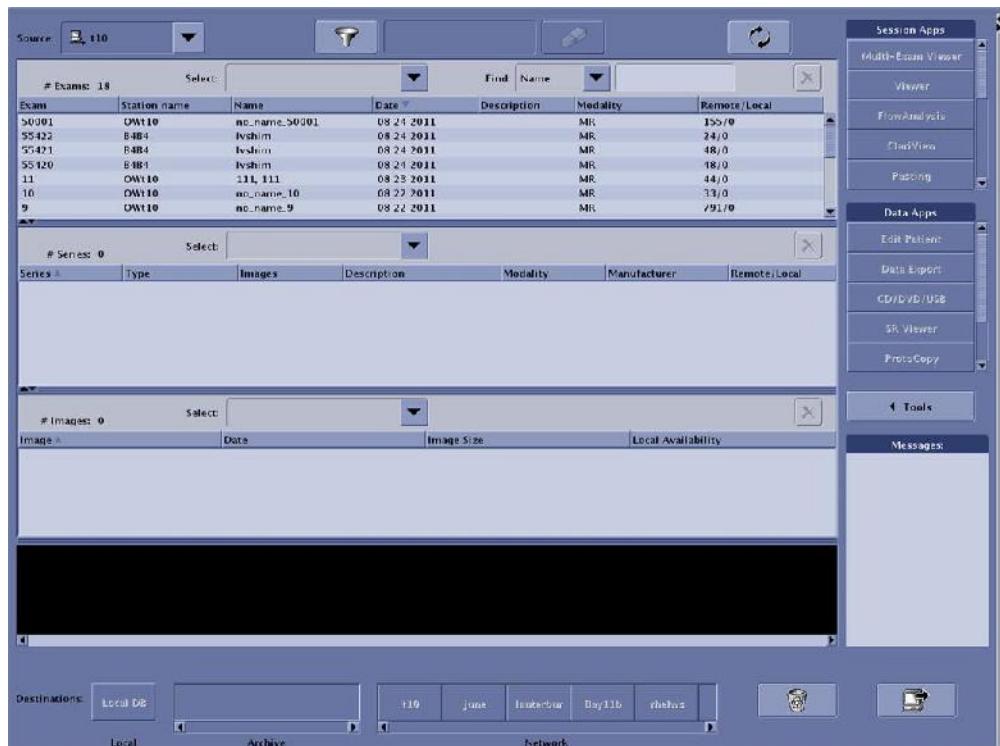
²Picture Archiving Communications System

- Exams
- Series
- Images
- Image thumbnails.

The size and sorting of each data area can be adjusted. For details, see the [Size exam/series/image areas in patient list procedure](#).

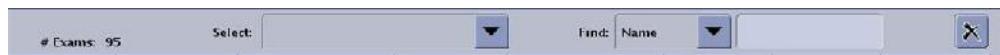
Figure 1-19: Patient list



Figure 1-20: Patient List from remote browser

Note that the remote browser has an exam and series column that displays the images in the remote and local exam and series. For details, see [View remote browser procedure](#).

The image thumbnails do not display on the remote browser; this is expected behavior.

Figure 1-21: Exam title area

The # Exams displays the total number of exams listed in the currently selected data base.

The Select menu selects all exams, all archived exams, all unarchived exams, or no exams.

The Find menu finds a category or a descriptive word of the specific exam you are trying to locate.



The [Remove icon](#) removes a selected exam from the local data base.

Figure 1-22: Series title area

The # Series displays the total number of series listed in the currently selected exam.

The Select menu selects all series, all archived series, all unarchived series, or no series.



The [Remove icon](#) removes a selected series from the local data base.

Figure 1-23: Image title area

The # Images displays the total number of images in the currently selected series.

The Select menu selects all images or no images.



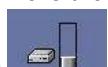
The *Remove icon* removes a selected images from the local data base.

Destinations



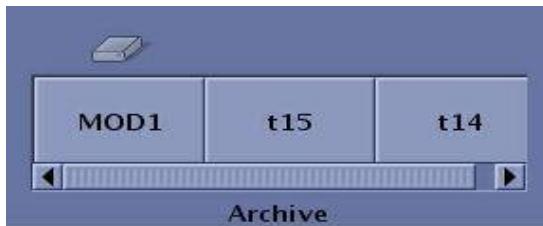
The *Local DB* displays the name of the data base that is currently active in the Patient List.

The Archive area displays all the available Archive Nodes. The slider becomes active when more than three archive



nodes are available. If the archive node is a device such as an *UDO*¹, then a *bar graph icon* appears above the button. Roll the cursor over the button and a tool tip appears indicating the available space on the device.

Figure 1-24: Archive destinations



The Network area displays all the available Network Nodes. The slider becomes active when the number of nodes is greater than the space available.

Figure 1-25: Network destinations



Recycle Bin



The *Recycle Bin icon* opens the Recycle Bin screen from which you can retrieve exams that were deleted before they were archived.

Job Management



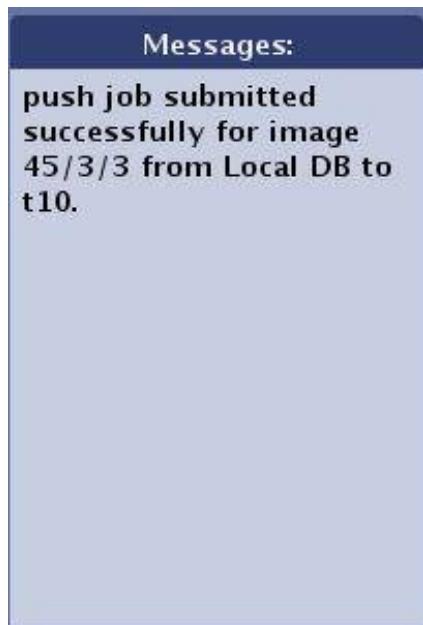
The *Job Management icon* opens the Job Management screen from which you can view jobs in a queue and jobs that are completed.

Image Management messages

The Image Management message area displays messages related to archive, network, and image display.

¹Ultra Density Optical disk

Figure 1-26: Message area



Related topics

[Image Management orientation](#)

USER INTERFACE

Viewer work area

The Viewer is accessed from two locations:

- From a scan session Task or Series tab, select the desired series and click **View** from the **Workflow Manager**.
The series must be in the "Done" state.
- From the Session Apps list on the Image Management desktop.

Figure 1-27: Viewer work area



Table 1-9: Viewer work area image legend

#	Description
1	Viewer control panel
2	Data selector tab
3	Film Composer
4	Viewports

Related topics

Viewer orientation

MR GENERAL REVIEWUSER INTERFACE

READY View work area

Open READY View to display the **READY View** work area.

Figure 1-28: READY View work area

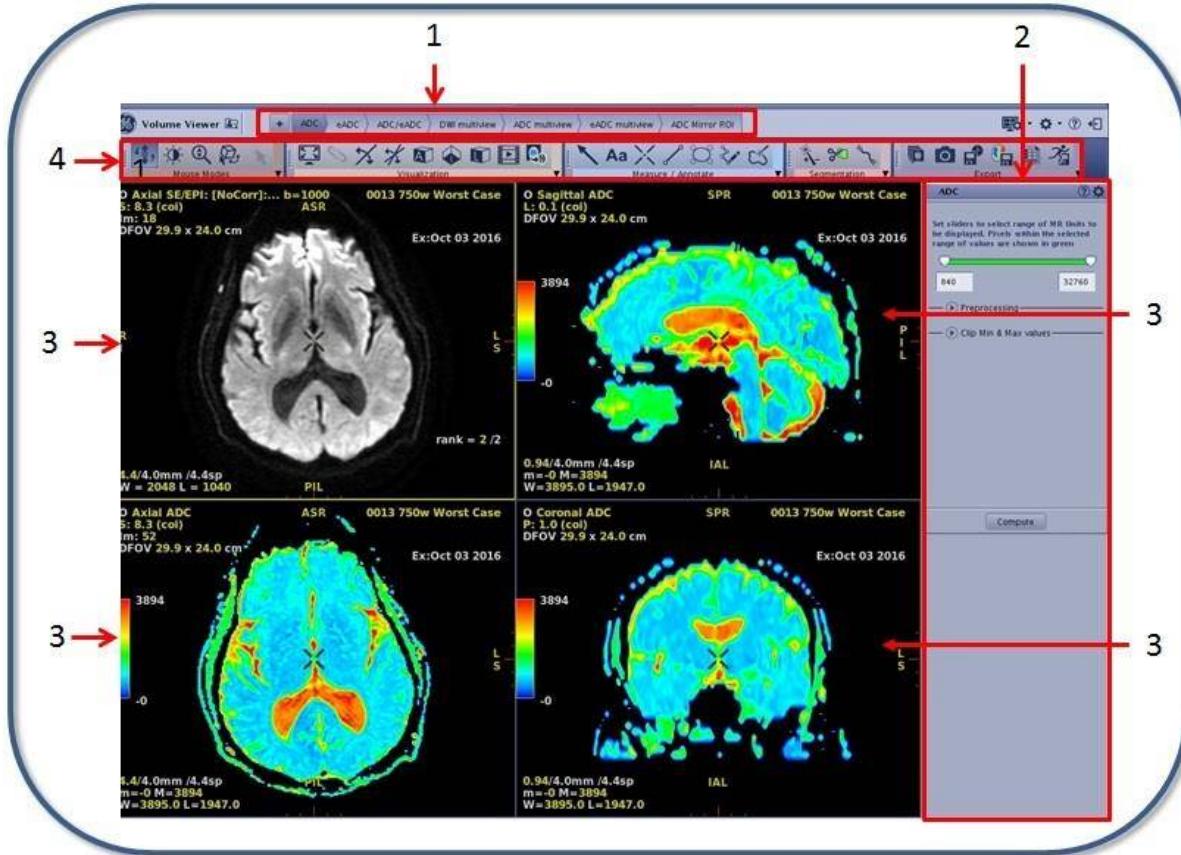


Table 1-10: Image legend

#	Description
1	List of review steps
2	Application panels
3	Source image/ image maps/graph viewports
4	Tool menus that can be displayed at the top or side of the image viewports

Review steps area

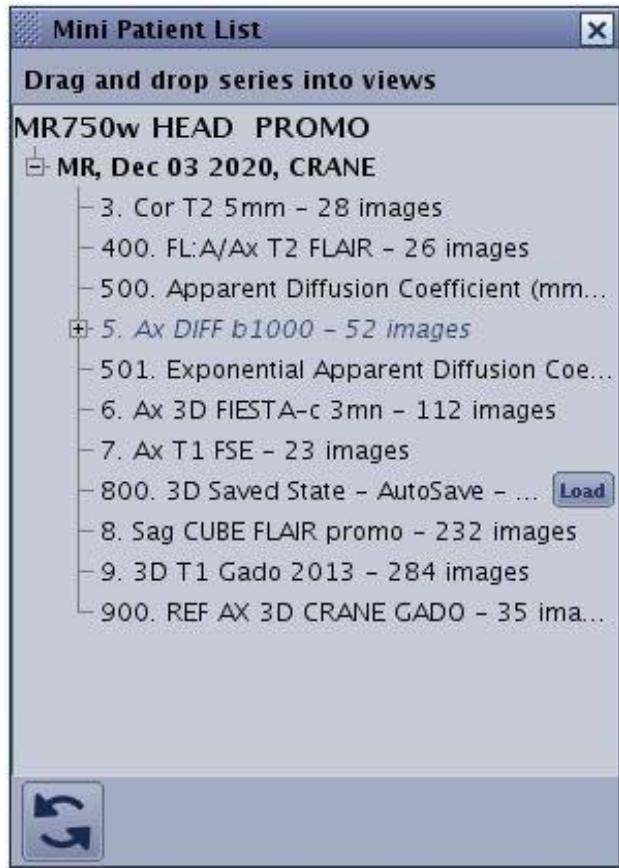
Review steps are displayed at the top of the MR General Reviewscreen: the displayed review steps correspond to the series that exist in the current exam and were selected from the Series Loading Page.

Mini Patient List

Click the **Mini Patient List icon**  to open the list of series for the currently active exam. The series already present in the session are shown in italics. To add series not present in the session, select a series from the list and

drag and drop it into any viewport.

Figure 1-29: Mini Patient list screen



Click the X on the Mini Patient List screen to close the Mini Patient List and return to the current review session.

Protocols

For more details see [Protocol selection work area](#).



The **+ icon** opens/closes the Protocol List screen from which you can select another review step. Protocol list is the list of all the protocols and review steps compatible with your data set. The list is filtered based on the selections made from the Protocol Filters menus.

Click **My Protocols** to only display protocols you have chosen as favorites.

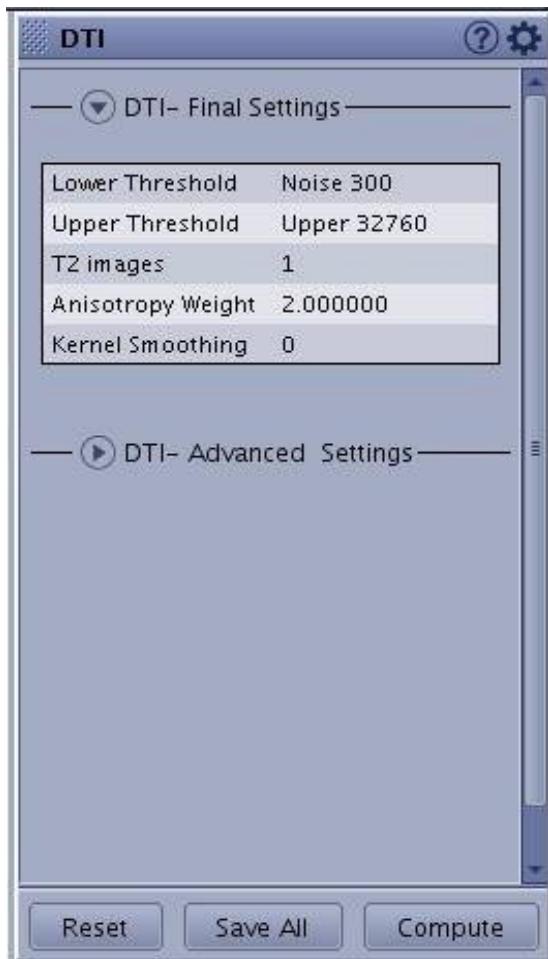
Type any key words in the Search field to easily find protocols within the protocol list.

The protocol list is ranked alphabetically with first the favorite protocols and in a second part, all the other protocols.

Click **Protocol Page** to open the Application Selection screen. If a new protocol is chosen within the protocol page, the loaded / selected series is launched into a new session and the previous session is lost.

Application screens area

The content in this panel changes based on the currently active application and the selected review step.

Figure 1-30: Example of a DTI application screen area

- Screens that have a **hash-marked symbol**  in front of the screen name can be picked up and moved to a new location on the screen.
- The **Tools icon**  displays additional selections. It is a toggle button that moves the screen area between two sets of screens.
- The **Help icon**  located at the top of each panel is a toggle button. It opens and closes a screen with explanations about the application screen.

Source image/ image maps/graph viewports

The content in the viewports changes based on the currently active application and selected review step. The viewport can display images, image maps, spectrum, graphs, etc.

Tools panels

Note that this panel may be placed either on the user interface at the top of the screen (horizontal display) or at the side of the screen (vertical display).

Each tool panel has an arrow in the lower right corner. Click on the arrow to see other icons in that tool group. Click on an icon and many display a screen in the upper right corner of the user interface.

For details on all tools, see [MR General Review \(Volume Viewer\) introduction](#)

Related topics

[READY View introduction](#)

MR GENERAL REVIEWUSER INTERFACE

MR General Review work area

Open MR General Review, 3D Viewer, Reformat or READY View to display the Volume Viewer work area.

Figure 1-31: Example of Volume Viewer work area



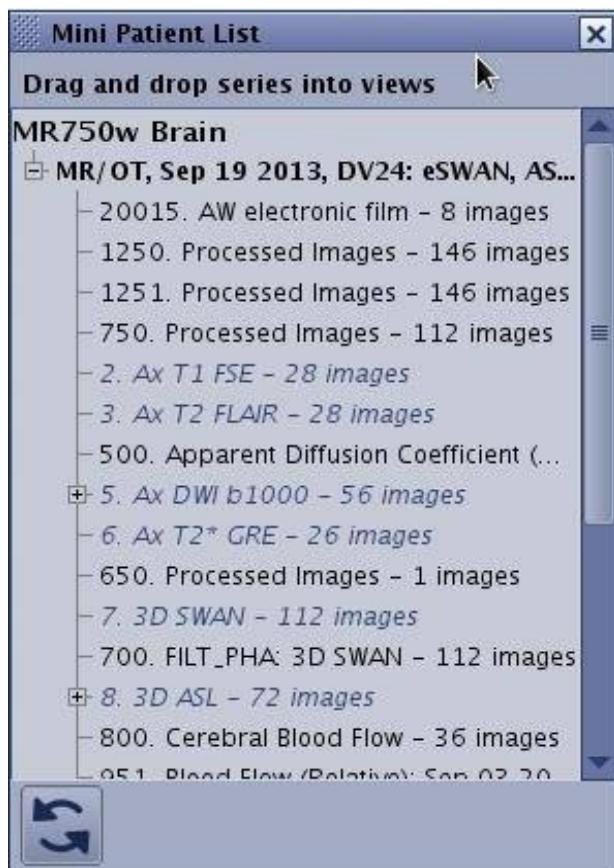
Table 1-11: Image legend

#	Description
1	Mini Patient list
2	List of review steps
3	Top level toolbar icons, for details, see Top level toolbar considerations/procedures
4	Toolbar icons, for details, see Toolbar introduction
5	Application panels
6	Source image/ image maps/graph viewports

Mini Patient List

Click the **Mini Patient List icon**  to open the list of series for the currently active exam. The series already present in the session are shown in italics. To add series not present in the session, select a series from the list and drag and drop it into any viewport.

Figure 1-32: Mini Patient list screen



Click the X  on the Mini Patient List screen to close the Mini Patient List and return to the current review session.

Review steps area

Review steps are displayed at the top of the MR General Review screen: the displayed review steps correspond to the series that exist in the current exam and were selected from the Series Loading Page.

Protocols

For more details see [Protocol selection work area](#).



The **+ icon**  opens/closes the Protocol List screen from which you can select another review step. Protocol list is the list of all the protocols and review steps compatible with your data set. The list is filtered based on the selections made from the Protocol Filters menus.

Click **My Protocols** to only display protocols you have chosen as favorites.

Type any key words in the Search field to easily find protocols within the protocol list.

The protocol list is ranked alphabetically with first the favorite protocols and in a second part, all the other protocols.

Click **Protocol Page** to open the Application Selection screen. If a new protocol is chosen within the protocol page, the loaded / selected series is launched into a new session and the previous session is lost.

Global icons

These icons are always available. For details, see [Top level toolbar considerations/procedures](#).

Toolbar icons

Note that this panel may be placed either on the user interface at the top of the screen (horizontal display) or at the side of the screen (vertical display), for details, see [Toolbar move procedure](#).

Each tool panel has an arrow in the lower right corner. Click on the arrow to see other icons in that tool group. Click on an icon and many display a screen in the upper right corner of the user interface.

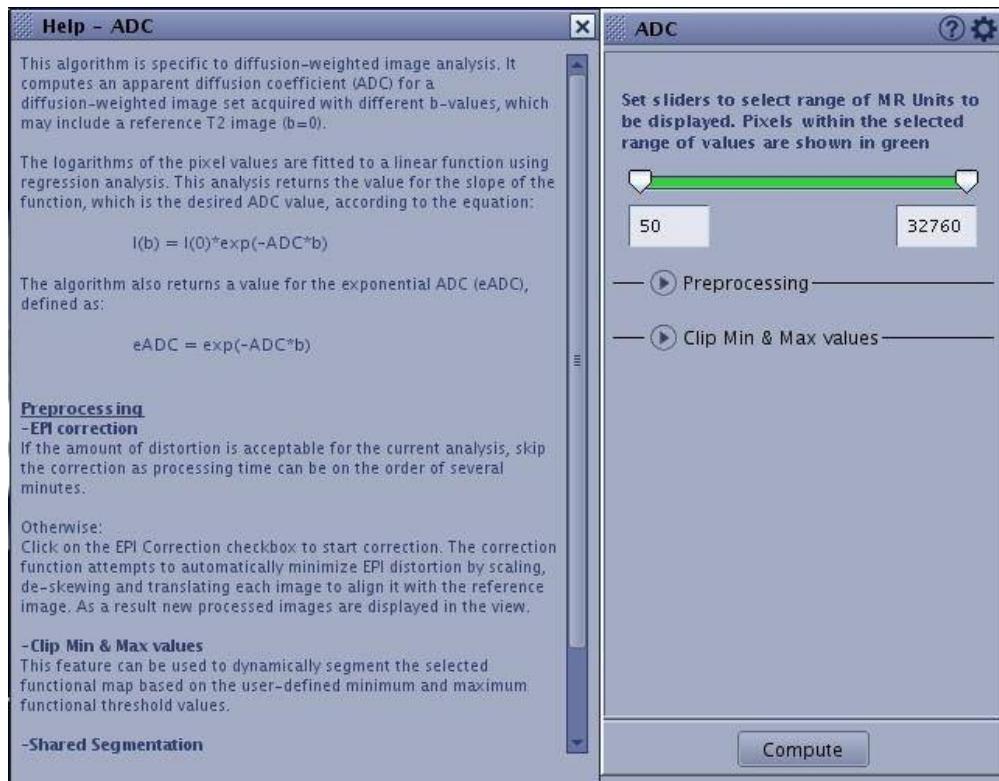
For details on all tools, see [Toolbar introduction](#).

Application screens area

The content in this panel changes based on the currently active application and the selected review step.

Figure 1-33: Example of an application screen area when MR General Review is open



Figure 1-34: Example of a READY View application screen with the Help icon active

- Screens that have a **hash-marked symbol** in front of the screen name can be picked up and moved to a new location on the screen.
- The **Tools icon** at the top of each panel displays additional selections. It is a toggle button that moves the screen area between two sets of screens.
- The **Help icon** at the top of each panel opens toggles a screen on/off with explanations about the application screen.

Source image/ image maps/graph viewports

The content in the viewports changes based on the currently active application and selected review step. The viewport can display images, image maps, spectrum, graphs, etc. For details, see [Series/images/maps/graphs/tables procedures](#).

Related topics

[Getting Started introduction](#)

[MR General Review \(Volume Viewer\) introduction](#)

USER INTERFACE

System Management work area



In the header area, click the **Tools icon** to open the System Management work area.

Scroll to the bottom of the graphic to see details.

Figure 1-35: System Management work area

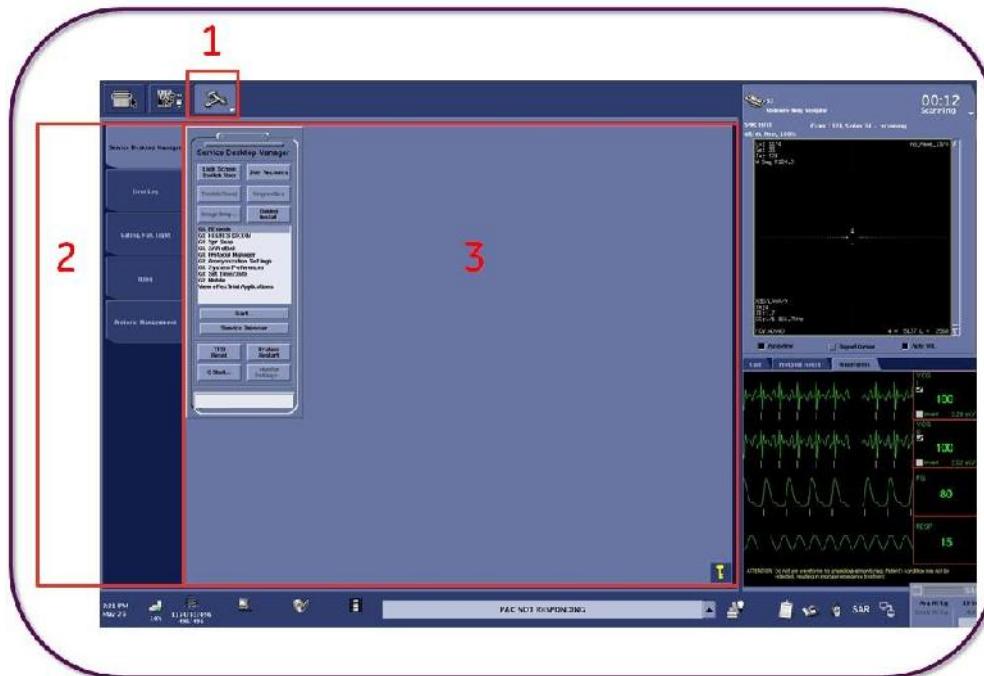


Table 1-12: Systems Management work area image legend

#	Description
1	Tools icon
2	Applications area
3	System Management work area

Applications and work area

Each tab displays different screens in the System Management work area.

- Service Desktop Manager screen
- Error Log screen
- Gating Control screen
- Protocol Man from Tools screen

Related topics

System management orientation

SESSIONS

Session introduction

This section contains information about sessions. In general, a session initiates a workflow in one of three areas: scan, review, and protocols. Sessions are identified by tabs displayed in the header or across the top of the screen. The tab always indicates the session type.

Procedures

[Open a Scan Session](#)

[Close a Scan Session](#)

[Open Image Management procedure](#)

[Open Service Desktop Manager procedure](#)

[Open Worklist procedure](#)

[Protocol Session Procedure](#)

[Review Session Procedure](#)

PREFERENCES

Preferences introduction

Preferences allow you to set default behaviors for a number of different features. Some system preferences require a password to change the status.

Procedures

[Auto Archive](#)

[Auto Network](#)

[Automatic table movement preferences](#)

[Graphic Rx toolbar preferences](#)

[Password preferences](#)

[SAR dB/dt](#)

[Scan parameter details preferences](#)

[Set Auto Calibration preference procedure](#)

[Save FTMRA Realtime images](#)

[Save localizers preference](#)

[Set Ready Brain reference line preference](#)

[Toggle Show Slices in Graphic Rx on/off](#)

[Anatomical Region menu preferences procedure](#)

PREFERENCES

Set Auto Calibration preference procedure



This feature is applicable only when the system is configured with [legacy coil selection](#).

Use these steps to set a preference for Auto Calibration coil feature. When turned on, the system automatically acquires a calibration scan prior to a series that has the following characteristics:

- PURE filter is selected
- ASSET Imaging Option is selected

Select Auto Calibration as a system preference



1. Click the *Tools icon menu*  and select **System Preferences**.
2. From the System Preferences screen, type your password in the Admin Password text field and click **Apply**. This step is only necessary if your site uses password protection to access these features.
3. From the System Preferences screen, choose the desired Auto Calibration option.
 - Select **On** to always have a calibration scan automatically acquired prior to a TDI coil scan that requires a calibration scan.
 - Select **Off** to either manually prescribe a calibration scan or turn on Auto Calibration on an Exam basis.
4. Click **Close**.

Select Auto Calibration for a currently active scan session

1. Click the Scan Session menu and select **Preferences**.
2. On the Exam Preferences screen, choose the desired Auto Calibration option.
 - Select **On** to activate Auto Calibration for all series within the exam that require a calibration scan.
 - Select **Off** to de-activate Auto Calibration if it is turned on at a System Preference level.
3. Click **Close**.
 - The changes apply to the currently active scan session as soon as you close the Exam Preferences screen.
 - Whichever selection is made from the Exam Selection screen, it only applies to the currently active scan session. Therefore, the next scan session reverts to the selection made from the System Preference screen.



IMPORTANT

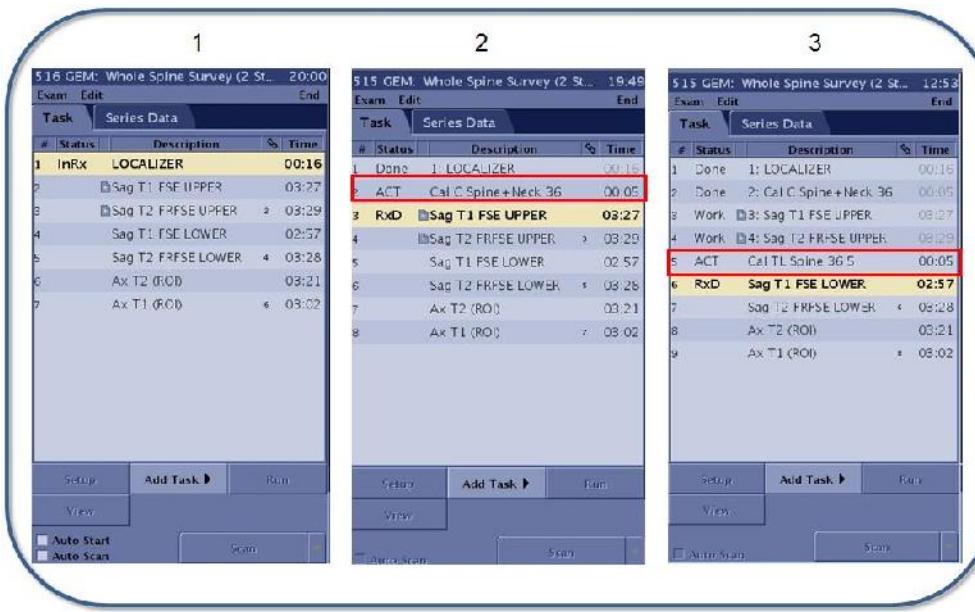
When Auto Calibration is turned off, then you must manually acquire a calibration scan. If you do not acquire a calibration scan, you cannot post process scan data with the PURE filter.

4. Consider turning **On** Auto Calibrations for the scan. For details see [Auto Calibrations](#).



- When auto calibration is **On**, once you click Scan for a series that requires a calibration (PURE and ASSET), then the system automatically starts Auto Prescan followed by the approximately 12 seconds calibration scan. During this time, the workflow manager is unavailable.

- If prescan fails for an automatically generated calibration series, that calibration series should be scanned manually using Manual Prescan and Scan. The acquisition series that generated the calibration series will also have to be manually scanned as well.
- Note that each time you change the coil configuration and prescribe a scan that needs a calibration, the system will acquire another calibration scan.

Figure 1-36: Auto Calibration turned On illustrating 3 different stages of an exam**Table 1-13:** Image legend

#	Description
1	Auto calibration is turned on and the first series, Localizer, is in prescription (InRx state).
2	The second series, Sag T1 FLAIR, is prescribed (RxD state) and since it has either ASSET or PURE as part of the scan prescription, a calibration scan, Cal Head 24, is active (ACT state).
3	The AX T2 FLAIR series is prescribed (RxD state) and it uses a different coil configuration than the previous series. Therefore, another calibration scan, Cal Head 32, is active (ACT state).

Related topics

[Preferences orientation](#)

PREFERENCES

Graphic Rx Toolbar procedure

Use these steps to specify whether the Graphic Rx Toolbar automatically displays when a series is in Setup mode or to open it manually.



1. Click the *Tools icon menu* and select **System Preferences**.
2. From the System Preferences screen, type your password in the Admin Password text field and click **Apply**. This is only necessary if your site uses password protection to access these features.
3. Choose the desired Graphic Rx Toolbar option.
 - Select **Hide** to keep the Graphic Rx Toolbar hidden when a series is in Setup mode. To view the Graphic Rx Toolbar click the *Graphic Rx icon* on the Scan Parameters screen.
 - Select **Show** to have the Graphic Rx Toolbar always visible when a series is in Setup mode. To temporarily hide the toolbar, click the **X** icon on the Graphic Rx Toolbar.
4. Click **Close**.

Related topics

[Preferences orientation](#)

PREFERENCES

Set Ready Brain reference line preference procedures

Use these steps to set a default preference for the reference line used in a Ready Brain scan.

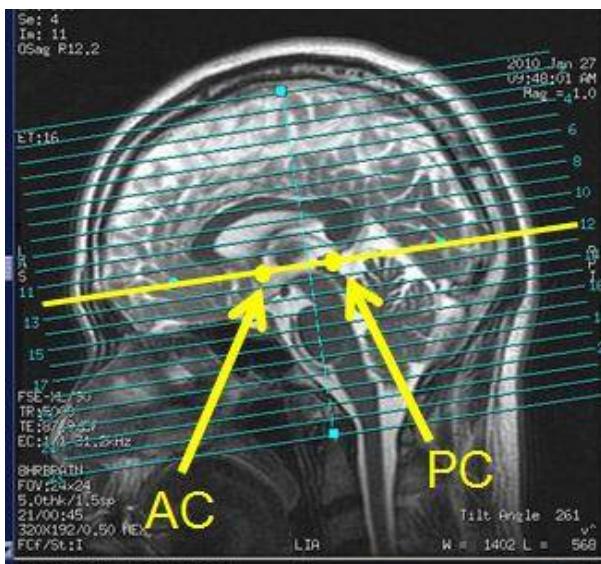


The Ready Brain reference line can be set from the Exam Preference screen before saving the first task or the System Preference screen before starting an exam. To set the Ready Brain reference line from the Exam Preference screen, click the Scan Session menu and select **Preferences**, and follow step 3 in the steps below.



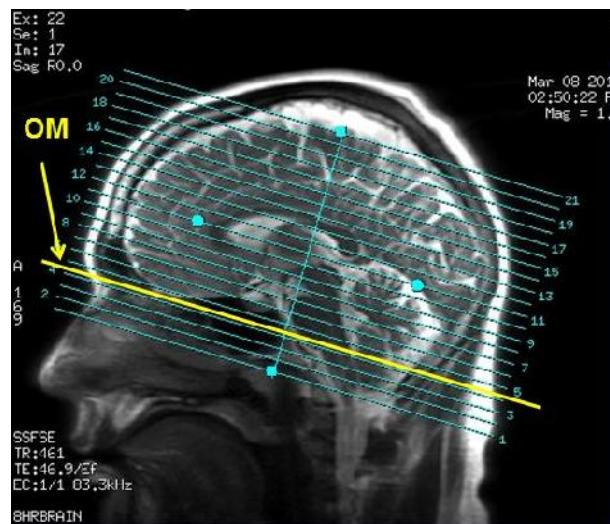
1. Click the **Tools icon menu** and select **System Preferences**.
2. On the System Preferences screen, type your password in the Admin Password text field and click **Apply**. This is only necessary if your site uses password protection to access these features.
3. From the Ready Brain Reference Line menu, select either **ACPC** or **OM**.
 - ACPC sets the ACPC line, which extends from the superior surface of the anterior commissure to the center of the posterior commissure.

Figure 1-37: ACPC line



- OM set the Orbitomeatal line, which extends from the nasal root through the pontomedullary junction.

Figure 1-38: OM line



4. Click **Close**.

Related topics

[Ready Brain](#)

[Preferences orientation](#)

PREFERENCES

Save localizers preferences procedure

Use these steps to automatically save the graphic lines displayed in all three graphic viewports to a series within the exam.



The **Save Localizers** option button must be selected from the **Graphic Rx toolbar** or Graphic Rx screen in PROPELLER for a successful save localizer action.



1. Click the **Tools icon menu** and select **System Preferences**.
2. From the System Preferences screen, click the **Enable Save Localizers** option button **On** or **Off**.
 - This action allows Save Localizer on the Graphic Rx toolbar to be an active selection. If it is turned off, the **Enable Save Localizer** option button on the Graphic Rx toolbar is grayed out or inactive.
 - If you change the on/off state during an exam, it is not active until the next exam.
3. Click **Close** to exit from the System Preferences screen.
4. From the Exam Preferences screen, click the **Enable Save Localizers** option button **On** or **Off**.
 - If you select Off, then the localizer is not saved to a separate series in the patient list, even though you have set the system preference for Save Localizers On.
 - If you select On, then the system saves the localizer to the patient for each series within the exam for which you have selected the **Enable Save Localizer** option button on the Graphic Rx toolbar.
5. Click **Close** to exit the Exam Preferences screen.

Related topics

[Save localizer images](#)

[View localizer images](#)

PREFERENCES

Scan parameter details procedure

Use these steps to automatically hide or show the scan Details tab in the third Graphic RX viewport.



1. Click the *Tools icon menu* and select **System Preferences**.
2. On the System Preferences screen, type your password in the Admin Password text field and click **Apply**. This is only necessary if your site uses password protection to access these features.
3. Choose the desired Additional Scan Parameters Screen option.
 - Select **Hide** to display three Graphic Rx viewports.
 - Select **Show** to display two Graphic Rx viewports with the lower-right viewport displaying the Details tab. At any time, you can close the Details tab to view the third Graphic Rx viewport.
4. Click **Close**.

Related topics

[Preferences orientation](#)

PREFERENCES

Save FTMRA Realtime images procedure

Use these steps to set a default preference to save pre-trigger FTMRA¹ real-time images as a separate series. The series number for these pre-trigger images may contain a duplicate series number with some existing series of the same exam.



1. Click the *Tools icon menu* and select **System Preferences**.
2. On the System Preferences screen, type your password in the Admin Password text field and click **Apply**. This is only necessary if your site uses password protection to access these features.
3. Choose the desired Save FTMRA Realtime images option.
 - The initial state of the **Save Image** toggle button on the FTMRA screen for the first FTMRA task in an exam, is derived from the status of the **Save FTMRA Realtime images** option on the System Preferences screen. The subsequent FTMRA task in the same exam will inherit the previous state of the Save Image toggle button.
 - Select **Off** to not save the pre-trigger realtime images.
 - Select **On** to save the pre-trigger real-time images as a separate series.

Figure 1-39: Save Image button located on the RealTime screen



4. Click **Close**.

Related topics

[Preferences orientation](#)

[Acquire a Real Time scan with Fluoro Trigger](#)

¹Fluoro Trigger Magnetic Resonance Angiography

PREFERENCES

Show Slices in Graphic Rx procedure

Use these steps to set a default preference to hide or show the 2D scan lines on a localizer when in Graphic Rx.



1. Click the *Tools icon menu* and select **System Preferences**.
2. On the System Preferences screen, type your password in the Admin Password text field and click **Apply**. This is only necessary if your site uses password protection to access these features.
3. Choose the desired Show Slices option.
 - Select **Hide** to display the first and last slices and the center of a 2D graphic prescription.
 - Select **Show** to display all the scan lines for your 2D scan graphic prescription.
4. Click **Close**.



For details on how to turn Show Slices on/off within a graphic prescription regardless of the system preference, see [Show Slices in Graphic Rx](#).

Related topics

[Preferences orientation](#)

PREFERENCES

Automatic table movement procedure

Use these steps to specify automatic or manual start of the table movement for all exams or an individual scan session.



When a session is saved to a protocol, the last preferences selected during the session are saved and then restored when the protocol is loaded. This can be useful if you want to disable one of the on/off options such as auto table movement for all emergency trauma protocols because you are concerned about life lines, for example.

Set preference to cross exams



1. Click the **Tools icon** and select **System Preferences**.
2. From the System Preferences screen, type your password in the Admin Password text field and click **Apply**. This is only necessary if your site uses password protection to access these features.
3. Choose the desired table movement option.
 - Select **On** to have the table move automatically to the scan location if the table travel distance is less than 5 cm.
 - Select **Off** to have the table not move to the scan location, thus requiring you to press **Move to Scan** on the **keyboard**.
4. Click **Close**.

Set preference for currently active scan session

1. Click the Scan Session menu and select **Preferences**.
2. On the Exam Preferences screen, choose the desired table movement option.
 - Select **On** to have the table move automatically to the scan location if the table travel distance is less than 5 cm.
 - Select **Off** to have the table not move to the scan location, thus requiring you to press **Move to Scan** on the keyboard.
3. Click **Close**.
 - The changes apply to the currently active scan session as soon as you close the Exam Preferences screen.
 - Whichever selection is made from the Exam Selection screen, it only applies to the currently active scan session. Therefore, the next scan session reverts to the selection made from the System Preference screen.

Related topics

[Preferences orientation](#)

PREFERENCES

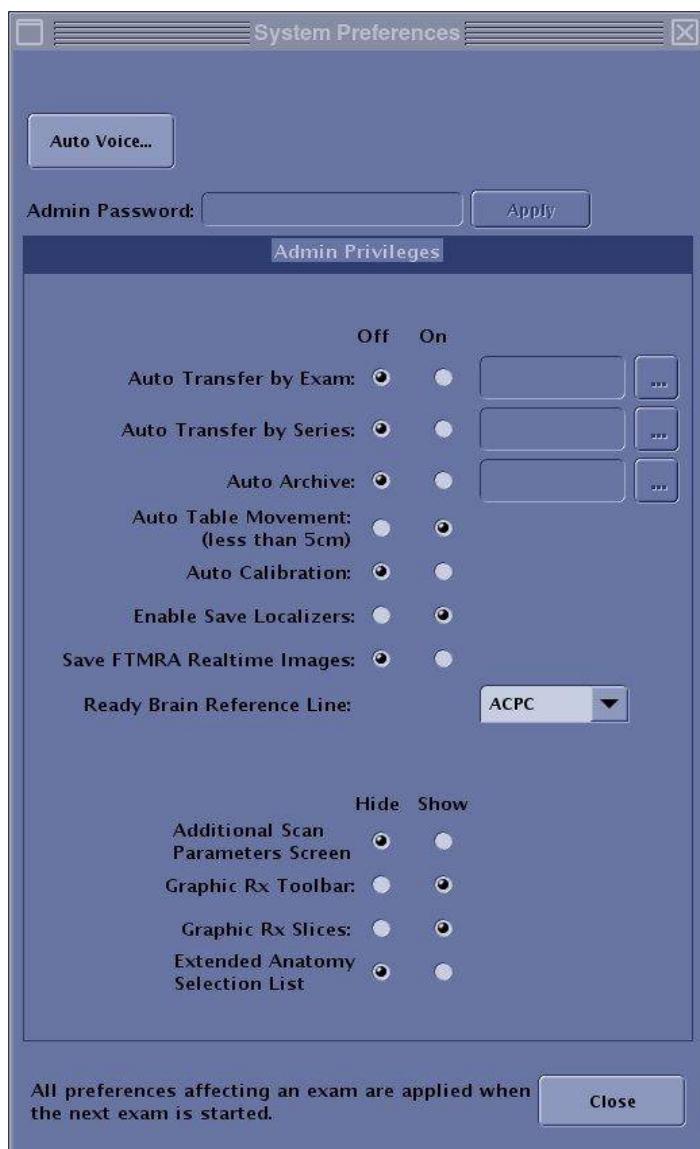
Anatomical Region menu preferences procedure

Use these steps to set the default for the Anatomical Region menu to either an extended or limited list.



1. From the screen header area, click the **Tools icon**.
2. Click **System Preferences**.
3. From the System Preferences screen, complete one of the following:

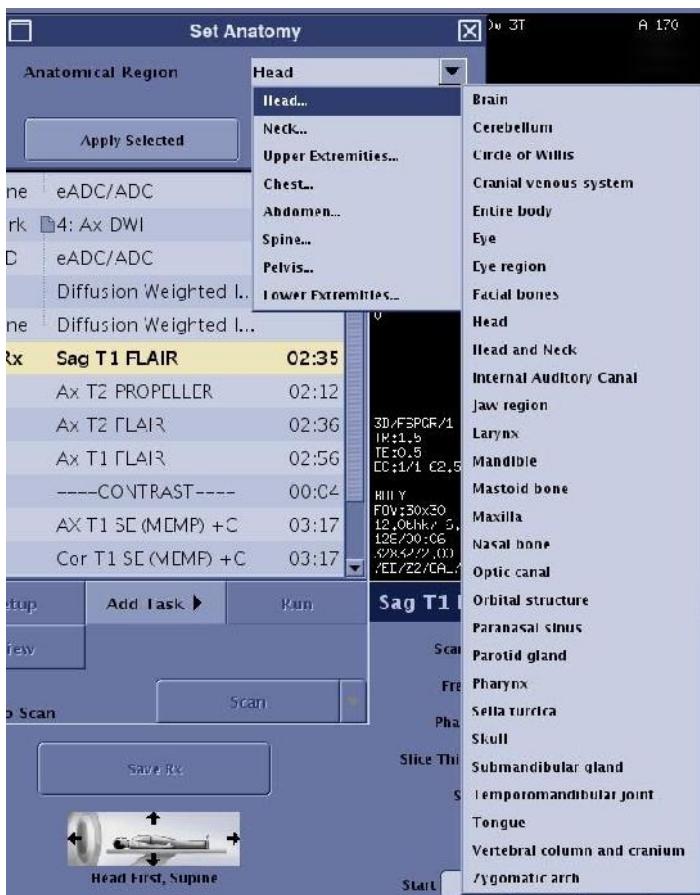
Figure 1-40: System Preferences screen



- a. From the Extended Anatomy Selection list option, click **Hide** for a limited number of options to display on the list.

Figure 1-41: Limited Anatomical Region list

b. From the Extended Anatomy Selection list option, click **Show** for all options to display on the list.

Figure 1-42: Extended Anatomical Region list

Related topics

[Anatomical Region procedure 1](#)

[Anatomical Region procedure 2](#)

[Anatomical Region considerations](#)

PRIVACY AND SECURITY

Privacy and security introduction

This section describes Privacy and Security considerations regarding:

- Expected intended use
- Privacy & Security capabilities and how they are configured and used appropriately

This manual assumes that you understand the concepts of Privacy and Security.

- Privacy is the property of protecting the personal private interests of patients. Privacy requires security.
- Security protects both the system and information from risks to confidentiality, integrity, and availability. Security protects Privacy but also protects more broadly against these risks.

In healthcare one must balance privacy, security, and safety. Most of the time there isn't a conflict between these three domains of risk. The healthcare provider organization is encouraged to use risk management procedures to assess and prioritize privacy, security, and safety risks. Through the use of risk management one can determine how to best leverage the capabilities provided in the system.

Definitions

Term	Description
InSite Agent	The client part of the InSite ExC platform.
InSite ExC	A GE Healthcare remote service platform.
InSite Server	The server part of the InSite ExC platform.
Online Center	A GE Healthcare service center
Local Archive	Archive containing images and patient information, residing locally on the system.
Remote Archive	GE healthcare proprietary remote archive with images and patient information. Both Image Vault and EchoPAC Share can act as a remote archive for the Vivid Ultrasound System and EchoPAC.

MDS2

The Manufacturer Disclosure Statement for Medical Device Security (MDS2) is available upon request as a statement of the security and privacy capabilities. Contact your sales representative.

Considerations

- Intended Use considerations
- Capability considerations
- Network connectivity considerations
- Information protection considerations
- System protection considerations
- Remote Service considerations
- Personal information considerations
- Security vulnerability considerations
- Hazardous situations due to network failures considerations

PRIVACY AND SECURITY

Intended Use considerations

The GE Healthcare system has been designed for an intended use with the following expectations of Privacy and Security protections included in the environment where this product is used:

- The system should be connected to a secured network, not open to unintended users.
- The system should be physically secured in a way that it is not accessible for unintended users.
- External media containing images, patient data, reports and logs should be secured. When no longer used, the data should be securely erased and/or the media should be securely deleted.
- The monitors of the system should be placed in a way limiting the visibility to the user only.

Related topics

[Privacy and security introduction](#)

PRIVACY AND SECURITY

Capability considerations

The system incorporates a broad assortment of capabilities to enable Privacy and Security. This section describes the capability and use of these Privacy and Security capabilities.

Access controls

The access control features may be used to help control access to sensitive information. Access control includes user account creation and assigning privileges.

Identity provisioning

The provisioning of user accounts includes the steps of account creation, maintenance, and suspension of the account when it is no longer needed. A user account is created for the use by a specific individual. This user account is associated with access rights, and is recorded in security audit logging.

Management of user accounts

The system is delivered from the factory with four application predefined user accounts:

- root: an administrative user account
- service: a GE service user account
- mruser: a normal user account with no administrative privileges
- insite: a GE remote service user account

When receiving the system or after installation, it is recommended that you complete the following steps to ensure customer control of the user accounts:

1. Create user accounts for each user of the system.
2. Give each user the privileges needed for the user.
3. Give administrative rights only to users intended to do administrative tasks on the system. (This should be a limited number of users).
4. Create individual users for each person that uses the system. This is needed to associate actions performed on the system with individual persons in the audit logs.
5. Maintenance of user accounts: establish routines for removal of user accounts that are no longer being used.

User name and password restrictions

The system allows you to set password minimum length. It is recommended you establish a policy for password length, complexity and expiration.

User authentication

The user authentication step verifies that the user attempting to use the system is indeed the user associated with the account given.

A user authenticated by a valid user name and password is granted access to the system.

The exception is for emergency access.

Assigning access rights

The Assigning of Access Rights is the administrative process to associate permissions with user accounts.

A user defined on the system is assigned with a set of operator rights. This is done by granting the user account membership to zero or more role based groups in the system.

Only users with the Admin right have access to manage user accounts.

Emergency access to the system

The system has an emergency access mode. The emergency mode is for making the system available for acquiring scans in emergency situations. This is especially important in emergency situations as the normal staff may not be available. The recognition of an emergency mode access is in recognition that patient care is more important than limiting access to patient data. No authentication is needed for using the system in emergency mode.

Service access

Service Access provides the service engineer with access to the system, including access to the systems file system.

When remote service connection is in progress, the system provides visual notification. You can terminate the connection at any time.

Patient privacy consent management

Patient Privacy Consent Management is the process of supporting the patient that requests their privacy requirements. This is distinct from other forms of consent such as the consent to treat.

There is no integrated functionality in the system for Patient Privacy Consent Management. If needed operational routines must be established.

Privacy and Security audit logging and accountability controls

Privacy & Security Audit Logging and Accountability Controls support Security surveillance and Privacy investigations and reporting.

The system has integrated functionality for audit logging that includes audit logging of privacy related events and display capabilities for the logged events on the system.

Audit logging content

The following events are captured by the audit logging:

- User Management events
 - Account creation, modification, enabling, disabling, and removal
 - Group creation, modification, enabling, disabling, and removal
 - Access to, or modification of, the equipment service password(s)
- Login events
 - User login
 - Failed login
 - Emergency user login
 - Logout
- Study or exam/Patient data handling events - creation, modification, deletion and access.
- Patient Scan events - start and stop scan.
- Protocol Modification events
- Transfer of patient data (both automatically and manually).
- Modality Work List transfers and MPPS transfers.
- Problem Report events – creation of Problem Reports containing patient study.

- Remote Access events
- Configuration-related events, such as changes to the system configuration or changes to the DICOM list.
- External media events, such as mounting of an external USB device, or an empty CD.

Information elements of the audit log:

- Type (activity)
- Time stamp in UTC
- Place (system)
- Source
- User

The information elements are logged for the events where they are applicable.

Related topics

[Privacy and security introduction](#)

PRIVACY AND SECURITY

Network connectivity considerations

Network connection for the system is required by several system features:

- DICOM connectivity to other DICOM devices
- Remote archive storage on another networked, compatible GE system
- Remote service capabilities given by GE's InSite remote service platform

System interconnections

The possible system interconnections are shown in Figure 1-43. For a particular installation, typically a subset of the interconnections is utilized.

Figure 1-43: Interconnections

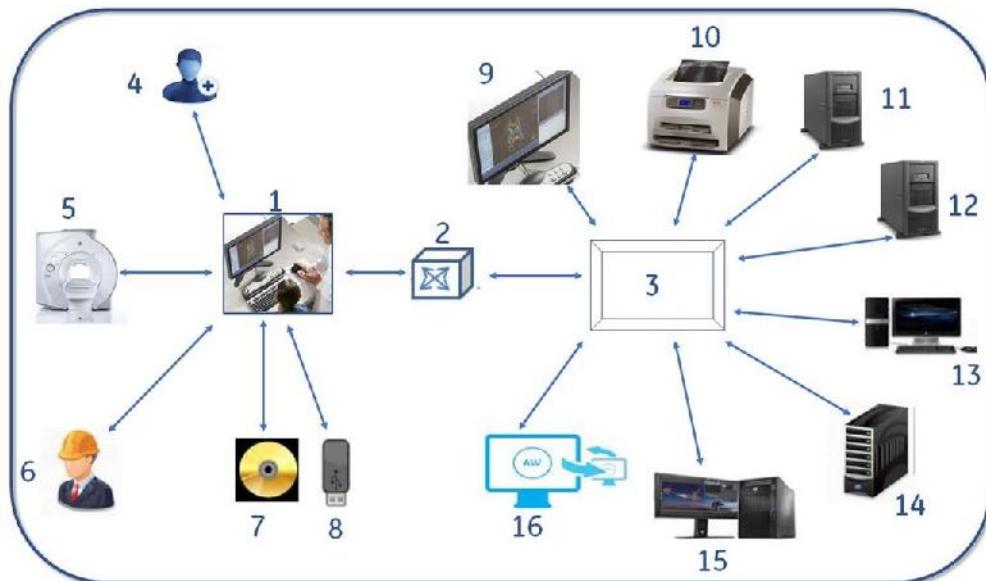


Table 1-14: Image legend

#	Description	#	Description
1	Workstation or operator console	9	Image reading station
2	Switch on Base/Hospital accredited network	10	DICOM filer
3	Internet LAN	11	RIS/Work list server
4	Radiologic technologist	12	PACS
5	Scanner	13	Modality Performed Procedure Step Notification to remote AE, query and receive images sent by remote AE
6	Field service engineer	14	Synchronize Time (NTP ¹)
7	Media: CD/DVD	15	Perform Remote Service on the system (Secure Tunneling)

¹Network Time Protocol

#	Description	#	Description
8	Media: USB device	16	Launch post processing applications (HTTP)

More interconnection details are described in Table 1-15 (below)

Table 1-15: Interconnection details

Source/Destination	Description
Manual / Terminal	<ul style="list-style-type: none"> ● User console manual operations
RIS/Worklist Server	<ul style="list-style-type: none"> ● Modality Work list query from remote AE (RIS¹/Worklist Server)
Remote DICOM AE	<ul style="list-style-type: none"> ● Transfer images to remote AE for review/storage (DICOM² SCP e.g., PACS³, Image Review Station) ● Transfer images to a remote AE for archival (DICOM Archival Node e.g., PACS) ● Query/Retrieve images from remote AE ● Receive the images sent by remote AE
DICOM Print-er/Filmer	<ul style="list-style-type: none"> ● Transfer images to a remote AE for Printing/Filming
Removable Storage	<ul style="list-style-type: none"> ● Save/Restore images to/from external media (CD/DVD/USB⁴) Save/Restore system state to/from external media (CD/DVD/USB) ● Save/Restore Scan Data to/from external media (CD/DVD/USB)
NTP Server	<ul style="list-style-type: none"> ● Synchronize Time
Local Service	<ul style="list-style-type: none"> ● Field Service Engineer performs local service for system
Remote Service	<ul style="list-style-type: none"> ● Optional connection to InSite remote service: <ul style="list-style-type: none"> - Terminal (SSH) - OLC - TVA (VNC through SSH) - Imaging Performance Manager
AW/Post Processing	<ul style="list-style-type: none"> ● Launch Post Processing Applications

Network requirements

Minimum throughput:

- Recommended minimum 100 Mbit/sec for wired network for large image file transfer

Host characteristics:

¹Radiology Information System

²Digital Imaging and COmmunications in Medicine

³Picture Archiving Communications System

⁴Universal Serial Bus

- TCP/IP¹ network
- Both DHCP and static IP allocation are supported
- AD/Domain integration is not supported

Network protocols

Physical and link layer interface:

- Ethernet IEEE 802.3 10BASE-T, 100BASE-TX and 1000BASE-T
- Isolated LAN connection to prevent increased leakage current

Wireless protocols:

- No wireless protocols are supported.

Internet protocol version:

- IPv4

Related topics

[Privacy and security introduction](#)

¹Internet Protocol

PRIVACY AND SECURITY

Information protection considerations

This section has information to guide in the preparation of a secure environment for your system.

Security operations are best implemented as part of an overall defense in depth information assurance strategy to be used throughout an Information Technology system that addresses personnel, physical security and technology. The layered approach of defense in depth limits the risk that the failure of a single security safeguard would allow and compromise the system.

NETWORK SECURITY

GE strongly recommends that medical information systems operate in a secure network environment that is protected from unauthorized intrusion. There are many effective techniques for isolating and protecting medical information systems, including implementing firewall protection, demilitarized zones (DMZs), Virtual Local Area Networks (VLANs) and network enclaves.

To assist in secure network design, the following network profile outlines the required network services for the System.

The system is supported with an internal firewall. The following two chapters describe the configuration of the firewall and the guidance for configuring the IT infrastructure where it is connected. Recommended firewall configurations for the computer hosting is described in chapter 5.2.

Inbound firewall configuration

All inbound connections are blocked by the system's internal firewall, with the exemptions listed in Table 1-16 (below)

The column "Recommended configuration of network infrastructure" describes the suggested configuration of the network infrastructure regarding the different network services.

Table 1-16: Inbound firewall and recommended configuration

Local port	Remote port	Protocol	Programs	Recommended configuration of network infrastructure	Network service
4006	Any	TCP	All	Open to DICOM server(s) configured on the system	DICOM Storage Service SCP
3002					
3003	Any	TCP	All	Optional	Enterprise Authentication/ Authorization
3004					
6386					
443	Any	TCP	All	Optional	InSite
22	Any	TCP	All	Optional	Secure shell
*	Any	ICMP	All	Optional	Ping

Security capabilities

Local archive: The system is provided with internal archive, for storing images and patient data locally on the system. The local archives file repository and patient database are not supporting file sharing or remote connection. These can only be accessed locally.

DICOM connections: Works as defined by DICOM guidelines. The application accepts connection only to/from DICOM entities with an IP-address, AE Title and port number matching the configured parameters in the system.

The communication sessions are on demand, always initiated locally from the system.

The system's internal firewall will have exemptions for ports used by the defined DICOM data flows in the system.

Remote service: See [Remote service considerations](#) for description of the Remote Service and the Remote Service security capabilities.

Network infrastructure: The infrastructure of the network where the system is connected must be configured to allow traffic as described in Table 1-16 (on the previous page) and Local archive security capabilities. All other traffic to and from the system can be blocked in the network infrastructure to prevent unintended access.

Removable media security

The system has an integrated CD/DVD drive and it supports USB connected storage devices. CD/DVD discs and USB storage device are used for:

- Exporting and importing scan data and images
- System back-up and restore
- Upgrading system and application software
- Storing service logs during service sessions

Data stored on CD/DVD media is stored unencrypted. As this data could contain personal information (PI), the CD/DVD and the content on the CD/DVD must be handled according to applicable regulations and guidelines for handling personal information (PI) / protected health information (PHI).

Booting from USB removable media is disabled in BIOS. Priority 1 boot device is the systems internal hard disk.

Data stored on removable media is stored unencrypted. As this data could contain personal information / protected health information , removable media and its content must be handled according to applicable regulations and guidelines for handling personal information / protected health information.

The system does not have an internal functionality for secure deletion of data stored on the removable devices.

Approved procedures and tools should be used for secure removal of data stored on removable media, according to applicable regulations and guidelines for handling patient information / personal information / protected health information.

Data at rest security

System's internal hard disk: Data stored on the system is stored unencrypted on the system's internal hard disk. Access to the file system is prevented for without system administrative or service privileges.

Back-up: The system stores data unencrypted to the back-up target. This may include PI/PHI. The target for the back-up, either removable media or servers, must be secured to ensure the required security of the backed-up data from the system.

External data flows: The system supports interconnections to external storage systems. This includes connections to DICOM servers. The security of data stored on the interconnected system must be secured on the external storage system (outside the scope of the system).

Stored data: Data stored on the host computer is stored unencrypted on the systems file system. This includes patient information in database, images, debug logs and audit log.

The data stored on the host computer should be secured to prevent unintended access to personal information / protected health information being part of this data.

Table 1-17: Directories potentially containing PI / PHI on the host computer

Data	Description	Typical path
Local Archive	Database containing PI / PHI	/usr/g/sdc_image_pool

Data	Description	Typical path
Audit log	Readable audit log containing PI / PHI	/usr/g/gehc_security/eat/logs
Debug log files	Logs for debugging purposes, potentially containing PI / PHI	/usr/g/service/log /usr/g/insite/logfiles /usr/g/ctuser/logfiles /var/adm

Data integrity capabilities

The system has integrated audit log capabilities to log changes to the data. For details, see [Privacy and Security audit logging and accountability controls](#).

De-identification capabilities

The system contains de-identification (anonymization and pseudonymization) capabilities to limit privacy and security risks to sensitive information. De-identification is done by clearing or overwriting all information in the image containing PI / PHI.

When creating a problem report, the option may be selected. The option is also selected for transferring the data via the Online Center.

Business continuity

To ensure business continuity several options must be considered related to the data storage. The target for the images and patient archive must be chosen to ensure safe storage of the data. Both internal and external alternatives are supported.

Patient archive solutions

The system supports following alternatives for storing images and patient information, both internally and externally:

- Local Archive: local storage on the system (intended for temporary storage only)
- DICOM storage: storage on DICOM / PACS server

Securing data on remote archive and DICOM/PACS servers

If external archive is used, make sure to establish backup procedures for the external archive. The business contingency planning of data stored on DICOM / PACS servers is outside the scope of this document.

Related topics

[Privacy and security introduction](#)

PRIVACY AND SECURITY

System protection considerations

The System needs to be configured and maintained in a way that continually protects Privacy and Security. Maintaining appropriate firewall settings and limiting physical access to the your system reduces the possibility of introducing malicious software to the system. Your system does not support anti-malware software.

System protection

Your GE Healthcare system contains additional features to improve local operational security.

Linux services disabled

Unused Linux services are disabled on the system.

GE Healthcare service access

To access advanced service software on your system, a USB service dongle and a service password is needed. GE service engineers have the USB service dongle and credentials. This is also available for purchase by in house and third-party service organizations.

Remote service access through InSite is limited to scanners that have a service contract with GE Healthcare. When enabled, the InSite remote service connection is established between the scanner and GE Healthcare through dedicated proprietary servers at GE Healthcare via a secure encrypted SSH tunnel. InSite service is entirely optional and can be completely disabled and blocked by the firewall with no impact to operation of the scanner.

Automatic screen lock

Your system has a configurable inactivity screen feature. It can be configured to lock the screen after a predefined inactivity time. The configurable inactivity time is by default 15 minutes. When the screen is locked, no patient information is visible on the screen. To unlock the user must enter the password of the current logged in user of the system or login as another user.

Firewall

For details, see Table 1-16 (on page 1-82)

System change management

The system is based on SUSE Linux Enterprise Server Release 11 SP3.

For privacy and security concerns regarding GE products, please see <http://www.ge.com/security>.

Third-Party Software

The following third-party applications are included as part of the Revolution CT software:

- Oracle JRE 1.6.0_115 and 1.7.0_101
- Apache HTTP Server 2.2.11
- Apache Mod-jk 1.2.27
- Mathworks MATLAB Compiled Runtime 8.2 (2013b)
- Mozilla Firefox 38.8
- openssl 0.9.8x
- RTI Connext DDS Professional 5.2

Security updates / patches

GE Healthcare is constantly monitoring for security vulnerabilities applicable for the products. This includes vulnerabilities in the application software, third-party components and the underlying operating system.

Announced vulnerabilities in the operating system or other third-party components, are assessed based on the system's configuration and use.

When needed, GE Healthcare will make security updates / patches for the products and make these available to customers. When applicable, these updates will include patches for the operating system and third-party components.

Disaster recovery

To recover from a disaster, it would be necessary to repair any damaged hardware, re-install software, and restore system state, which contains all the calibrations and customer settings used to configure your system. Patient images are not archived on the system. It is recommended that all patient images be networked to a PACS as soon as possible after a patient exam is complete so that they can be recovered on the PACS.

The System State media is created after the system is installed, configured, and calibrated for the specific site and device. It is recommended that the System State media be refreshed or a new copy be made whenever the system calibrations or configuration changes.

Related topics

[Privacy and security introduction](#)

PRIVACY AND SECURITY

Remote Service considerations

Often the fastest, most efficient and cost-effective manner to provide service is to connect to the system remotely. Every effort is made to ensure that this connection is as secure as possible.

The GE Healthcare InSite remote service platform is integrated in your system. InSite enables real-time application support, problem diagnosis and repair.

InSite remote service

The two major technical components of InSite are the Agent and the Server. The Agent is installed on the your system, while the Server resides within GE Healthcare. The Agent establishes secure communications to the Server via the Internet. Key features of the InSite platform include:

- Communication from the Agent to the Server is initiated by the on-site user securely via an outbound connection over port 443 (HTTPS).
- The Agent always connects to a known IP address (the Server). The ability to identify the Server is therefore guaranteed, because the Server is visible to the Agent only via a known IP address.
- The Agent communicates with the Server via transmissions that require password authentication. Data transmissions are encrypted using the Secure Socket Layer (SSL) protocol over port 443.
- Inbound Firewall on the system is not compromised. Web services standard protocol uses only outbound HTTPS Port 443.
- Inbound connections are managed using SSH tunneling over port 22.

Data Privacy

In some cases, GE Healthcare may encounter personal information (PI) / protected health information (PHI) as part of the troubleshooting procedures or under data access rights granted to GE Healthcare. Access to this data is limited to GE Healthcare authorized personnel only. PI / PHI encountered as part of remote service sessions will be handled according to GE Healthcare's standards for handling PI / PHI.

Related topics

[Privacy and security introduction](#)

PRIVACY AND SECURITY

Personal information considerations

Your scanner collects patient demographic and personal or protected health information for use within the system. The information entered for the selected application is also collected.

The following types of information are collected for the purposes of patient medical diagnosis, user management, audit logging and debug logging:

- Patient demographics
- Medical diagnostics and measurements
- Medical images
- Facility information
- Provider information
- Device data

If your system is connected to external archive systems, patient demographics, medical diagnostics, measurements and images will be communicated to/from the external archive systems. For details see [Network connectivity considerations](#)

Related topics

[Privacy and security introduction](#)

PRIVACY AND SECURITY

Security vulnerability considerations

Security Vulnerability scanning is done on your system using Nessus Security Center. All Identified vulnerabilities are mitigated as appropriate based on risks they pose to the product. Critical and High-risk vulnerabilities, if any, are mitigated before the software is released.

Security scanning is performed before the release of the product.

Related topics

[Privacy and security introduction](#)

PRIVACY AND SECURITY

Hazardous situations due to network failures considerations

Hazardous situations

The following general hazardous situations have been identified as potentially hazardous as a result of the IT network failing to provide the required characteristics specified above.

- Delayed or impaired access to images or other exam information or patient data.
- Permanent loss of images or other exam information or patient data.
- Corruption of images or other exam information or patient data.
- LAN connection loss during operation may cause loss of data, and damage data integrity.

Warning

In addition to the hazardous situations identified above, connection of the system to a network that includes other equipment could result in other unidentified risks to patients, operators or third parties. The responsible organization should identify, analyze, evaluate and control these risks on an ongoing basis including after changes to the network such as those listed below, which could introduce new risks and require additional analysis.

- Changes in network configuration
- Connection of additional items to the network
- Disconnecting items from the network
- Update of equipment connected to the network
- Upgrade of equipment connected to the network

Related topics

[Privacy and security introduction](#)

ENTERPRISE AUDIT TRAIL

Enterprise Audit Trail procedure

The main purpose of EAT is to provide an API for application generated audit messages and to send those messages to an audit repository. The transportation protocol between EAT and Audit Repository is configurable. EAT supports multiple transportation protocols and multiple repositories. EAT provides a web based tool to configure EAT settings. It also provides a basic viewer to view local stored audit events.

Use these steps to open the Enterprise Audit Trail user interface.



Service assistance is required for initial setup of either the Local or EAT Repository Server information, which must be supplied by the customer.



1. From the header area of the screen, click the **Tools icon**.
2. From the **System Management work area**, click the **Service Desktop Manager** tab.
3. On the Service Desktop Manager, click **Service Browser**.
4. From the MR Service Desktop screen, click the **Utilities** tab.

Figure 1-44: MR Service Desktop tabs area



5. From the Security Tools folder, click **Enterprise Audit Trail**.

Figure 1-45: Toolbox list



6. From the Enterprise Audit Trail area of the InSite Browser screen, click **Click here to go to the link**.
7. From the Enterprise Audit Trail screen, select a tab.
 - Audit Message Settings tab.
 - Audit Source ID: the system identifier chosen by the customer.
 - Patient Name Anonymized: can be set to **On** or **Off** to anonymize the patient name.
 - **Save**: saves your selections.

Figure 1-46: Audit Message Settings tab



- Enterprise Repository tab, which only applies if your system has an Enterprise Audit Trail Repository Server.
 - Enterprise Repository On/Off: **On** enables Enterprise Audit Trail Repository Server. Default = **Off**.
 - Host Name / IP: the Host Name / IP Address for Enterprise Audit Trail Repository Server.
 - Port Number: the Port number for Enterprise Audit Trail Repository Server.
 - Protocol: appropriate transfer protocols (necessary for Enterprise Audit Trail Repository Server) are displayed in the menu.
 - **Send Test Message**: used to test server configuration and connection.
 - **Save**: saves your selections.
-  If you have more than one Enterprise Audit Trail Repository Server, configure a second Repository Server information.

Figure 1-47: Enterprise Repository tab



- Local Repository tab
 - On/Off: use **On** if no Enterprise Audit Trail Server is available and/or Customer desires to keep event logged locally to the system, otherwise use **Off**. Default = **On**.
 - Display Raw XML: shows Event XML data when an event is selected and you click **Display Raw XML**.

Figure 1-48: Local Repository tab

The screenshot shows the Local Repository tab of an audit interface. At the top, there are three tabs: Audit Message Settings, Enterprise Repository, and Local Repository. The Local Repository tab is selected. On the left, there is a radio button group for 'Audit Message Settings' with 'On' selected. Below it are buttons for 'Refresh' and 'Display Raw XML'. A large central area displays a list of audit messages. The list header is 'Event ID / Time / Event Outcome'. The messages are as follows:

Event ID / Time / Event Outcome
110114 [2018-06-14T16:23:44] Success
110114 [2018-06-14T15:44:15] Success
110114 [2018-06-14T15:02:41] Success
110113 [2018-06-13T19:39:22] Success
110114 [2018-06-13T19:01:52] Success
110113 [2018-06-13T15:58:38] Success
110114 [2018-06-13T14:59:46] Success
110113 [2018-06-12T21:38:17] Success
110114 [2018-06-12T21:00:12] Success
110113 [2018-06-11T19:38:27] Success
110114 [2018-06-11T18:58:09] Success
110114 [2018-06-11T18:58:02] Minor Failure
110113 [2018-06-11T16:13:00] Success
110114 [2018-06-11T15:39:34] Success
110113 [2018-06-11T15:37:12] Success
110100 [2018-06-11T15:37:12] Success
110114 [2018-06-11T15:35:19] Success
110113 [2018-06-11T15:31:45] Success
110100 [2018-06-11T15:31:45] Success

At the bottom, a message states 'Local Repository : 19 Messages'. There are also page navigation buttons at the bottom of the main content area.

8. Click **X** to close the screen.

Related topics

[Enterprise Audit Trail introduction](#)

DATA PRIVACY

Data Privacy introduction

Globally, laws and requirements for patient data privacy have been enacted to protect the health information of individuals against access without consent or authorization. Examples of global privacy standards are:

- Health Insurance Portability and Accountability Act (HIPAA)
- Directive 95/46/EC on Data Protection (the Data Protection Directive)
- Personal Information Protection and Electronic Documents Act (PIPEDA)
- Department of Defense Platform IT (PIT)
- EA3 (Enterprise Authentication, Authorization & Audit trail)
- Data Protection Act UK
- European Union Data Protection Directive EU

EA3 is the global term for data privacy. HIPAA is the term used for data privacy on the MR system user interface.

The Privacy Rule establishes regulations for the use and disclosure of Protected Health Information. Your MR system's Data Privacy features help your site control access to the scanner and to patient data.

GE Medical Systems has a longstanding reputation of providing customizable, clinical solutions to protect the privacy and security of your organization's unique clinical workflow, as well as your patient's confidentiality.

Please recognize the intended use of the product when determining how critical any privacy risk is, relative to patient care and safety. GE is very concerned with providing the best care to the patients, and in some cases we have determined that patient care is more important than the risk to privacy. In these cases we take every precaution to minimize privacy risk.

Security and Privacy are maintained across a Healthcare system. Any product that is placed into an uncontrolled environment will not be secure and cannot protect privacy. As we design scanners, we design them to be implemented in a "Secure Environment". A secure environment is based on multiple layers of security, a concept known as defense in depth. For example, a Best Practice that is gaining much attention places firewalls between departments, as well as at a DMZ, between all extranets, and the external Internet access point. In this example a radiology firewall may allow DICOM and HL7 traffic through, but no other protocols. These DICOM and HL7 protocols would be blocked at the DMZ and again at the Internet Firewall.

Data Privacy using EA3 requires you to log on to the scanner and log off when you are done scanning for a period of time. If you do not log off, the system will log you off and you will have to log back on. Data Privacy using EA3 contains the following permissions. You can have Administrative, GE Service, Standard User or Limited User. Standard User can perform scanning functions and modify protocols. Administrator can set up and delete users. Limited users can perform all scanning functions. GE Service can do all functions. You must have Administrative permission to add or delete users.

When you are adding users for local databases, certain rules apply. You must use the following guidelines:

- Users/Groups – Lower case letters and numbers only
- Users/Groups – No limit on length
- Passwords – for details, see [Password procedures](#).

Administrator and Limited User permissions have different abilities when logging on. The Administrator permission can add users. The Standard User permission can scan and modify protocols in Protocol Management. The Limited User can only scan. Emergency User login has Limited User permission.

Data Privacy is an option that can be enabled or disabled by your Field Engineer through reconfiguration of your system.

Permissions

Data Privacy using EA3 contains the following permissions:

- Administrative User - can add and delete users
- GE Service - Limited User scanning functions
- Standard User - can perform scanning functions and modify protocols
- Limited User- can perform all scanning functions
- Emergency User - has Limited User functions as designated by the administrator

Users and groups

Every person who has permission to use the system is a user. Users are set up by system administrators. These administrators may be IT personnel in an enterprise environment, or a site manager or lead tech in stand-alone environments. The administrator adds new users and assigns the users to a group, which dictates the level of privileges a person will have.

For example, a person named Sue Smith could belong to a group called technologists, radiologists, administrators, or any combination.

Groups and privileges

The group to which a person belongs has privileges. If you do not have an enterprise system, the assignment of group privileges is probably limited to those who have administrator privileges and those who do not. Additionally, permission for protocol edit may be assigned to groups. If your system is set up for enterprise login, your IT person or administrator may use more of the features.



If you make modifications to the following tabs the changes don't appear until after a system reboot:

- Local Users tab
- Groups tab
- Applications tab
- Enterprise tab

Procedures

[Activate data privacy procedure](#)

[User Account procedure](#)

[Role based membership procedure](#)

[Passwords](#)

[Password procedures](#)

[Force a user to change password procedure](#)

[Change your password procedure](#)

[EA3 procedures](#)

[Configure HIPAA/EA3 properties procedure](#)

[Local user procedures](#)

[Local User Procedures](#)

[Add a Local user procedure](#)

[Configure user login procedure](#)

[Change a user's name procedure](#)

[Remove a user procedure](#)

[Add or remove a user from a group procedure](#)

[Lock/unlock a user procedure](#)

[Group procedures](#)

[Group procedures](#)

[Add a Local or Enterprise group procedure](#)

[Add users to a group procedure](#)

[Remove a Local or Enterprise group procedure](#)

[Remove a user's group membership procedure](#)

[Enterprise procedures](#)

[Configure the enterprise tab procedure](#)

[Auto enterprise configuration procedure](#)

[Manual enterprise configuration considerations](#)

DATA PRIVACY

Activate role based or auto start procedure

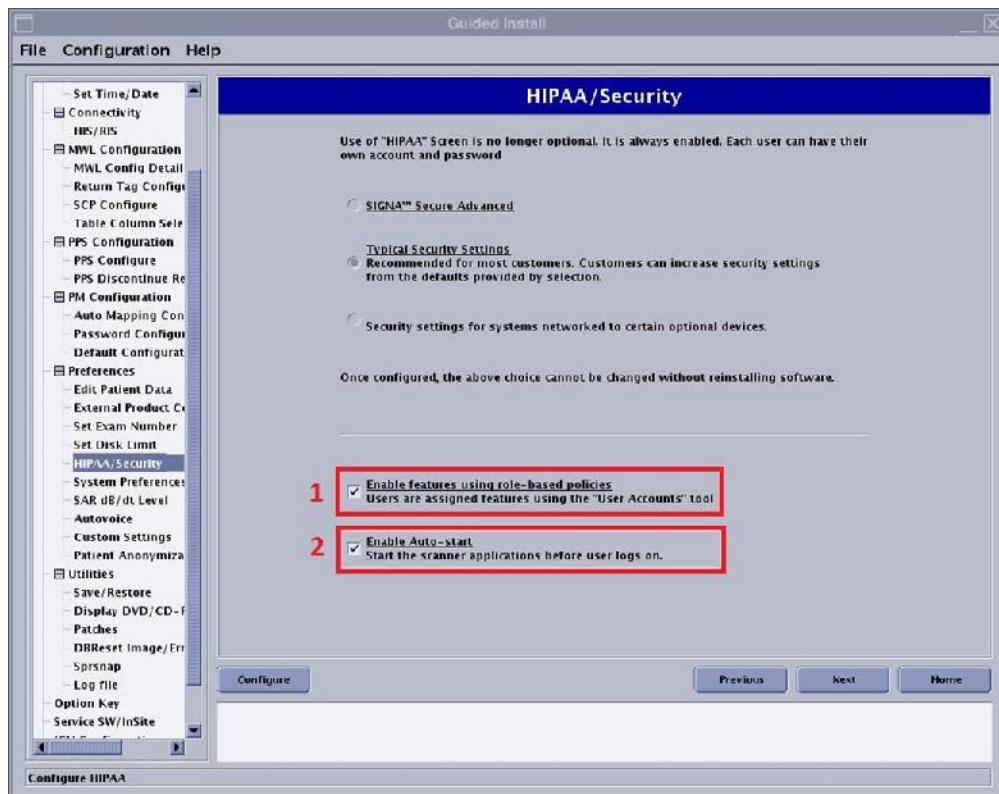
The use of the HIPAA screen is no longer optional; it is always enabled. Each user can have their own account and password.

Use these steps to activate role based or auto start features.



1. From the header area of the screen, click the **Tools icon**
2. Click the **Service Desktop manager** tab.
3. On the Service Desktop Manager, click **Guided Install**.
4. Select **GI: FE mode** in the program list and click **Start**.
5. Place the cursor in the Install window and click to activate.
6. At the root password prompt, type your password and press **Enter** to display the Guided Install screen.
 - **operator** is the default password. If your facility has changed the password, consult your site administrator.
7. To activate the Role Based feature or Enable Auto-start, follow these steps.
 - a. From the HIPAA/Security screen, click the **Enable features using role-based policies** option.

Figure 1-49: 1 = Enable features using role-based policies, 2 = Enable Auto-start



- Every person who has permission to use the system is a user.
- Users are set up by a system administrator (there can only one system administrator).

- The administrator may be an IT person in an enterprise environment, a site manager, or a lead tech in stand-alone environments.
 - The administrator adds new users and assigns the users to a group, which dictates the level of privileges a person will have. For details, see [Role based membership procedure](#).
- b. From the HIPAA/Security screen, click the **Enable Auto-start** option.
 - Auto-start enables the scanner applications to automatically begin before a user logs on. A message displays with a 30 second count-down at logon.
 - c. Click **Configure** to accept your configuration changes.
8. To close the Guided Install screen, click **File >Quit**.
 9. In the Message box, click **Yes** to confirm the quit action.
 10. From the Tools menu, click **System Restart** to reboot the computer.

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Data Privacy Controlled Access considerations

Data Privacy using Controlled Access always enables the HIPAA¹ Logon screen and a level of security for your system. The security level setting is set by your service representative during software installation. Your site should collaborate with your service representative to choose the security settings for your system. Once configured, this security setting cannot be changed without reinstalling the software.

There are three levels of security:

- Highest Security Settings
- Typical Security Settings
 - Recommended for most customers. Customers can increase security settings from the defaults provided by selection.
- Security settings for systems networked to certain optional devices.

At installation, a default "sdc" account is provided. Your site can choose to use this shared account or accounts can be created for each user. If the default account is used, it is strongly recommended to change the password.

Logon and logout is done using a lock-screen. Entering a username and password opens the lock-screen. If you are not performing a system shutdown when you finish using the system, you should lock the screen so others can log on.

Your site should assign an administrative user to further customize the security settings. The administrative user can perform the following functions:

- Create a unique account for each user
- Delete accounts, such as the default sdc account
- Enable/disable an Emergency Logon feature that allows a user to log on without a password
- Set an inactivity timeout to automatically lock the screen
- Set the password complexity rules
- Assign which users can use certain features

Procedures

[User Account procedure](#)

[Password procedures](#)

[System logon and logout procedures](#)

¹Health Insurance Portability and Accountability Act

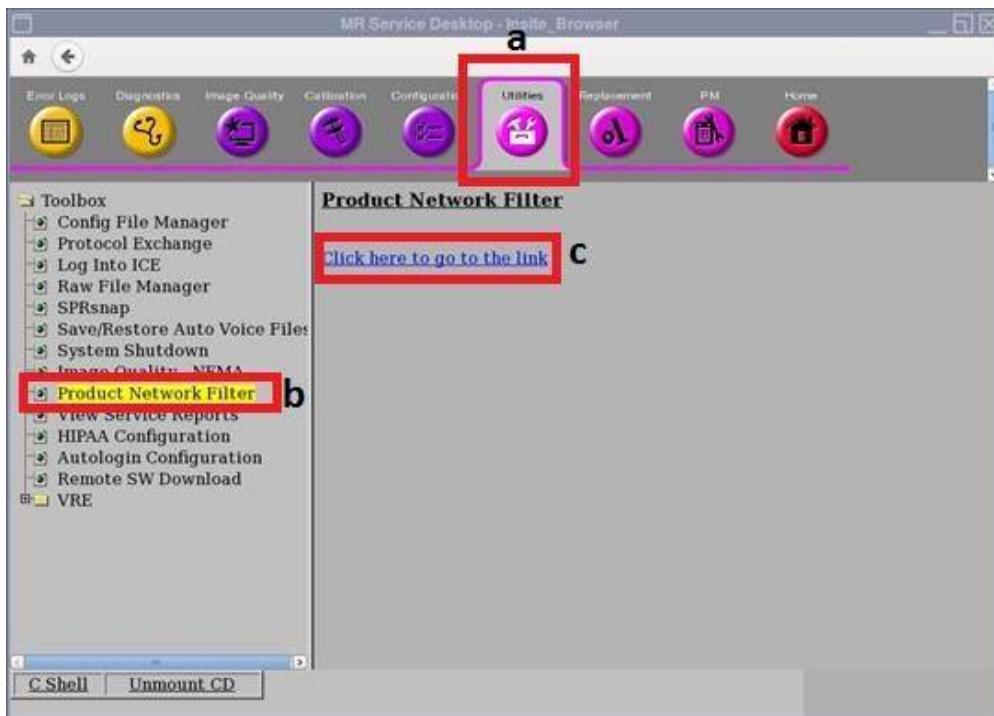
DATA PRIVACY

Product Network Filters procedure

Use these steps to set filters that restrict which system services are allowed to be controlled by other devices trying to access the Operator console.

1. From the header area of the screen, click the **Tools icon** 
2. From the System Management work area, click the **Service Desktop Manager** tab.
3. On the Service Desktop Manager, click **Service Browser**.
4. From the MR Service Desktop screen, complete the following
 - a. Click **Utilities** tab.
 - b. From the Utilities tab, click **Product Network Filter**.
 - c. From the Product Network Filter area of the Service Desktop screen, click **Click here to go to the link**.

Figure 1-50: Utilities tab



5. From the Product Network Filters screen, click the help icon in the upper right corner and follow the help screen instructions.
 - Your Field Engineer can assist you and your IT Department in configuring PNF.

Figure 1-51: Product Network Filters screen and help icon

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

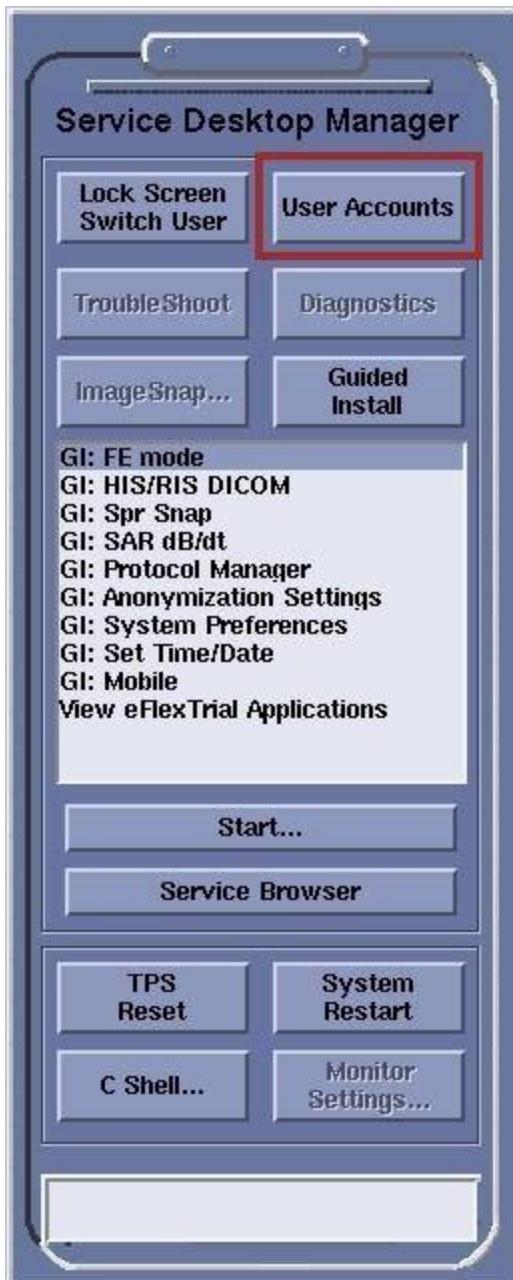
User Account procedure

Use these steps to open the Controlled Access User Accounts interface to configure data privacy settings. Only administrative users have permission to access the User Accounts configuration.



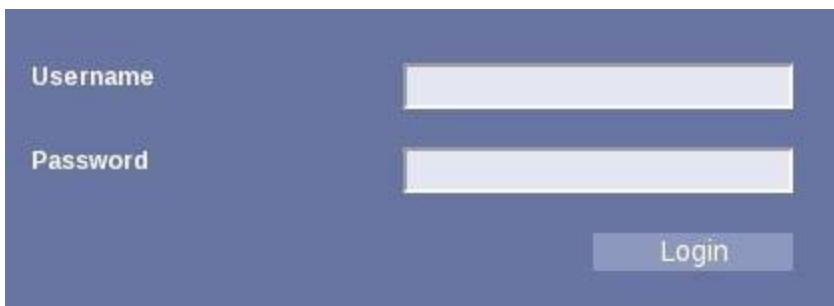
1. From the header area of the screen, click the *Tools* icon.
2. From the System Management work area, click the **Service Desktop Manager** tab.
3. From the Service Desktop Manager, click **User Accounts**.

Figure 1-52: Service Desktop Manager



4. Type the administrative user name and password.
 - To initially set up User Accounts, you must have administrative privileges.
 - The default user name = root.
 - The default password = operator.
 - It is advisable to change the default username and password to your facility created defaults.

Figure 1-53: User Accounts Login



5. Click **Login**.
 - When you log in, the User Accounts interface opens to the Application tab.
 - System administrators can perform a number of tasks that affect what users can do or will see when they log into the system.

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Role-based membership procedure

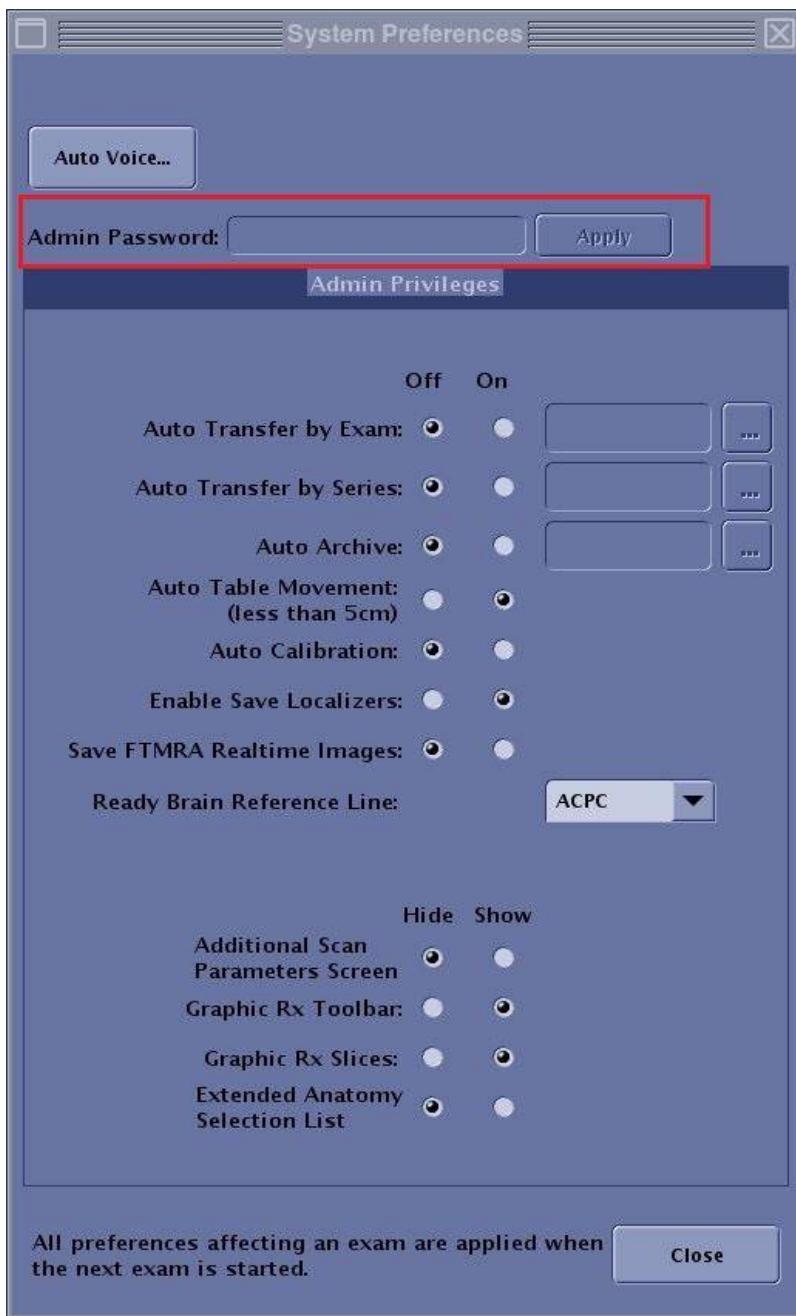
Every person who has permission to use the system is a user. Users are set up by a system administrator (there can only one system administrator). The administrator may be an IT personnel in an enterprise environment, or a site manager or lead tech in stand-alone environments. The administrator adds new users and assigns the users to a group, which dictates the level of privileges a person will have.

If role-based membership is enabled by your GE Service engineer, then when a Local User is added to a group from the Local Users tab, the administrator can define the groups to which a user belongs. For example, a user named Sue Smith could belong to a group called technologists, radiologists, administrators, or any combination. Sue may have privileges for Protocol Edit, System Preference but no permission for GE Level 2 Group.

The following groups require a password:

- **ProtocolEdit**, which means that the user can edit site protocols.
- **GESystemPreferenceGroup**, which means that you can change Administration Privilege settings on the System preferences screen once you have entered your personal password in the Administration Password text field and click **Apply**.

Figure 1-54: Example of a 1.5T System Preferences screen accessed from the top level Tools menu



Considerations

- If your facility uses the Enterprise option with Role-based membership, and you have clicked **Enable Authorization** on the Application tab and clicked **Enable Enterprise Authentication** on the Enterprise tab, contact your IT department for the Group Membership name that has access to the scanner.
- After obtaining the Enterprise Group Membership name, from the Groups Tab, click **Add Enterprise Group** and enter the name provided by the IT department. From the Groups Tab, apply the roles for the group; at a minimum a single role must be selected.
- Failure to add these roles to the Group tab may inadvertently lock all users out of the scanner.

Prerequisite

The GE Service engineer enables the use of role-based policies by selecting the following from the HIPAA/Security screen:

- Enable features using role-based policies

If you are unable to access your role-based membership, contact your GE Service engineer.

Procedure

Use these steps to define group privileges for a user.

1. [Open the Controlled Access User Accounts interface.](#)
2. From the Application tab, follow these steps.
 - a. In the upper left corner, click **Enable Authorization**.
 - When authorization is enabled, anyone logging in through EA3 (both local and enterprise users) must have a role. Anyone without a role is denied access.

Figure 1-55: Upper left corner of Application tab.



- b. In the lower left corner, click **Apply Configuration**.
3. From the Local User tab, follow these steps.
 - a. From the list of Local Users, click a name to which you want to assign group privileges .

Figure 1-56: Local User list

- b. From the Groups area, click **Add to Groups**.
- c. From the Groups area, click the group(s) you wish to add for this user. If you want more than one group press and hold **Ctrl** and click each desired group.

Figure 1-57: Groups list

- d. Click **Add Membership**.
- e. In the lower left corner, click **Apply Configuration**.



Note that if a user does not have permissions for one of the roles, and the user tries to access that privilege, an error message displays. The user must acknowledge the error message to proceed.

DATA PRIVACY

Password procedures

Considerations

Read these password guidelines before completing the procedures below.

- By default, the following password rules are enforced in Controlled Access Data Privacy / HIPAA account management.
 - Must have a minimum of X alphanumeric characters, where X is specified by the system administrator on the Local Users tab.
 - Must not include the users Logon Name
- By selecting the Advanced Password Rules option on the Local Users tab, the following additional password rules are enforced in addition to the default rules.
 - Must not contain a white space character
 - Must have a minimum of 15 alphanumeric characters
 - Must have at least one lower case alphabetic letter
 - Must have at least one upper case alphabetic letter
 - Must have at least one numeric character
 - Must have at least one non-alphanumeric special character, e.g., \$, #, etc.
 - Must not contain more than three consecutive repeating characters

Procedures

[Force a user to change password procedure](#)

[Change your password procedure](#)

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Force a user to change password procedure

Force a user to change password procedure

Use these steps to force a user to change his or her password on the next login. This procedures is to be performed by an administrative user with access to User Accounts.

1. From the Local Users tab, select a user from the Local Users list.
2. From the bottom of the Local Users tab, select **Change Password on Next Login**.
3. Click **Apply Configuration**.
 - The next time the user logs in, he or she will be required to enter a new password.
 - Once the new password is entered, the **Change Password on Next Login** option is de-selected.

Related topics

[Password procedures](#)

[Data Privacy introduction](#)

DATA PRIVACY

Change your password procedure

Use these steps to change your password.

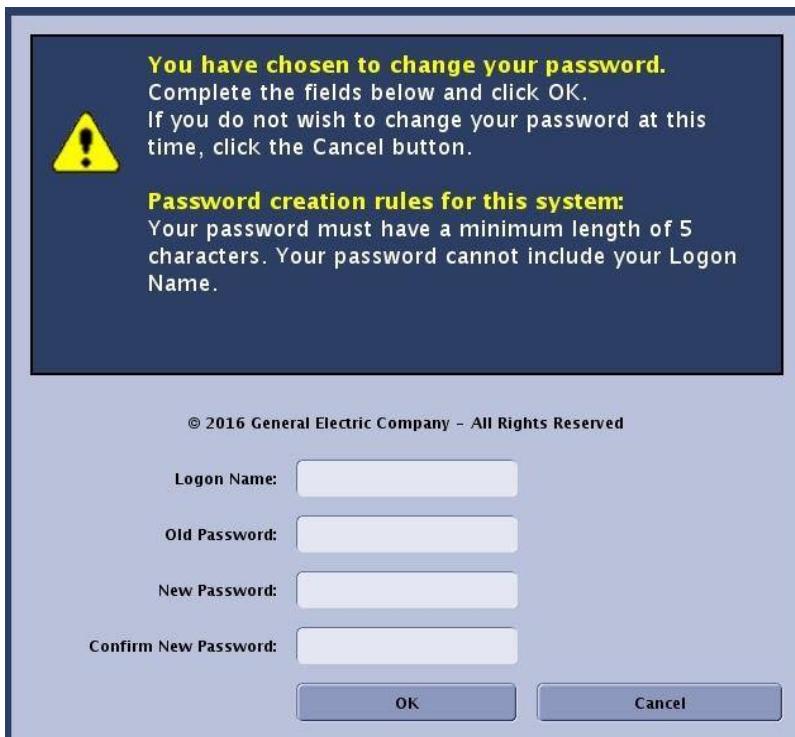
1. From the header area of the screen, click the **Tools icon**.
2. From the System Management work area, click the Service Desktop Manager tab.
3. From the Service Desktop Manager, click **Lock Screen Switch User**.
4. From the Logon screen (Figure 1-58), click **Change Password**.

Figure 1-58: Logon screen



5. From the Change Password screen (Figure 1-59), update your password.
 - Type your old password.
 - Type your new password.
 - Type your new password again to confirm.
6. Click **OK**.

Figure 1-59: Change Password screen



Related topics

[Password procedures](#)

[Data Privacy introduction](#)

DATA PRIVACY

Configure HIPAA/EA3 properties procedure

Use these steps to configure application properties.

1. From the Applications tab, enter the desired selections.
 - Enable Authorization - enable or disable authorization. If authorization is enabled, anyone logging in through EA3 (both local and enterprise users) must have a role. Anyone without a role is denied access, if authorization is turned on. The User role does not matter for logging into EA3, however, other EA3 client applications may restrict which roles can login.
 - Emergency Logon Allowed - enable or disable emergency access. If EA3 is used in GUI mode, this entry decides whether or not to display the Emergency login button. If this is disabled, emergency user access is prevented.
 - Emergency Roles - the roles assigned to the emergency user. The defaults allow an admin to assign a Standard user role, Limited User role, or both roles.
 - Inactivity Timeout (minutes) - The minutes that must elapse without any mouse/keyboard, etc. activity before a timeout is generated. When a timeout is generated, the EA3 logon screen is displayed. This value can be any positive integer, or it can be 0. If the value is 0, this indicates NO inactivity timeout; regardless of how much time has elapsed the system does not timeout.
 - Display Last Logon Name - enable or disable to display the username of the last user that has logged in on the splash logon screen.
 - Administrator Message - under certain circumstances / error conditions, the user of EA3 is asked to contact an administrator. This field allows the administrator to specify contact details for himself / herself and a custom message.
 - Emergency Prompt - the text that is displayed to any user logging in as emergency. The user is asked to enter information (usually their actual user name). This text appears in that prompt for information.
2. Click **Apply Configuration** to accept your configuration changes. Alternatively, click **Restore Configuration** to undo any changes made that have not yet been saved.
 - If there was a problem with making the changes (such as an invalid value or a problem contacting the back end Servlet) an error message box appears with a description of the error.
 - If the changes are successful, then a brief message appears indicating that the changes were applied in a green label.



If you make modifications to the following tabs the changes don't appear until after a system reboot:

- Local Users tab
- Groups tab
- Applications tab
- Enterprise tab

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Local User Procedures



When you are adding users for local databases, certain rules apply. Follow these guidelines:

- Users/Groups
 - Lower case letters and numbers only
 - No limit on length
- Passwords, for details, see [Password procedures](#).



If you make modifications to the following tabs the changes don't appear until after a system reboot:

- Local Users tab
- Groups tab
- Applications tab
- Enterprise tab

User restricted fields

Some fields and buttons on the Local User tab are not selectable under the following conditions. The following roles, users or groups have one or more of these criteria and they cannot be modified. Roles: limited user, standard user, GE service, administration. Users: root, sdc, insite.

- Permanent - if a user is permanent, he can never be removed. When a permanent user is in context, the Remove User button is disabled.

The following procedures are to be performed by an administrative user with access to EA3. All procedures assume EA3 is open and the Local Users tab is selected.

Procedures

[Add a Local user procedure](#)

[Configure user login procedure](#)

[Change a user's name procedure](#)

[Remove a user procedure](#)

[Add or remove a user from a group procedure](#)

[Lock/unlock a user procedure](#)

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Add a Local user procedure

Use these steps to add a local user to have permission to log onto the system.

1. From the Local Users tab, click **Add Local User**.
2. From the Add User screen, type information for each of the following:
 - A unique User ID
 - Full Name
 - Password
 - Confirm Password

Figure 1-60: Add User screen



If an error occurs, a message box displays, and your changes are not committed to the database. Correct your errors and try again. Common errors include:

- Password does not meet the minimum requirements. Review password guidelines and type a new password.
 - Password and Confirm Password box do not match. Make sure the passwords match.
3. Click **Add User**.



You may want to add all users and then assign them to groups or you can assign groups as users are entered.

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Configure user login procedure

Use these steps to configure user lock and password rules.

1. From the Local Users tab, enter values for the following Lock selections.
 - Max Logon Attempts Before Lock - how many times a user can attempt to enter an incorrect password before they are locked from logging on to the system.
 - Lock Duration (Minutes) - the number of minutes the user will stay locked if he or she becomes locked due to failed login attempts. An administrator can unlock this user before the lock duration time has elapsed by unchecking Locked at the bottom of the Local User tab when a user is selected.
2. Define the password rules.
 - Minimum Password Length
 - Advanced Password Rules - select this option to require the password to contain one number, one uppercase letter, one lower case letter, and one non-alphanumeric character. The password also cannot contain three consecutive characters or a whitespace character.
3. Click **Apply Configuration** to accept your configuration changes.
 - Alternatively, click **Restore Configuration** to undo any changes made that have not yet been saved.
 - If there was a problem with making the changes (such as an invalid value or a problem contacting the back-end Servlet) an error message box appears with a description of the error.
 - If the changes are successful, then a brief message appears indicating that the changes were applied in a green label.

Related topics

[Data Privacy introduction](#)

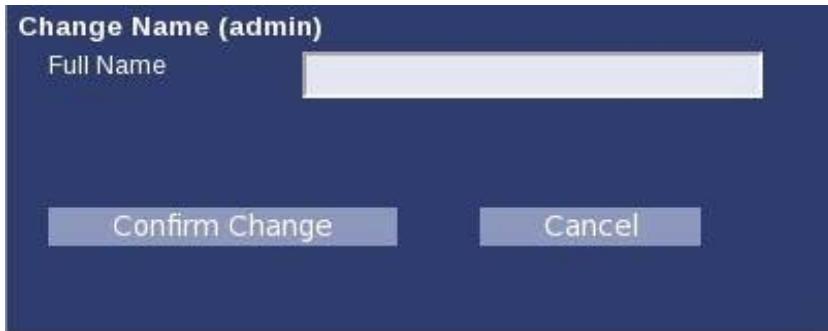
DATA PRIVACY

Change a user's name procedure

Use these steps to change a user's full name.

1. From the Local Users tab, select a user from the Local Users list.
2. Click **Change Name**.
3. From the Change Name screen, type a new name.

Figure 1-61: Change Name screen



4. Click **Confirm Change**.

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Remove a user procedure

Use these steps to remove a user from the Local user's list.

1. From the Local Users tab, select a user from the Local user's list.
2. Click **Remove User**.
3. From the Confirm Removal screen, click **Confirm Removal**.

Figure 1-62: Confirm Removal screen



Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Add or remove a user from a group procedure

Use these steps to add or remove a user from a defined group.

1. From the Local Users tab, select the user you want to modify from the Local Users list.
 - The groups that the selected user has membership are listed in the Groups area.
2. From the Groups area, click **Add To Groups** or **Remove From Groups**.

Figure 1-63: Add To Groups > Add Membership For User



3. Select the group you wish to add or remove for this user.
4. Click **Add Membership** or **Remove Membership**.

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Lock/unlock a user procedure

Use these steps to lock/unlock a user from login privileges. The lock duration setting does not apply to a user who is forcefully locked by an administrator. The user will be locked until the administration unlocks them.

1. From the Local Users tab, select a user from the Local Users list.
2. From the bottom of the Local Users tab, select the **Locked** option.
 - This option locks the user from logging onto the system, even if he or she has a valid password.
 - If Emergency User is enabled on your system, the locked user can logon as an Emergency User.
3. Click **Apply Configuration**.



A message appears when a user attempts logon.

Figure 1-64: User Locked messages when user attempts logon



Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Group procedures

The following procedures are to be performed by an administrative user with access to EA3. All procedures assume EA3 is open and the Groups tab is selected.



Consider the following when performing Groups procedures:

- Only one group and user can be in context at a time. If you choose multiple users, the system selects the top user in your selected list. Once a user or group is in context, you can make any necessary modifications to that user or group.
- If there are no users or groups, then there are no items in context. All of the buttons in the center panel are disabled until a user or group is added.
- To save the changes, **Apply Configuration** needs to be performed when the changes are completed.



If you make modifications to the following tabs the changes don't appear until after a system reboot:

- Local Users tab
- Groups tab
- Applications tab
- Enterprise tab

Group restricted fields

Some fields and buttons on the Group tab are not selectable. The following roles, users or groups have one or more of these criteria and they cannot be modified.

- Roles: limited user, standard user, GE service, administration.
- Users: root, sdc, insite.

Procedures

[Add a Local or Enterprise group procedure](#)

[Add users to a group procedure](#)

[Remove a Local or Enterprise group procedure](#)

[Remove a user's group membership procedure](#)

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Add a Local or Enterprise group procedure

Use these steps to add a Local or Enterprise group.

1. From the **Groups tab**, click **Add Local Group** or **Add Enterprise Group**.
2. From the Add Local Group (See "Add Local Group" on page 1-121) or Add Enterprise Group screen, type a unique group name.
 - If an error occurs, a message displays, and your changes are not committed to the database. Correct your errors and try again. Common errors include:
 - Group name already exists in the database
 - Application session timeout

Figure 1-65: Add Local Group



Figure 1-66: Add Enterprise Group



3. Click **Add Group**.
 - The group is added to the Local Groups or Enterprise Groups list.
 - All information and buttons in the center panel refer to the selected group.
 - This action does not add an Enterprise Group. It provides EA3 the ability to manage roles for that group that already exists on the Enterprise directory server, e.g., if you add a group All Employees as an Enterprise Group to EA3, and assign that group with the STANDARD role, then any enterprise user that logs in through EA3 and belongs to the All Employees group has the STANDARD role.
 - You cannot manage group memberships for Enterprise Groups. This is managed by the directory server, not EA3. Therefore, whenever an Enterprise Group is in context, both the Add Membership and Remove Membership buttons are unavailable. This does not mean that no one belongs to the Enterprise Groups, but rather that this is managed by the directory server and not EA3.
 - Once an enterprise group is added, it is automatically highlighted in the Enterprise Groups list box and it is in context.¹
4. To change a group's roles, select the desired Roles and click **Apply Roles**.
 - A green label confirms the applied roles.
 - An error message box displays if it is unsuccessful.

Related topics

Group procedures

¹A HIPAA term meaning that all information and buttons in the center panel refer to the selected user or group.

DATA PRIVACY

Add users to a group procedure

Add users to a group procedure

Use these steps to give users membership to a defined group.

1. From the Groups tab, select a group in the Local Groups list.
2. In the Group Members area, click **Add Membership**.
 - The Add Users To Group screen lists all the users that are eligible to be added to the selected group.
3. Select the users you want to add to the group.
 - If no users are eligible to be added to this group, an error message displays.
4. Click **Add To Group**.

Related topics

[Group procedures](#)

DATA PRIVACY

Remove a Local or Enterprise group procedure

Remove a Local or Enterprise group procedure

Use these steps to remove a group from the Local Groups or Enterprise Groups list.

1. From the Group tab, select a group from the Local Groups or Enterprise Groups list.
2. Click **Remove Group**.
3. From the Confirm Removal screen, click **Confirm Removal**.

Figure 1-67: Confirm Removal screen



Related topics

[Group procedures](#)

DATA PRIVACY

Remove a user's group membership procedure

Use these steps to remove a user's membership from a specified group.

1. From the Group tab, select a group from the Local Groups list.
2. Click **Remove Membership**.
 - The Remove Users From Group screen lists all of the users that are eligible to be removed from the selected group.
 - If no users are eligible to be removed from this group, an error message displays.
3. Select the users that you want to remove from the group.
4. Click **Remove From Group**.

Related topics

Group procedures

DATA PRIVACY

Configure the Enterprise tab procedure

Use these steps to configure the properties necessary to make a connection to an Enterprise directory server (i.e., MSAD, Novell, etc.). The Enterprise tab is used by the site's IT or GE Service personnel. It provides connectivity to the site's user database. If you do not have a network established in your hospital or clinic, this tab is not used.

1. From the Enterprise tab, enter desired selections.
 - Enable Enterprise Authentication - login authorization. If it is unchecked, only local EA3 users can log in. If it is checked, both local users and enterprise EA3 users can log in and local EA3 user database is tried first.
 - Cache Enterprise Users - enables Enterprise users to be cached once they successfully login. If the Enterprise directory server is not available due to network or other issues the following scenarios occur:
 - If it is checked, a local record of an Enterprise user is kept and you can login.
 - If it is unchecked, an Enterprise user is denied access.
 - Hashed passwords are cached; the actual password is not cached.
 - Enterprise Authentication Latency (Seconds) - the time the EA3 login process wait for a response from the Enterprise directory server. Often times, there is a network latency when connecting to servers, which is dependent on your network configuration. If the amount of time is reached without a response from the directory server, the EA3 login process returns a failed login. A value of 5 seconds is typically enough time to allow a properly configured directory server to respond, without causing undue user annoyance.
2. Modify properties in the lower two boxes of the Enterprise tab to make the Enterprise directory server connection.
3. Click **Apply Configuration** to accept your configuration changes. Alternatively, click **Restore Configuration** to undo any changes made that have not yet been saved.



If you make modifications to the following tabs the changes don't appear until after a system reboot:

- Local Users tab
- Groups tab
- Applications tab
- Enterprise tab

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Auto Enterprise configuration procedure

1. From the Enterprise tab, click **Auto-detect Server Name**.
 - The system searches for the Server Name of the directory server.
 - If the DNS allows service lookups, EA3 executes an auto-detection with the Enterprise Directory Server. If it cannot find the server, it is not an error. Continue with these steps to configure the Server.
2. In the Server Configuration text field, type the Server Name or IP address of the Enterprise directory server that HIPAA configuration should connect to.
 - The system must either have DNS enabled or the system must have static information in a hosts file (i.e., /etc/hosts).
3. Select the Authentication type the directory server supports.
 - If it is a Microsoft Active Directory Server, typically select Kerberos. If it is a Novell eDirectory Server, typically select LDAP. If you do not know, check with the owner of the directory server for information.
 - If the enterprise server supports SSL connections, select the 'Use SSL' option.
 - If you use LDAP authentication without SSL, passwords are sent in the clear. This is not recommended. An alert is posted for this configuration. With kerberos and non-SSL, the authentication is encrypted, but the LDAP traffic is not.
4. Click **Test Connection** to test if the machine can connect to the directory server.
 - If the connection is successful, CONNECTION OK is displayed next to the Test Connection button.
 - If the connection is unsuccessful, CONNECTION BAD is displayed next to the Test Connection button.
 - If the connection is bad, then there is a problem connecting to the directory server. Check the following:
 - IP/server name
 - if system has DNS running
 - if the system can resolve the IP address / server name
 - Once the Test Connection procedure indicates that the connection is good.
5. Once the Test Connection is successful, select the type of directory server, either Microsoft Active Directory, Novell eDirectory, or another.
6. Click **Generate Defaults** to populate the Realm Name, Format, DN, Login Attribute, First Name Attribute, Last Name Attribute, and Group Attribute fields with default values for that directory server type.
 - If the directory type is MSAD, both the realm name and the DN are populated.
 - If the directory type is eDirectory, the realm name is left blank. If you are configuring a directory server that is not MSAD or Novell eDirectory, the configuration must be done manually. Get the correct LDAP property information from the owner of the directory server.
 - If this is a non-MSAD, non-eDirectory server, or is a server with a non-default configuration, manually change some properties, as needed.
7. Enter a username and password of a user that resides on the directory server.
8. Click **Login** and view the result information to see if the login is successful.
 - The First Name, Last Name, and any group memberships for the user are printed. If First Name, Last Name, or Group Memberships are not found, a warning is posted, which indicates that:
 - the LDAP properties are mis-configured (i.e., First Name Attribute, Last Name Attribute, and/or Group Attribute).

- the user does not have a First Name, Last Name, or any Group Memberships configured on the Enterprise directory server.
 - If you get these warnings, talk with the owner of the directory server to verify you have everything set up correctly.
 - If the test login succeeded and you are satisfied with the first name, last name, and group membership information, then your Enterprise directory server is properly configured.
9. Click **Apply Configuration** to accept your configuration changes. Alternatively, click **Restore Configuration** to undo any changes made that have not yet been saved.

Related topics

[Data Privacy introduction](#)

DATA PRIVACY

Manual enterprise configuration considerations

Use this information to connect to a directory server other than MSAD, Novell eDirectory, or any other system that has a custom configuration. The following LDAP definitions are for configuration properties that may need to be manually selected.

Format - set to domain or dn.

- domain is the 'MSAD' way of doing LDAP authentication (i.e <userId>@<realm name>).
- dn is the eDirectory, and most other directory servers use (i.e. loginAttribute=<userId>,<ldap base dn>) way of doing LDAP authentication. If you are connecting to a non-MSAD directory server, more than likely use dn.

DN - is the LDAP base DN of the LDAP server to which you are connecting. Typically this is the fully qualified domain name separated by a bunch of 'DC='. For example, if the fully qualified domain name of the directory server is 'example.com', it is likely that the DN is 'DC=example,DC=com'.

Login Attribute - is the LDAP attribute to be used for the unique user identifier, that is the user id to login. Set it to the unique identifier your server uses.

- On MSAD it is: sAMAccountName
- On eDirectory, it is typically: cn

First Name Attribute - is the LDAP attribute that is used for the user's first name.

Last Name Attribute - is the LDAP attribute that is used for the user's last name.

Group Attribute - is the LDAP attribute that is used to find group memberships for the user. On MSAD, it is 'memberOf'.

- HIPAA Configuration finds all instances of this attribute (not just the first, like it does for other attributes). If a user belongs to more than one group, EA3 finds all memberships.
- Regarding LDAP parameter configurations, EA3 finds the first instance of the configured attribute for a user, except for Group Membership. If you configure the First Name attribute to be an attribute that is listed multiple times, HIPAA assumes the first one found during an LDAP query is the correct First Name. For Group Membership, EA3 finds all instances of that attribute.

Save changes

No changes are saved to HIPAA on a tab unless you click **Apply Configuration** before you navigate to another tab or click Confirmation on a popup panel. If there is more than one **Apply Configuration** button on a tab, click the one associated with the data you changed (the buttons are grouped with the data they manage in a bordered panel).

Click **Apply Configuration** or **Restore Configuration** and in 5 seconds a label appears indicating that the changes have or have not been saved, respectively:

- Enable Authorization
- Limited User
- Inactivity Timeout (Minutes)
- Emergency Prompt
- Apply Configuration

Related topics

[Data Privacy introduction](#)

GUIDED INSTALL

Second Level dB/dt password setup procedure

Use these steps to setup or change your password.



1. In the header area, click the *Tools icon* to open the **System Management work area**.
2. Click **Service Desktop Manager** tab .
3. On the Service Desktop Manager, click **Guided Install**.
4. From the list of applications, click **SAR dB/dt**.
5. Click **Start**.
6. Click **SAR dB/dt Level** to view the SAR dB/dt Level screen.
7. Verify the Enable SAR dB/dt Level prompt is **Yes**.
8. Enter your current password or new password if you are setting up the password for the first time.
 - If you are changing the password and you do not know your current password, consult your service engineer, who will have to contact GE to clear the existing lockout.
 - You can also click **Reset password to default**. This action also requires a password that is set in the FE MODE. Consult your service engineer or site administrator for the FE MODE password.
9. If you are changing your password, re-enter the new password.
10. Click **Save the new password**.
11. Click **OK**.
12. Click **File > Quit** at the top of the screen.
13. Click **Yes**.

Related topics

[Guided Install introduction](#)

PREFERENCES

Research/clinical mode activate procedure

Use these steps to activate the research/clinical mode for all exams or an individual scan session.

1. To set preference to cross exams, follow these steps.



- a. Click the **Tools icon menu** and select **System Preferences**.
- b. From the System Preferences screen, select **Research** or **Clinical**. Respond to any message prompts.
 - This option is only available if your site has a research agreement with GEHC.
 - The new selection will apply to the next scan session. For example, if you are currently scanning in clinical mode and you select research mode, the current exam remains in clinical mode and the next scan session opens in research mode.
- c. Click **Close**.

2. To set preference for currently active scan session, follow these steps.

- a. Click the Scan Session menu and select **Preferences**.
- b. On the Exam Preferences screen, select **Research**. Respond to any message prompts.
 - This option is only available if your site has a research agreement with GEHC.
 - All remaining un-scanned series in the Workflow Manager will be acquired in research mode. You cannot switch from research mode back to clinical mode within a scan session.
- c. Click **Close**.

Related topics

[Preferences](#)

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Chapter 2: Safety

This section presents the concepts necessary to successfully complete the working safely process. Specifically, you need to understand:

- [Introductions](#)
- [Safety standards](#)
- [Magnetic fields](#)
- [Gradient fields](#)
- [Electromagnetic fields](#)
- [Clinical hazards](#)
- [Equipment hazards](#)
- [Clinical screening](#)
- [Patient emergencies](#)
- [Additional scan and display cautions and warnings](#)
- [System maintenance](#)
- [Safety procedures](#)
- [Safety Review](#)
- [MR Compatibility](#)
- [Service Schedules](#)
- [China RoHs](#)

Introduction

The MR Safety Guide contains information applicable to the SIGNA Voyager system configuration. A topic heading, a note, or other wording indicates information that is applicable to a specific system configuration.

This chapter focuses on the visible and invisible sources of hazard and concern in the magnetic resonance (MR) imaging environment and emphasizes the need to work safely. To ensure safe operation of your scanner, you must understand several components of your imaging system. This chapter provides brief guidelines for working in a magnetic field, key concepts regarding the patient alert system, as well as magnet, quench, radio frequency (RF), laser light, metal sliver, acoustic, peripheral nerve stimulation (PNS), and equipment hazards. It contains the step-by-step instructions to help you learn how to:

- Eliminate Magnet Hazards
- Respond to Emergencies
- Check the Cryogen Levels
- Handle Contact with Liquid Cryogens



This chapter contains important safety information that you and the physician must understand thoroughly before using the system.

INTRODUCTION

Safety Information

The Magnetic Resonance Imaging (MRI) system uses a magnet, which can have a field strength several thousand times greater than that of the earth's magnetic field. The magnetic field surrounding the magnet may present a hazard to personnel and equipment within the immediate area. Therefore, the magnetic field safety information described in this chapter is very important. You and your physician must understand it thoroughly before you begin to use the system. You can find additional safety information throughout your Operator Manual. If you need additional training, seek assistance from qualified General Electric (GE) personnel.

Make sure your training guides are readily available at all times. Review the procedures and safety precautions periodically. Through Magnetic Resonance (MR) safety education, careful planning, and diligent upkeep of your MR facility, a safe environment can be provided for both patients and personnel.

For any hazardous incident or system malfunction related to the use of the GE MR Scanner please use the following contact methods:

If Serviced by GE: Please contact your Field Service Engineer to report out on the incident.

If third party serviced: Please contact your third party Field Service Engineer and have them send a manufacturers notice to:

Complaint Handling Unit Manager
GE Medical Systems, LLC
3200 N Grandview Blvd WT-893
Waukesha, WI 53188

If the user is self servicing the GE MR Scanner please provide the following information:

- System type
- System ID
- Date of incident
- Description of incident
- Contact Information (facility, address, contact name, title, and telephone numbers)

Locate the contact number on your scanner or visit GE on the web <https://www.gehealthcare.com/about/contact-us> and locate the appropriate telephone number for your location. In the US please us: 1-800-437-1171.



WARNING

Do not modify this equipment without the specific authorization of GE.

INTRODUCTION

User Training

GE provides purchasable on-site training by an MR Applications Specialist. GE advises that anyone who operates the system should attend this session after reading the Operator Manual and related training materials.

GE strongly recommends that physicians who prescribe studies and review images on the MR system, attend at least two full days of professional meetings dealing with MR imaging each year. Such meetings include the Radiological Society of North America (RSNA), the Society for Magnetic Resonance in Medicine (SMRM) and the American Roentgen Ray Society (ARRS). In addition, MR system user groups present symposia and workshops throughout the year that provide additional learning opportunities.

The healthcare facility is responsible for training outside emergency personnel (e.g., fire department and other outside emergency personnel) not to bring any ferrous fire-fighting equipment, including axes, ferrous stretchers, or oxygen tanks into the magnet room. Be sure to show such outside emergency personnel where the Emergency Magnet Rundown switch is located.

MR workers shall be adequately trained to minimize health effects of high static magnetic field as described above. The training includes the following topics:

- **Emergency medical procedures**
- **Security zone** and **exclusion zone**
- **Emergency stop** and **emergency off**
- **Fire precautions**
- **Emergency actions in the event of a quench**

INTRODUCTION

Product identification labels

Product identification labels (ratings) can be found on the tops and sides of the cabinets, the rear of monitors, and other exterior surfaces on the equipment. Such product labels alert you to specific hazards and the level of hazard importance. The labels may also contain messages that communicate the specific hazard, the probable consequence of involvement with the hazard, and how the hazard can be avoided. In the event you are unable to identify these labels, contact your service personnel.

One or more of the product identification labels in the tables below may be on your system or peripheral equipment. Please familiarize yourself with the labels that apply to your particular system.

Table 2-1: Warning symbols

Label	Description (typical use)
	Warning: Crushing of hands
	Warning: Hot surface
	Warning: Magnetic field
	Warning: Electricity (barriers, points of entry)
	Warning: General warning sign
	Warning: Laser beam
	Warning: Non-Ionizing radiation

Table 2-2: Prohibited symbols

Label	Description (typical use)
	Prohibited: Do not obstruct
	Prohibited: No access for unauthorized persons

Label	Description (typical use)
	Prohibited: Do not touch - hazardous voltage
	Prohibited: No metallic articles or watches
	Prohibited: No access for people with metallic implants*
	Prohibited: No access for people with active implanted cardiac devices*
	Prohibited: Do not loop cable

*In general, patients with conductive (e.g. metallic) implants are contraindicated for MR scans. Some implantable devices have been labeled as MR Conditional under certain operating conditions. Only use quadrature transmit for MR Conditional devices. MR Safe implants will have the MR Safe symbol in their implant documentation.

When evaluating whether to proceed with MR scanning on patients with such implants, consult the implantable device's labeling.

Table 2-3: Mandatory symbols

Label	Description (typical use)
	Mandatory: Instruction manual
	Mandatory: Maintenance instructions
	Mandatory: Refer to instruction manual/booklet
	Mandatory: Wear ear protection

Table 2-4: Manufacturer information symbols

Label	Description (typical use)
	Manufacturer

Label	Description (typical use)
	Country of manufacture - Assembled in US
	Date of manufacture
REF	Model reference
SN	Serial number
Rx ONLY	Prescription Use

Table 2-5: Patient comfort symbols

Label	Description (typical use)
	Patient comfort lighting
 or 	Patient comfort ventilation (fan)

Table 2-6: Environmental symbols

Label	Description (typical use)
	Atmospheric pressure limitation
	Temperature limitation
	Humidity limitation

Table 2-7: PAC¹ symbols

Label	Description (typical use)
Figure 2-1: Type BF applied part 	Respiratory bellows port. Either of the labels may be on your system.
Figure 2-2: Type BF applied part 	ECG leads port. Either of the labels may be on your system.
Figure 2-3: Type BF applied part 	Peripheral gating port. Either of the labels may be on your system.
Figure 2-4: Type BF applied part 	Patient alert port. Either of the labels may be on your system.

¹Physiological Acquisition Control

Table 2-8: MR safety symbols for implantable devices

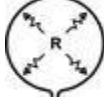
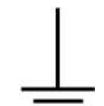
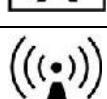
Label	Description (typical use)
 or 	MR Safe
	MR Conditional
	MR unsafe
 or 	Receive only coil

Table 2-9: Product identification symbols

Label	Description (typical use)
	Alternating current (rating plate, terminals)
	Direct current (rating plate, terminals)
	Three-phase alternating current
	Earth (ground terminals)
	Protective earth (ground terminals)
	Equipotentiality (terminals)

Label	Description (typical use)
	Dangerous voltage (components, points of entry)
	Main power on (main disconnect/power switch)
	Main power off (main disconnect/power switch)
	Power on (only for a part of equipment)
	Power off (only for a part of equipment)
 or 	Emergency stop
 or  or 	Fast stop
	Class II equipment (double insulated) (ratings)
	Type B Applied Part (ratings, AP connections)
	Type BF Applied Part
	Non-ionizing electromagnetic radiation (ratings)
	Attention – Consult accompanying documents

Label	Description (typical use)
	CAUTION – Static Sensitive (Electrostatic discharge (ESD) susceptible parts)
	Laser Radiation (laser devices)
	Table mass in Kg. without the patient

Table 2-10: Environmental packaging symbols

Symbol	Description
	This way up.
	Keep away from rain.
	Fragile, handle with care.

INTRODUCTION

Indications for use

To view indications for use statement, click [Indications for Use](#).



CAUTION

These devices are limited by federal law to investigational use for indications not in the "Indications for Use" statement for a specific system type. Under federal law, these devices should only be used for the functions set forth in the "Indications for Use" statements.



WARNING

Read the *full prescribing information* on the contrast media label before use of contrast media. Use contrast media only in accordance with Indications and Usage as described in full prescribing information.

INTRODUCTION

Restrictions on use



CAUTION

Federal law restricts the sale, distribution, and use of this device to or on the order of a physician.



CAUTION

Do not load non-system software onto the system computer.



WARNING

The MR system is not designed to provide information for clinical stereotactic use. The spatial accuracy obtainable with your MR system may not be adequate for stereotactic procedures and can vary depending on the patient, the pulse sequence used, and the system itself. It is therefore recommend that MR images not be used for stereotactic applications.



WARNING

Electrically conductive stereotactic devices may lead to high localized SAR. Excessive transmit power may result from interactions between the structure and the transmit coil. In addition, improper padding between the patient and any conductor may lead to excessive localized heating.



Clinical stereotactic use refers to being used in localization for surgical procedures.

INTRODUCTION

Instructions for use

IEC 60601-2-33 assumes that because no chronic effects from exposure to MR fields are known, worker safety limits are the same as for patients. However, it is prudent to minimize worker exposures.

Workers must prevent ferromagnetic materials from entering the magnet room. Ferrous projectile hazards are a major safety concern. Note that some materials that are initially non-magnetic may become magnetic when subjected to a static magnetic field over a period of time. Motion in static magnetic fields (especially near large spatial field gradients) may induce metallic tastes, vertigo, nausea, and possibly flashes of light (magneto-phosphenes). These motion effects are considered to be non-hazardous, provided they do not cause the worker to fall.

Time-varying gradient magnetic fields may induce peripheral nerve stimulation if the worker intercepts sufficient time-varying flux. Peripheral nerve stimulation is non-hazardous unless it causes the worker to injure himself when startled by the effect. MR workers shall be adequately trained to minimize health effects of high static magnetic field as described above. Field plots of the maximum time-varying gradient $|B|$ workers could experience outside the magnet bore is shown in the figure below.

Figure 2-5: Maximum Magnitude Gradient Magnetic Field from three Simultaneous Axes at the Patient Bore Radius (worker exposure is limited to these levels as a function of z).

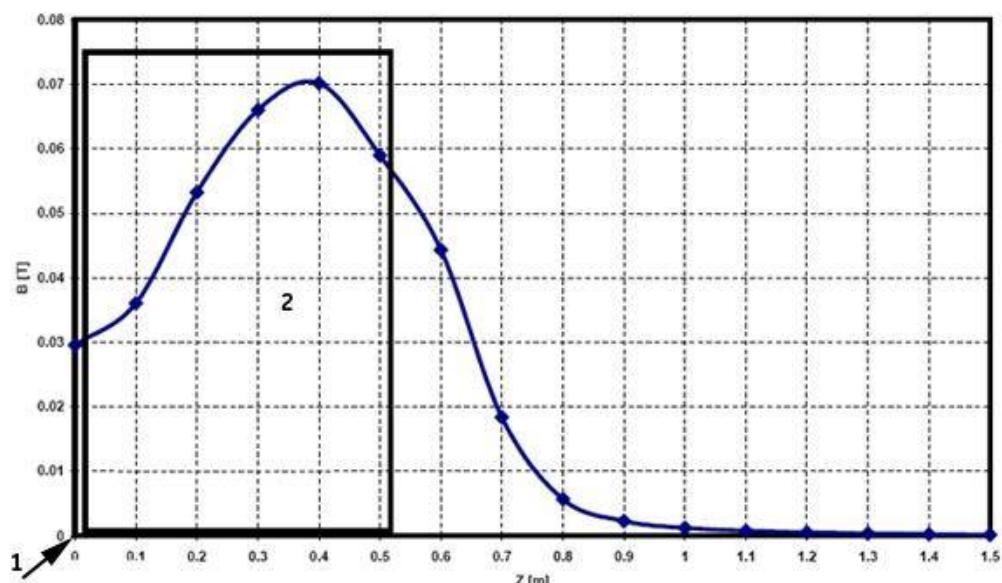
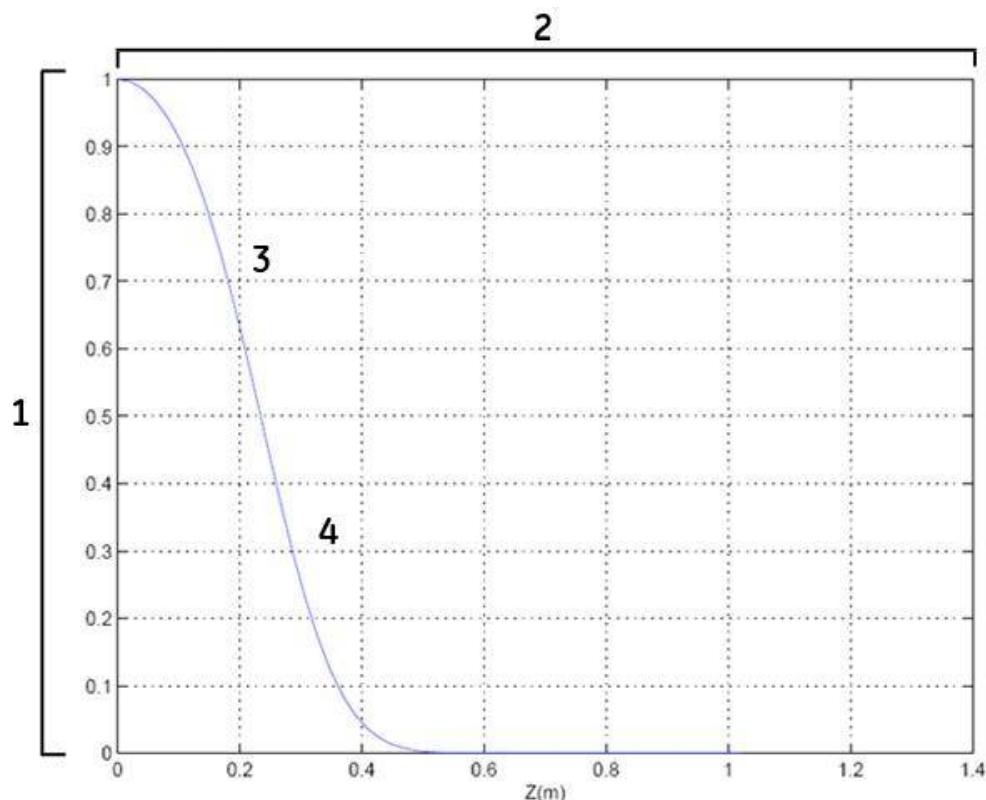


Table 2-11: Imagelegend

#	Description
1	Isocenter
2	Magnet from isocenter to front

Radio frequency fields at sufficiently high levels may cause heating. Outside the magnet bore the radio frequency fields rapidly decay. Let B_1 be the magnetic field strength of the radio frequency magnetic field. A plot of the square B_1 normalized to its value at isocenter is shown in figure below. At most B_1 at isocenter may produce the whole-body Specific Absorption Rate (SAR) limit. If as much of the body were exposed outside the bore then the graph below shows the scale factor for each Z location. This is a very conservative estimate of SAR since the total flux into the body is likely to be much smaller.

Figure 2-6: Plot of the Square of B1 Normalized to Isocenter for the Body Birdcage Coil on Axis.**Table 2-12:** Image legend

#	Description
1	Square of B1 normalized to isocenter.
2	Square of B1 normalized to isocenter for body birdcage coil on axis.
3	The point (0.707) at which RF transmission is reduced by 3 dB from maximum at isocenter.
4	The point (0.316) at which RF transmission is reduced by 10 dB from maximum at isocenter.

INTRODUCTION

Contraindications for use

Contraindications for use statement

In general, MR examinations are contraindicated for patients with electronic or electrically conductive implants or metals, especially those containing ferromagnetic material.

However, certain implantable medical devices have been cleared, approved and/or licensed by the competent governmental authorities and/or labelled by the manufacturer as "MR conditional" or "MR safe". For such devices, the general contraindications as stated above may not be applicable in their entirety.

It is the responsibility of the implant manufacturer to declare an implant as "MR conditional" or "MR safe", if appropriate, and to define the conditions (constraints) for safe MR scanning. The mr operator must be aware of any such conditions for MR scanning. It is the obligation of the MR OPERATOR to assure that these conditions are strictly adhered to.

To obtain these specific conditions, the operator is advised to refer to the labelling of the implant or to contact the implant manufacturer. The MR manufacturer does not assume responsibility for the operation of the MR when scanning patients with any implantable medical device. Especially the MR manufacturer is not responsible for controlling technical

parameters of the MR SYSTEM other than those defined by the normal operating mode or the first level controlled operating mode, the FPO (if available) and the data provided in the compatibility technical datasheet, such as spatial field gradient.

When evaluating whether to proceed with MR scanning on patients with such implants, consult the implantable device's labeling.

- **MR Safe:** For patients with implants that are labeled as MR Safe, consult the implantable device's labeling.
- **MR Conditional:** For patients with implants that are labeled as MR Conditional, consult the implantable device's labeling.
- **MR Unsafe:** Patients with implantable devices that are MR Unsafe are contraindicated.

If the level of MR compatibility is not known, then an implantable device should be considered MR Unsafe.

MR environment safety terminology

The MR Environment Safety Terminology is intended to help explain labeling matters for medical devices and other items that may be used in the MR environment to ensure the safe use of MR technology.

Terminology for defining the safety of items in the MR environment is provided in ASTM F2503 Standard Practice for Marking Medical Devices and Other Items for Safety in the Magnetic Resonance Environment. FDA recommended using the terminology MR Safe, MR Conditional, and MR Unsafe, defined in ASTM F2503 (FDA guidance document, "Establishing Safety and Compatibility of Passive Implants in the Magnetic Resonance (MR) Environment Document").

Definitions

MR safe: An item that poses no known hazards in all MR imaging environments.

With this terminology, MR safe items are non-conducting, non-metallic, and non-magnetic items, such as a plastic Petri dish. An item may be determined to be MR safe by providing a scientifically based rationale rather than test data.

MR Conditional: An item that has been demonstrated to pose no known hazards in specified MR environment with specified conditions of use. Field conditions that define the MR environment include static magnetic field strength, spatial gradient, time rate of change of the magnetic field (dB/dt), RF fields, and specific absorption rate (SAR).

Additional conditions, including specific configurations of the item (e.g., the routing of leads used for a neurostimulation system), may be required.

MR Unsafe: An item that is known to pose hazards in all MR environments.

MR unsafe items include magnetic items such as a pair of ferromagnetic scissors.

ASTM standard F2503 also describes how MR Safe, MR Conditional and MR Unsafe device Icons are to be used for MR labeling of implants and devices. For details see [MR safety labels](#).



CAUTION

Safe scanning of patients with MR Conditional devices or implants may be complex. Health care professionals that scan patients with MR Conditional devices or implants should consult the implant or device manufacturer for instructions with respect to safety guidelines.



WARNING

Scanners are not designed to regulate SAR and dB/dt for levels other than the IEC NORMAL MODE (WB SAR <= 2 W/kg, head SAR <= 3.2 W/kg and dB/dt <= 80% of the mean nerve stimulation limit) and IEC FIRST MODE (WB SAR <= 3 W/kg, head SAR <= 3.2 W/kg and dB/dt <= 100% of the mean nerve stimulation limit). No other limits are enforced.



WARNING

The magnetic field of the MR system can cause a ferrous implant (e.g., surgical clip, cochlear implant, intracranial aneurysm clip etc.) or prosthesis to move or be displaced, resulting in serious injury. Patients and MR workers should be screened for implants and those individuals with implants should, in general, not enter the scan room. For patients and MR workers with implants that are labeled as "MR Safe" or "MR Conditional", consult the implantable device's labeling and the technical information about the MR system.

Prostheses should be removed before scanning to help prevent injury.



WARNING

The tests commonly employed to determine MR Conditional implant heating safety (standard, ASTM F2182, ASTM.org), require quadrature excitation. Heating results for non-quadrature excitation (such as parallel transmit, MultiDrive, or elliptical drive) are unknown.

For patients with MR Conditional implants or devices, applying Preset or Optimized RF Drive Modes may violate the MR Conditional specifications.

When scanning patients with MR Conditional implants, check with GEHC to ensure your system has quadrature transmit.



This system supports only quadrature (CP) transmit in scan parameters.

MR safety standards

In most countries the MR safety standard IEC 60601-2-33 provides safety limits for MR exams, for ventilation, and for occupational exposure of MR workers. The International Electrotechnical Commission (IEC) developed a widely-used MR safety standard. The IEC MR safety standard is three-tiered. The NORMAL OPERATING MODE is for routine scanning of patients. The operator must take a deliberate action (usually an ACCEPT button) to enter the FIRST CONTROLLED OPERATING MODE. This mode provides higher scanner performance, but requires monitoring of the patient. Finally, there is a SECOND CONTROLLED OPERATING MODE used only for research purposes under limits controlled by an Investigational Review Board (IRB). The static magnetic field, gradient output and SAR levels for patient are based on current scientific literature research.

The scanner employs a whole body gradient system whose IEC 60601-2-33 compliance volume is:

- a cylinder with axis coinciding with the magnet axis and with a radius of 0.20 meters, for cylindrical magnets, or
- a volume bound by planes parallel to the magnet poles and separated by a distance of 0.40 meters, for vertical-field magnets.

Table 2-13: IEC safety limits

Operating mode	Whole body SAR (W/Kg)	Head SAR (W/Kg)	Partial body SAR (W/Kg)	Local head/trunk SAR (W/Kg)	Local extremity SAR (W/Kg)	Short term SAR (W/Kg)	dB/dt (% mean PNS)
IEC Normal Mode	2	3.2	= $\left(10 - \frac{8M_{\text{exposed}}}{M_{\text{patient}}}\right)$	10	20	2 x long term	80% PNS
IEC 1st Controlled Operating Mode	4	3.2	= $\left(10 - \frac{6M_{\text{exposed}}}{M_{\text{patient}}}\right)$	10	20	2 x long term	100% PNS
IEC 2nd Controlled Operating Mode	IRB Limit	IRB Limit	IRB Limit	IRB Limit	IRB Limit	IRB Limit	IRB Limit

Local SAR is averaged over the worst-case 10 g. Short term SAR is averaged over 10 s. SAR limits are reduced if temperature can exceed 24 degrees C or if humidity exceeds 60%. Hearing protection (only earplugs have been validated) with NRR >= 29 dB to reduce the A-weighted root-mean-squared sound pressure level below 99 dB(A) shall be used. IEC 60601-1 limits surface contact temperatures to 41 degrees C.

SAFETY STANDARDS**IEC EMC compliance**

Per IEC 60601-1-2: 2014, Medical Electrical Equipment needs special precautions regarding Electromagnetic Compatibility (EMC) and needs to be installed and put into service according to the EMC information provided in the following tables. The tables below provide details about the level of compliance and provide information about potential interactions between devices.

Portable and mobile RF communications equipment can affect Medical Electrical Equipment.

**WARNING**

The MR System may be interfered with by other equipment, even if that other equipment complies with CISPR EMISSION requirements.

**WARNING**

The MR System should not be used adjacent to or stacked with other equipment; if adjacent or stacked use is necessary, the MR System should be observed in order to verify normal operation in the configuration in which it will be used.

**WARNING**

The MR System should be used only in a shielded location named as the Magnet Room. Magnetic and RF Shielded Room requirements are defined in the Preinstallation Manual.

**WARNING**

The use of accessories, transducers and cables other than those specified, with the exception of transducers and cables sold by GE or replacement parts for internal components, may result in increased emissions or decreased immunity of the MR system.

Adhering to the recommendations provided herein for the interaction of the MR System with other electrical devices within the electromagnetic environment may not eliminate all the disturbances.

The MR system has no essential performance per IEC 60601 standards, however, the MR system will maintain its critical functions by continuing to acquire, display, and store scanning images safely.

The MR system complies with emissions limits (Group 2, Class A) Medical devices as stated in IEC 60601-1-2:2014.

Table 2-14: Guidance And Manufacturer's Declaration – Electromagnetic Emissions

The MR System is intended for use in a typical health care electromagnetic environment specified below. The customer or the user of the MR System should assure that it is used in such an environment.

Emissions Test	Compliance Level	Electromagnetic Environment - Guidance
RF emissions CISPR 11	Group 2	The MR system must emit electromagnetic energy in order to perform its intended function. Nearby

The MR System is intended for use in a typical health care electromagnetic environment specified below. The customer or the user of the MR System should assure that it is used in such an environment.

Emissions Test	Compliance Level	Electromagnetic Environment - Guidance
		electronic equipment may be affected.
RF emissions CISPR 11	Class A	The MR system is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Not Applicable	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Not Applicable	

NOTE: The emissions characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

Table 2-15: Guidance And Manufacturer's Declaration – Electromagnetic Immunity

The MR System is intended for use in a typical health care electromagnetic environment specified below. The customer or the user of the MR System should assure that it is used in such an environment.

Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment – Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±15 kV air	±8 kV contact ±15 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±0.5 kV, ±1 kV Line to line	±0.5 kV, ±1 kV Line to line	Mains power quality should be that of a typical commercial or hospital environment.
	±0.5kV, ±1 kV, ±2 kV Line to ground	±0.5kV, ±1 kV, ±2 kV Line to ground	
Voltage dips IEC 61000-4-11	$U_t = 0\%, 0.5 \text{ cycle } (0, 45, 90, 135, 180, 225, 270, \text{ and } 315 \text{ degrees})$ $U_t = 0\%, 1 \text{ cycle}$ $U_t = 70\%, 25/30 \text{ cycles } (0 \text{ degrees})$	Not applicable	Mains power quality should be that of a typical commercial or hospital environment. If the user of the MR System requires continued operation during power mains interruptions, it is recommended that the MR System be powered

The MR System is intended for use in a typical health care electromagnetic environment specified below. The customer or the user of the MR System should assure that it is used in such an environment.

Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment – Guidance
Short interruptions and voltage variations on power supply input lines IEC 61000-4-11	$U_t = 0\%, 250/300$ cycles	$U_t = 0\%, 250/300$ cycles	from an uninterruptible power supply.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	30 A/m 50 Hz or 60 Hz	30 A/m 50 Hz or 60 Hz	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz 6 Vrms 150 kHz to 80 MHz at ISM bands ^a	3 Vrms 150 kHz to 80 MHz 6 Vrms 150 kHz to 80 MHz at ISM bands	Portable and mobile RF communications equipment should not be used closer to any part of the equipment, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance. $d = 1.2 \sqrt{P}$ 150 kHz to 80 MHz $d = 1.2 \sqrt{P}$ 80 MHz to 800 MHz. $d = 2.3 \sqrt{P}$ 800 MHz to 2.7 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer, and d is the recommended separation distance in meters (m).
Radiated RF IEC 61000-4-3	3 V/m ^b 80 MHz to 2.7GHz	3 V/m 80 MHz to 2.7GHz	Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey ^c should be less than the compliance level in each frequency range ^d . Interference may occur in the vicinity of equipment marked with the following symbol: 

The MR System is intended for use in a typical health care electromagnetic environment specified below. The customer or the user of the MR System should assure that it is used in such an environment.

Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment – Guidance
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NOTE U_t is the AC mains voltage prior to application of the test level.

a The ISM (industrial, scientific and medical) bands between 0.15 MHz and 80 MHz are 6.765 MHz to 6.795MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.

b For more information, see section Proximity field immunity compliance.

c Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the MR equipment is used exceeds the applicable RF compliance level above, the equipment should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the equipment.

d Over the frequency range 150 KHz to 80 MHz, field strengths should be less than 3 V/m.

Table 2-16: Recommended Separation Distances between portable and mobile RF communications equipment and the MR system

The MR System is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the MR System can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the MR System as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter stated in meters		
	150 kHz to 80 MHz	80 MHz to 800 MHz	800 MHz to 2.7GHz
	$d = 1.2 \sqrt{P}$	$d = 1.2 \sqrt{P}$	$d = 2.3 \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.69	3.69	7.38
100	11.67	11.67	23.33

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Table 2-17: Proximity field immunity compliance

The MR System is intended for use in a typical health care electromagnetic environment specified below. The customer or the user of the MR System should assure that it is used in such an environment.

Test Frequency [MHz]	Band [MHz]	Service	Modulation	Maximum power [w]	Distance [m]	Immunity compliance level [V/m]	Immunity test level [V/m]
385	380 ~ 390	TETRA 400	Pulse Modulation 18 Hz	1.8	0.3	27	27
450	430 ~ 470	GMRS 460, FRS 460	FM ± 5 kHz deviation 1 kHz sine	2	0.3	28	28
710	704 ~ 787	LTE Band 13, 17	Pulse Modulation 217 Hz	0.2	0.3	9	9
745							
780							
810	800 ~ 960	GSM 800/900, TETRA 800, iDEN 820, CDMA 850, LTE Band 5	Pulse Modulation 18 Hz	2	0.3	28	28
870							
930							
1720	1700 ~ 1990	GSM 1800; CDMA 1900; GSM 1900; DECT; LTE Band 1, 3, 4, 25; UMTS	Pulse Modulation 217 Hz	2	0.3	28	28
1845							
1970							
2450	2400 ~ 2570	Bluetooth, WLAN, 802.11 b/g/n, RFID 2450, LTE Band 7	Pulse Modulation 217 Hz	2	0.3	28	28
5240	5100 ~ 5800	WLAN 802.11 a/n	Pulse Modulation 217 Hz	0.2	0.3	9	9
5500							
5785							

Note: The distance values represent the recommended separation distance between interfering equipment and components of the MR system.

SAFETY STANDARDS

Temperature and humidity specifications

System Suite

Use the specifications listed in Table 2-18 for designing your HVAC (heating, ventilation, and air conditioning) system. Proper insulation and moisture barrier should be installed within the environmental controlled space (e.g. area above drop ceiling) for humidity, condensation, and temperature control.



To help prevent a patient from feeling uncomfortably warm during a scan, make sure the magnet room temperature does not exceed 69.8°F (21°C) maximum. If the scan room temperature exceeds 69.8°F (21°C), then the SAR limit is automatically derated, which means that the current scan parameters may trip the SAR monitor.

Table 2-18: Temperature and humidity specifications

Area	Temperature		Humidity	
	Range °F (°C)	Change °F/Hr (°C/Hr)	Range%	Change%/Hr
Equipment Room at Inlet to Equipment	59-89.6* (15-32)*	5 (3)*	30-75*	5
Magnet Room	59-69.8 (15-21)	5 (3)	30-60*	5
Operator's Control Room	59-89.6* (15-32)*	5 (3)	30-75*	5

Note

* Non-condensing humidity with 50% nominal at 65.F (18.3.C).

MAGNETIC FIELDS

Magnetic field basics introduction

Though it is generally accepted that no published evidence exists supporting cumulative or long-term negative effects of EMF¹ exposure, it is advisable for pregnant MR workers to exercise extra precaution in limiting their exposure as much as possible. Health effects increase with increasing magnetic field strength. The existence of local regulations establishing upper limits for MR workers may not apply to pregnant MR workers, although no epidemiological evidence exists supporting negative effects of EMF exposure on the health of a pregnant worker or her fetus. The User is responsible for determining whether local or country legislation may exist establishing occupational limits for exposure to EMF. If such limits exist it is the User's responsibility to ensure they are being observed.

To ensure safe operation of your system, for both you and your patient, you must understand several components of your MR system. Your MR system includes the following magnetic fields:

- Static Magnetic Field (the magnet)
- Gradient Magnetic Fields (the gradients)
- Electromagnetic Fields (the RF)

The following definitions are used throughout Magnetic Field Basics section. Not all modes of operation apply to all GEHC MR scanners.

- **Normal Operating Mode (Clinical Mode):** mode of operation of the MR equipment in which none of the outputs have a value that may cause physiological stress to patients.
- **First Level Controlled Operating Mode:** mode of operation of the MR equipment in which one or more outputs reach a value that may cause physiological stress to patients, which needs to be controlled by medical supervision.
- **Second Level Controlled Operating Mode:** mode of operation of the MR equipment in which one or more outputs reach a value that may produce significant risk for patients, for which explicit ethical approval is required (i.e., a human studies protocol approved to local requirements).



SIGNA Voyager cannot enter second controlled operating mode.

¹Electro Magnetic Field

MAGNETIC FIELDS

Static magnetic fields

The main magnet is a stable and very intense magnetic field.



Note that the MR magnet is always on even when the system is not acquiring scan data. The only exception to this is if service has ramped down the magnet or it has undergone quench.

The main safety issues regarding the static magnetic field include the potential for biological effects, the potential for attraction of ferromagnetic objects, and the potential for a quench of the cryogens.

The MR system static magnetic field may be classified under several modes:

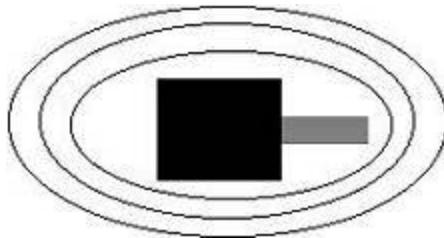
- Normal: the normal operating mode, admissible for all individuals.
- First Level: controlled operating mode, admissible for patients on whom a medical decision was made ensuring they can handle the increased static magnetic field.
- Second Level: controlled operating mode, approval of an IRB or Human Ethical Committee required, with the static field limit explicitly stated.

Table 2-19: Static magnetic field

Mode	System
</= 3T for Normal Mode	1.5T

A magnet produces invisible lines of force that extend beyond the magnet that are called the fringe field. The size of the fringe field depends on the strength of the magnet and whether or not it is shielded. Active and inactive shielding are used to reduce or tighten the fringe field.

Figure 2-7: Fringe field



CAUTION

For some patients or MR workers, rapid movement of the head while in the magnetic field may cause dizziness, vertigo, or a metallic taste in their mouth. None of these motion effects are considered to be hazardous, provided they do not cause the worker to fall.

It is recommended that the patient and the MR worker endeavor to remain still while in the region of high static magnetic field. The MR worker should always vacate the area of the static magnetic field when duties do not require otherwise.

The tesla to gauss conversion is 1 tesla = 10,000 Gauss.

The magnetic field exerts force on susceptible materials and biomedical implants and can create hazards. There are two critical zones: the Security Zone and the Exclusion Zone. Each zone has specific restrictions regarding people and materials.



WARNING

It is your responsibility to ensure permanent creation of the Security Zone and the Exclusion Zone and to establish rules for access. Ensure occupational exposure to static magnetic field complies with local requirements.

MAGNETIC FIELDS

Security zone

The Security Zone is the magnet room and the walls of the magnet room.

Figure 2-8: Security Zone

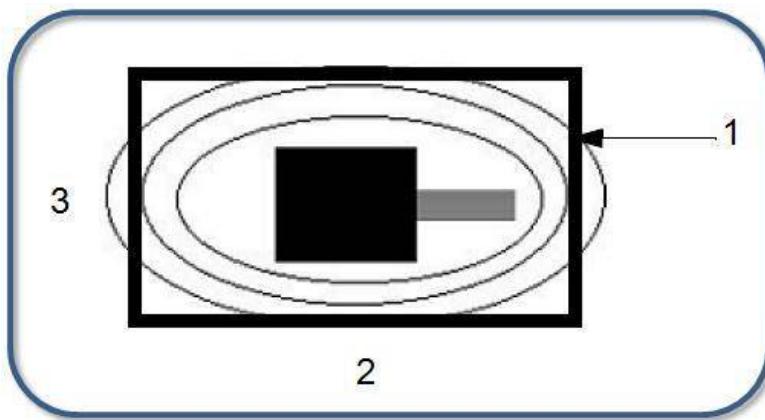


Table 2-20: Image legend

#	Description
1	Magnet room
2	Room length = 19.1 feet (5.8 m)
3	Room width = 12.1 feet (3.7 m)

Static magnetic field plots for siting (rule of thumb - assumes no ferromagnetic materials) may be found at:
<http://www.gehealthcare.com/company/docs/siteplanning.html#mr>

NOTE: The figure above states the approximate minimum room size for your MR system. Consult your GE System Pre-Installation Manual for specific dimensions of your system and additional magnetic field plot information.

IMPORTANT! You need to understand the meanings of ferromagnetic and ferrous substances or items:

- A substance that is ferromagnetic has a large positive magnetic susceptibility. (Example: Iron.)
- An item that is ferrous can possess intrinsic magnetic fields and react strongly in an applied magnetic field. (Examples: Iron, nickel, and cobalt.)

The attractive force of the magnetic field in the Security Zone can cause ferromagnetic items to become projectiles and contraindicated biomedical implants to fail. In short, ferromagnetic items and contraindicated biomedical implants are NOT allowed in the Security Zone.

The MR System operates with a highly sensitive RF receiving front end to be able to capture the signal of an object scanned. The Magnet Room part of the MR System installation provides the RF isolation to reduce the interference from electrical devices outside the shielded location.

It is possible that any device that functions with active electronic circuitry may potentially interfere with the operation of the MR System if such device is introduced inside the Magnet Room even though the device does not have an intentional RF Transmitter. Extreme EMC measures must be taken into account in the design and manufacturing of an electrical device if such device is intended to operate inside the Magnet Room.

A device that may potentially interfere the MR System if introduced inside the Magnet Room are those containing active electronics. Some examples include: Switching Mode Power Supply (SMPS), microprocessor, Digital Signal Processors, analog to digital converters, LCD displays, keypad controllers, motors, battery operated devices.



WARNING

The Security Zone warning sign must be posted on the entrance to the magnet room to alert personnel to the high magnetic field and warn not to bring ferromagnetic objects into the magnet room.



WARNING

Ensure that the Security Zone complies with your local statutory requirements.

Security Zone Warning sign

The Security Zone Warning Sign alerts personnel and patients of the following:

- Strong magnetic field
- Hearing protection: During a scan, all persons in the scan room are required to wear hearing protection to avoid possible hearing impairment.
- No pacemakers*
- No neurostimulators*
- No conductive/metallic implants*
 - Persons with pacemakers, neurostimulators or metallic implants must not enter this area. Serious injury may result.
- No loose metal objects: Iron, steel and other ferrous material must not be taken into this area. Serious injury or property damage may result.
- Risk of non-ionizing radiation: If a scan is performed with the magnet room open.

*In general, patients with conductive (e.g. metallic) implants are contraindicated for MR scans. Some implantable devices have been labeled as MR Conditional under certain operating conditions. Only use quadrature transmit for MR Conditional devices. MR Safe implants will have the MR Safe symbol in their implant documentation.

When evaluating whether to proceed with MR scanning on patients with such implants, consult the implantable device's labeling.

Figure 2-9: Security zone warning sign



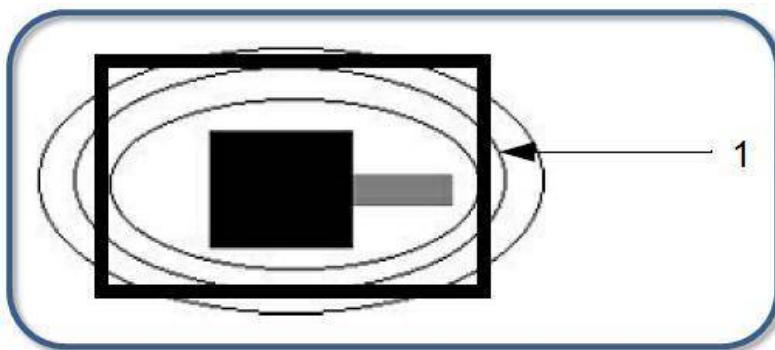
Your system may have a slight variation of this sign.

MAGNETIC FIELDS

Exclusion zone

The Exclusion Zone begins at the 5-gauss line. Magnetic shielding may, however, restrict the 5-gauss line to the magnet room, making the security and the exclusion zone the same.

Figure 2-10: Exclusion Zone, 1 = 5 gauss line



Static magnetic field plots for siting (rule of thumb - assumes no ferromagnetic materials) may be found at:

<http://www.gehealthcare.com/company/docs/siteplanning.html#mr>

All personnel should be aware of the gauss line and actively screen the changing conditions of the environment. There are gauss lines and equipment that must remain outside certain limits. Consult your GE Service Engineer to know where these gauss lines are located in your facility.



WARNING

The Exclusion Zone warning sign must be posted at the 5 gauss boundary. Locate and read the Exclusion Zone signs at your facility.

Exclusion Zone Warning sign

The Exclusion Zone Warning Sign alerts personnel and patients of the following:

- Strong magnetic field
- No pacemakers*
- No neurostimulators*
- No conductive/metallic implants*
 - Persons with pacemakers, neurostimulators or metallic implants must not enter this area. Serious injury may result.

*In general, patients with conductive (e.g. metallic) implants are contraindicated for MR scans. Some implantable devices have been labeled as MR Conditional under certain operating conditions. Only use quadrature transmit for MR Conditional devices. MR Safe implants will have the MR Safe symbol in their implant documentation.

When evaluating whether to proceed with MR scanning on patients with such implants, consult the implantable device's labeling.

Figure 2-11: Exclusion zone warning sign



Your system may have a slight variation of this sign.



WARNING

Ensure that the Exclusion Zone complies with your local statutory requirements.

MAGNETIC FIELDS

Biological effects

The static magnetic field strengths used by your MR system are within the guidelines provided by the United States Food and Drug Administration (FDA) for clinical imaging. However, there are several cautions that need to be understood:

**CAUTION**

Minimize the time spent near the magnet. Spend only the time necessary to attend to the needs of the patient.

**CAUTION**

MR scanning has not been established as safe for imaging fetuses or infants. Carefully compare the benefits of MR versus alternative procedures before scanning to control risk to the patient. A physician should consider whether to limit scanning of pregnant or infant patients to the Normal dB/dt and Normal SAR operating mode. It is not advisable to scan pregnant patients in the first trimester or unknown pregnancy status as the fetus is especially sensitive to potential thermal events during the first trimester.

MAGNETIC FIELDS

Ferromagnetic objects

Ferromagnetic objects brought within close proximity of the static magnetic field can become projectiles, which could cause harm to someone standing between the object and the magnet. The force of attraction between a magnet and a ferromagnetic object is determined by the magnetic field strength (fringe field), the magnetic susceptibility of the object, its mass, its distance from the magnet, and its orientation to the field.

Use only non-ferrous oxygen tanks, wheelchairs, gurneys, intravenous (IV) poles, ventilators, etc. in the magnet room. Be sure anyone who has access to the MR suite is aware that only non-ferrous items are allowed in the magnet room. Make them aware that policies and procedures are in place for bringing medical devices and other equipment into the magnet room.

In addition to the projectile hazard, the static magnetic field can cause ferromagnetic objects within the patient (e.g., surgical clips, prostheses) to move, thus possibly causing harm. Electrically, magnetically, or mechanically activated implants can become dysfunctional due to the static magnetic field. If these devices are life-supporting, harm could result. For medical devices that are labeled as MR Safe or MR Conditional consult the device manufacturer's documentation.



WARNING

The attractive force of the magnetic field of the MR system can cause ferrous objects to become projectiles that can cause serious injury. Post the security zone warning sign on the entrance to the magnet room and keep all hazardous objects out of the magnet room. If a ferromagnetic object has become attached to the magnet, contact GE Service for assistance.



WARNING

To help prevent patient or operator injury, do not bring ferrous materials such as battery operated devices into the magnet room.



WARNING

To help prevent patient or operator injury, do not bring ferrous oxygen bottles into the magnet room.



CAUTION

Common hospital equipment, which often have ferrous battery packs, such as patient monitoring, and life supporting devices, may be adversely affected when in proximity to the magnetic field or image quality may be affected by the presence of this equipment.



CAUTION

The only GE supplied tools recommended for use inside the Security zone are the phantoms supplied with your system.



WARNING

Electrical discharges between conductive devices and the MR coils can startle or burn the patient and possibly cause the patient to injure himself/herself. To help avoid such reactions, do not place metal objects (e.g., limb braces, traction mechanisms, stereotactic devices, etc.) in the MR magnet.



WARNING

The fringe field can cause injury by interfering with the normal operation of biomedical devices.

MAGNETIC FIELDS

Spatial magnetic field data

MR environment safety terminology

The MR Environment Safety Terminology is intended to help explain labeling matters for medical devices and other items that may be used in the MR environment to ensure the safe use of MR technology.

Terminology for defining the safety of items in the MR environment is provided in ASTM F2503 Standard Practice for Marking Medical Devices and Other Items for Safety in the Magnetic Resonance Environment. FDA recommended using the terminology MR Safe, MR Conditional, and MR Unsafe, defined in ASTM F2503 (FDA guidance document, "Establishing Safety and Compatibility of Passive Implants in the Magnetic Resonance (MR) Environment Document").

Definitions

MR safe: An item that poses no known hazards in all MR imaging environments.

With this terminology, MR safe items are non-conducting, non-metallic, and non-magnetic items, such as a plastic Petri dish. An item may be determined to be MR safe by providing a scientifically based rationale rather than test data.

MR Conditional: An item that has been demonstrated to pose no known hazards in specified MR environment with specified conditions of use. Field conditions that define the MR environment include static magnetic field strength, spatial gradient, time rate of change of the magnetic field (dB/dt), RF fields, and specific absorption rate (SAR).

Additional conditions, including specific configurations of the item (e.g., the routing of leads used for a neurostimulation system), may be required.

MR Unsafe: An item that is known to pose hazards in all MR environments.

MR unsafe items include magnetic items such as a pair of ferromagnetic scissors.

ASTM standard F2503 also describes how MR Safe, MR Conditional and MR Unsafe device Icons are to be used for MR labeling of implants and devices. For details see [MR safety labels](#).



CAUTION

Safe scanning of patients with MR Conditional devices or implants may be complex. Health care professionals that scan patients with MR Conditional devices or implants should consult the implant or device manufacturer for instructions with respect to safety guidelines.



WARNING

Scanners are not designed to regulate SAR and dB/dt for levels other than the IEC NORMAL MODE (WB SAR <= 2 W/kg, head SAR <= 3.2 W/kg and dB/dt <= 80% of the mean nerve stimulation limit) and IEC FIRST MODE (WB SAR <= 3 W/kg, head SAR <= 3.2 W/kg and dB/dt <= 100% of the mean nerve stimulation limit). No other limits are enforced.



WARNING

The tests commonly employed to determine MR Conditional implant heating safety (standard, ASTM F2182, ASTM.org), require quadrature excitation. Heating results for non-quadrature excitation (such as parallel transmit, MultiDrive, or elliptical drive) are unknown.

For patients with MR Conditional implants or devices, applying Preset or Optimized RF Drive Modes may violate the MR Conditional specifications.

Magnet information

The peak main magnetic field (B_0), peak gradient of the main magnetic field ($\text{grad}(B_0)$), and the peak force product (main magnetic field times the peak gradient of the main magnet field [$B_0 \text{ grad}(B_0)$]) and their spatial locations are provided in cylindrical coordinates with centers at magnet isocenter.



Note that peak accessible values typically occur (see figure below) at or near the magnet covers (shroud) in a patient accessible area. To find the magnet type used with your system, contact your GE field service engineer.

Definitions

- Peak main magnetic field (B_0), maximum magnetic field magnitude at patient accessible locations.
For solenoid magnets these values typically lie on circles with radius R from the axis of the magnet on both the front and the back of the magnet at $\pm Z$ from isocenter.
- Peak gradient of the main magnetic field ($\text{grad}(B_0)$).
The peak gradient of the static magnetic field, B_0 , is the maximum rate of change of the main magnetic field magnitude along any direction at a patient accessible location. For solenoid magnets these values typically lie on circles with (see table and figure below) radius R from the axis of the magnet on both the front and the back covers of the magnet at $\pm Z$ from isocenter.



Note that the strength of time-varying gradients are small and not relevant to magnetic force considerations.

- Peak force product ($B_0 \text{ grad}(B_0)$).
The peak force product is the maximum product of B_0 and $\text{grad}(B_0)$ at accessible locations. Note that maximum forces and torques will occur at this location. Only values in a patient accessible area with magnet covers in place are given in the table below. For solenoid magnets (see figure below) these values typically lie on circles with radius R from the axis of the magnet on both the front and the back of the magnet at $\pm Z$ from isocenter.
- Locations
Defined in cylindrical coordinates, (Z , R) with ($Z=0$, $R=0$) being magnet isocenter apply to both the front and back of the magnet (see table and figure below). For solenoid magnets the same maximum values occur at R , $\pm Z$ for all angles, i.e., the same peak values form a circle with radius R at $\pm Z$.
- Translational Force
Force acting to move the center of mass of an object. Ferromagnetic objects in non-uniform magnetic fields experience translational forces.
- Torque
A pair of opposite forces some distance apart acting to rotate an object without changing the position of the center of mass. Asymmetrically-shaped ferromagnetic objects (such as needle-shaped objects) experience torques in magnetic fields.

Figure 2-12: Magnet location of fringe-field maximum. Spatial locations of peak fields accessible to patients. The origin of the cylindrical coordinates is magnet isocenter. Cylindrical coordinates locate points a radius R from the magnet axis (centerline) and a distance z from isocenter on axis.

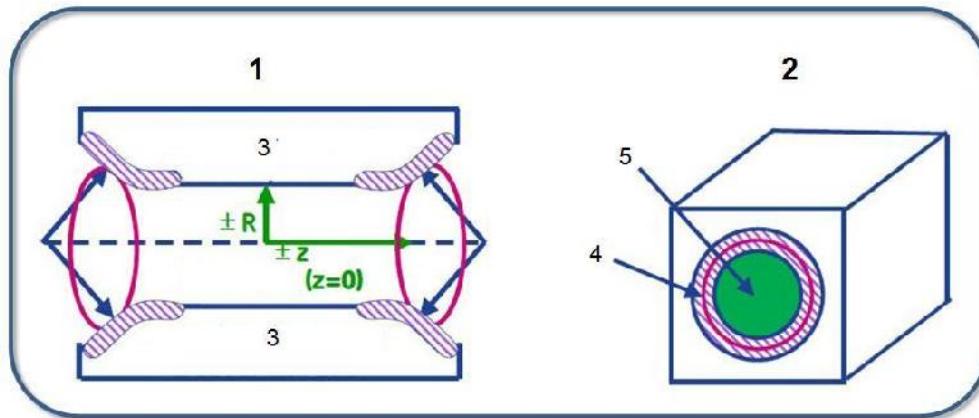


Table 2-21: Image legend

#	Description
1	Side cut-away view of magnet.
2	Front view of magnet.
3	Cylindrical magnet and cover (shroud).
4	Peak B Peak grad (B) Peak $B^* \text{grad}(B)$ Typically, peak B, peak grad (B), and peak $B^*\text{grad}(B)$ are close to the magnet covers in a patient accessible area and are symmetric for rotations about the long axis of the magnet (equal fields for (Z,R) along a circle centered on axis). The peak values are in the shaded regions. Specific locations (R,Z) are identified in table below.
5	Patient bore.

Spatial Magnetic Field

Maximum forces and torques on ferromagnetic objects depend on the force product.

Forces and Torques

Spheres of uniform ferromagnetic material experience translational forces near magnets, but no torque.

- Asymmetric ferromagnetic objects (for example long cylinders) may experience both translational forces and torques. For such objects the translational force can be orders of magnitude lower than those related to torque.
- Magnetic translational force depends on the force product ($B_0 \text{grad}(B_0)$) with the maximum force occurring for the maximum force product.
- Torques increase rapidly with $(B_0)^2$ and depend on angle from B_0 and shape of object.
- MR compatibility investigators have reported the maximum static magnetic fringe field gradient in the past as a safety criterion. For each maximum the maximum values, the spatial locations (cylindrical coordinates (Z,R)), and the values of the other (typically non-maximum) parameters are given below for GE magnets.

The table below contains coordinates for and values of maximum B_0 , maximum $\text{grad}(B_0)$, and maximum $B_0(\text{grad}(B_0))$. MR compatibility investigators have reported the maximum static magnetic fringe field gradient in the past as a

criterion for MR compatibility though the force product actually determines translational force on ferromagnetic objects. The maximum field values (shown with red borders), the spatial locations (in cylindrical coordinates (z, R)), and the values of the other (typically non-maximum) parameters are given below for GE magnets

Useful unit conversions

- $1 \text{ T/m} = 100 \text{ G/cm}$
- $1 \text{ G/cm} = 0.01 \text{ T/m}$
- $1 \text{ T}^2/\text{m} = 10^6 \text{ G}^2/\text{cm}$
- $1 \text{ G}^2/\text{cm} = 10^{-6} \text{ T}^2/\text{m}$

Peak static spatial gradients on patient accessible areas table

See figure above for explanation of R and Z. If you are not sure of your system configuration, consult your service engineer.

SIGNA Voyager Enclosure



Go to [About MR Scanner](#) in your system software to understand the magnet configuration.

Figure 2-13: Classic enclosure for IPM magnet



Figure 2-14: Modern enclosure for IPM magnet



Figure 2-15: Enclosure for LCCW magnet



Table 2-22: SIGNA Voyager enclosure peak static spatial gradients on patient accessible areas for LCCW magnet

Field Name	Patient bore type	Parameter	Radial Location R(m)	Location along Z(m)	B(T)	Grad(B) (T/m)	$\max(B)^*$ grad(B) (T^2/m)
1.5T LCCW	70 VRMW	Peak B	0.35	0.62	2.0	4.8	9.7
		Peak Gradient	0.35	0.74	1.7	6.4	10.5
		Peak Product	0.35	0.68	2.0	5.6	11.0

Table 2-23: SIGNA Voyager enclosure peak static spatial gradients on patient accessible areas for IPM magnet

Field Name	Patient bore type	Parameter	Radial Location R (m)	Location along Z (m)	B (T)	Grad (B) (T/m)	$\max(B)^*$ grad(B) (T^2/m)
1.5T IPM	70 VRMW	Peak B	0.35	0.62	2.0	3.7	7.2
		Peak Gradient	0.35	0.78	1.5	5.7	8.8
		Peak Product	0.35	0.74	1.7	5.3	9.2

Magnetic Field Plots

Static magnetic field plots for siting (rule of thumb - assumes no ferromagnetic materials) may be found at:

<http://www.gehealthcare.com/company/docs/siteplanning.html#mr>

Coordinate system for field and gradient where Z is in the B0 direction, R is the radius, and the origin is isocenter. The following figures represent the contour map for the static magnetic field (B0) from the MR system at positions accessible to the MR worker.

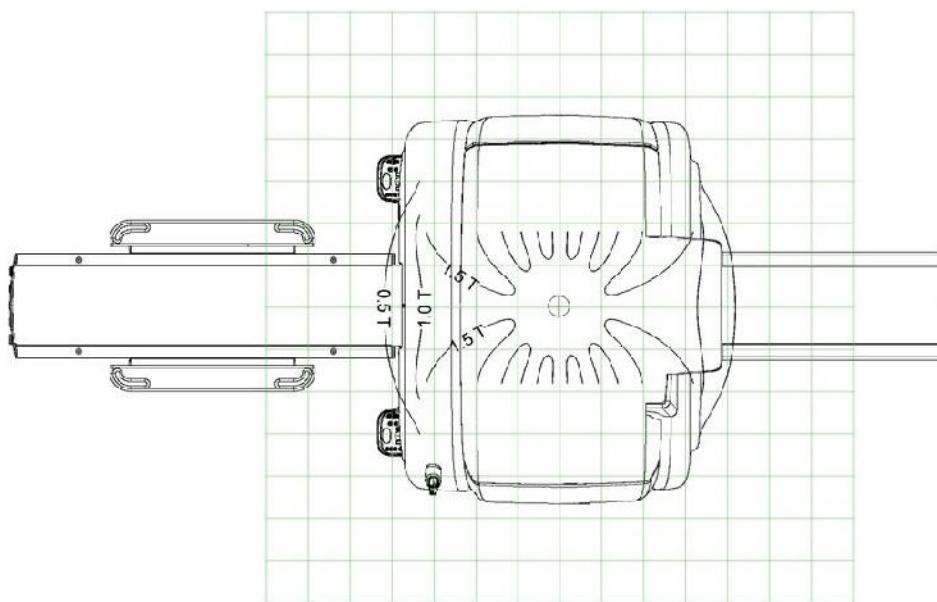
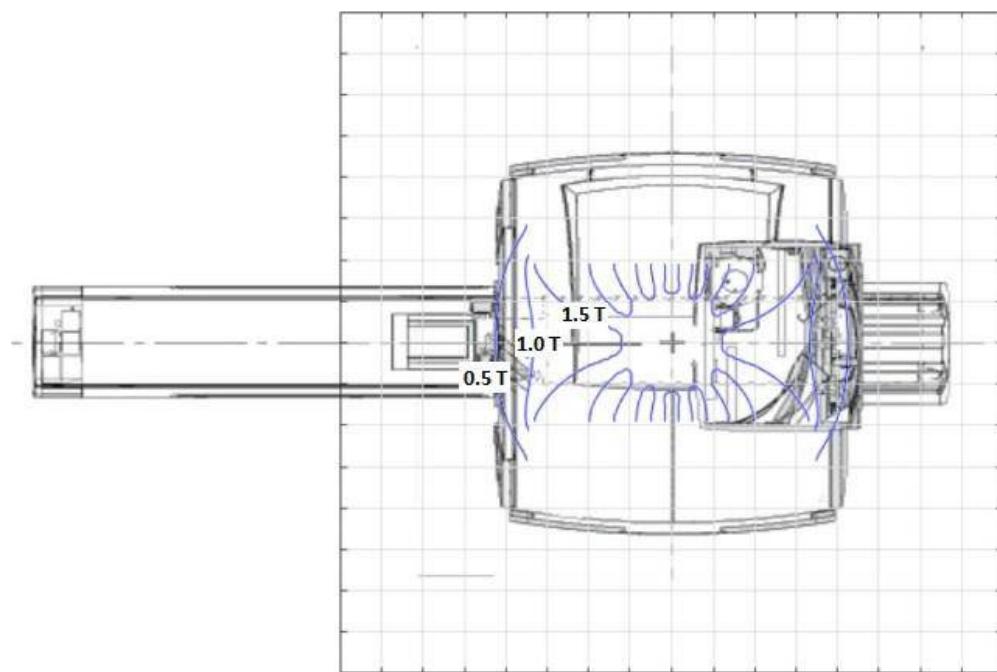
Figure 2-16: Contour map of the static magnetic field (B0) for an 1.5T LCC magnet. View from above magnet with a 25 cm grid overlaid

Figure 2-17: Contour map of the static magnetic field (B_0) for an 1.5T IPM magnet. View from above magnet with a 25 cm grid overlaid



MAGNETIC FIELDS

Understanding spatial gradients

This information is provided to assist in understanding spatial gradients. This information should be used together with the information in the safety manuals for your system.

- What does a magnet's B_0 field look like?
- What is the spatial gradient?
- How do I know where a given spatial gradient value occurs?
- What are the spatial gradients differences between 1.5T and 3.0T systems?
- What are the spatial gradients differences between 60 cm and 70 cm bores?
- Spatial gradient control distances for SIGNA Voyager systems for LCCW magnet
- Spatial gradient control distances for SIGNA Voyager systems for IPM magnet

MAGNETIC FIELDS

The B0 field

When we speak of an MRI magnet “field” we usually mean the main magnetic field, or B0 field. The center of a 1.5T magnet has a B0 field of 1.5 Tesla, or 15,000 Gauss. The B0 field decreases rapidly as you move away from the bore; at 2 meters from isocenter, this field is down to several percent of the field at isocenter.

The shape of the B0 field approximately matches that of the magnet and (typically) the enclosures encapsulating it. The cylindrical magnets used in MRI create a roughly barrel shaped field outside the magnet. Figure 2-18 shows two isocontours (surfaces of constant magnetic field strength) for a typical 1.5T magnet’s B0 field. The green surface shows where the field strength is 300 G, which is 2% of the field at center. The blue surface is 1200 G, or 8%. (One quadrant is removed for clarity.)

A contour map, or contour plot, is a two dimensional diagram of a slice through this 3D field. Figure 2-19 shows the same field as Figure 2-18 – translated into a contour map. The map shows the field contours on a horizontal plane through the center of the magnet. The 300 and 1200 G contours are shown along with several others (100, 600, 3000, and 10000 G). You can see how the contour shapes match between the two figures.

It is important to understand and remember that the magnet’s field is in three dimensions, shaped roughly like the magnet, and that the contour maps commonly used are two dimensional representations of the actual field.

Figure 2-18: Two isocontours for the B0 field for a 1.5T magnet.

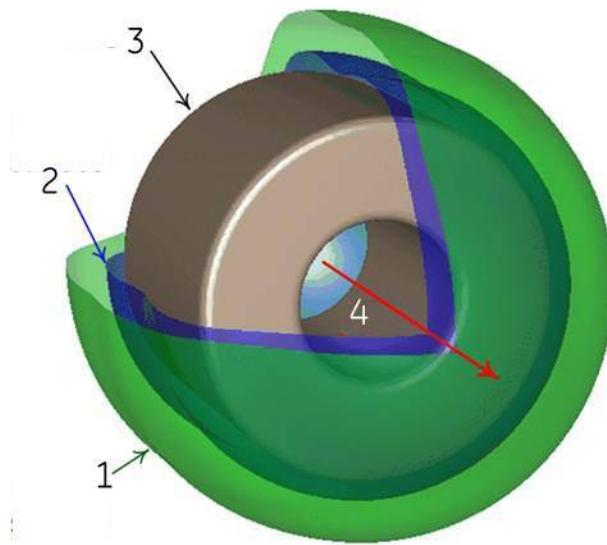
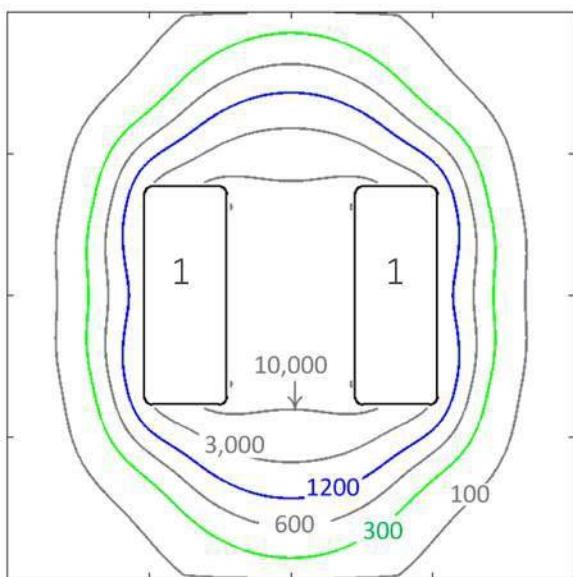


Table 2-24: Image legend

#	Description
1	300 G surface
2	1200 G surface
3	Magnet
4	B0 field

Figure 2-19: A contour map, showing the field contours on a plane through the center of the magnet (1)



MAGNETIC FIELDS

Spatial gradient

The spatial gradient, or SG, of the B₀ field gets a lot of attention because it is part of what affects objects susceptible to magnetic fields. Spatial gradients are typically given as G/cm or T/m. (100G/cm = 1 T/m.)

The spatial gradient is defined as how the B₀ field changes with location: if the strength of the B₀ field changes by 500 G between two locations 1 cm apart, the spatial gradient is 500 G/cm between those two points.

The shape of the SG field is quite different from the shape of B₀. Like the B₀ field, the spatial gradient's shape is a symmetrical, three dimensional field that follows the cylindrical shape of the magnet. Figure 2-20 shows two spatial gradient isocontours for a 1.5T magnet. The green surface is at 400 G/cm. The blue is a higher spatial gradient at 700 G/cm. (The spatial gradient is the same at the front and back of the magnet – the back isocontours are removed for clarity in this figure.)

Figure 2-21 is a spatial gradient contour map (again, a two dimensional slice through the three dimensional field) shows the 700 and 400 G/cm contours. The contours are symmetrical around the centerline of the magnet, both side-to-side and end-to-end. Contours at 20, 100, and 250 are added, and they show three important behaviors of the spatial gradient field:

1. The SG is greatest near the ends of the magnet, and decreases both further from the magnet and near the center of the magnet.
2. The isocontour shape leaves a circular opening at the mouth of the magnet. The opening size increases with the value of the SG. The opening in the blue 700 G/cm isocontour is larger than the green 400 G/cm isocontour.
3. Although the center of the magnet has very low spatial gradients, there is no way to get there without passing through higher spatial gradient regions. In this example, the spatial gradient reaches at least 250 G/cm on the way into the magnet.

Figure 2-20: Two isocontours of the spatial gradient for a 1.5T magnet

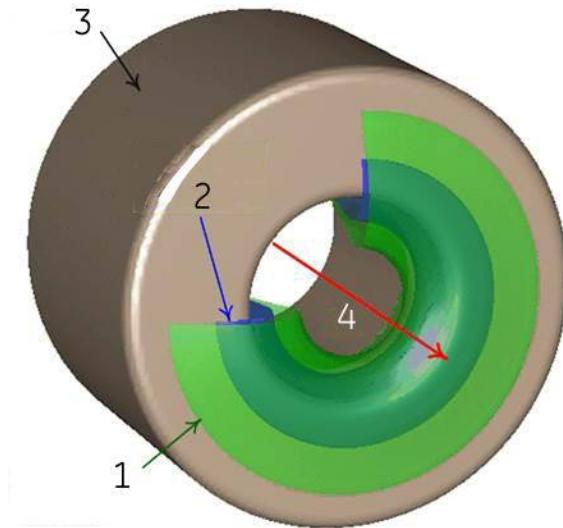
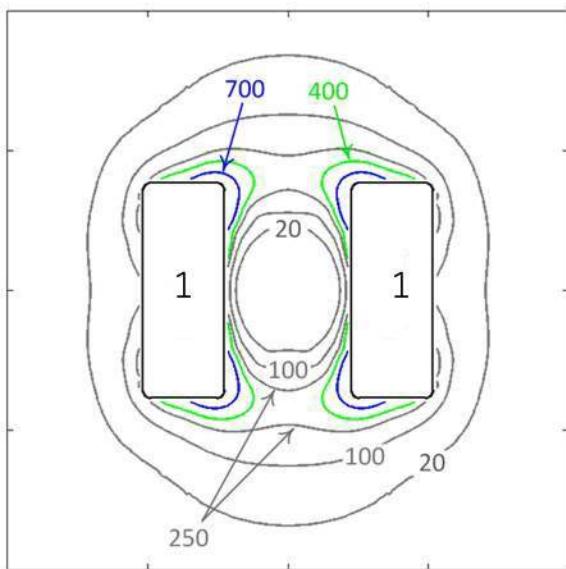


Table 2-25: Image legend

#	Description
1	400 G/cm surface
2	700 G/cm surface
3	Magnet
4	B_0 field

Figure 2-21: A contour map of the spatial gradient for an 1.5T magnet(1)

MAGNETIC FIELDS

Locations of spatial gradient occurrences

A clear understanding of the spatial gradient inside the bore is useful. In general, spatial gradients "reach into the bore" near the mouth of the magnet. A higher SG reaches less into the bore than a lower one. Figure 2-22 (again a typical 1.5T magnet) gives some insight. In this example, two spatial gradient contours are compared: 320 and 400 G/cm. The 320 contours reach into the bore far enough to leave a 28 cm gap. The 400 G/cm contours leave a 48 cm gap.

Given the three dimensional shape of the field, these gaps translates into a circular opening, centered on the magnet's z axis; when extended along the z-axis, this circle becomes a cylinder, centered in the bore. Staying within this cylinder assures that you stay away from a high spatial gradient. In this example, staying within a 28 cm diameter cylinder keeps the spatial gradient below 320 G/cm.

Rather than trying to visualize a cylinder, it may be easier to think of staying a certain distance away from the bore wall. Example: for a 70 cm system and a 48 cm gap, this distance is 11 cm, as shown below.

Figure 2-22: The spatial gradient near the mouth of a 1.5T magnet

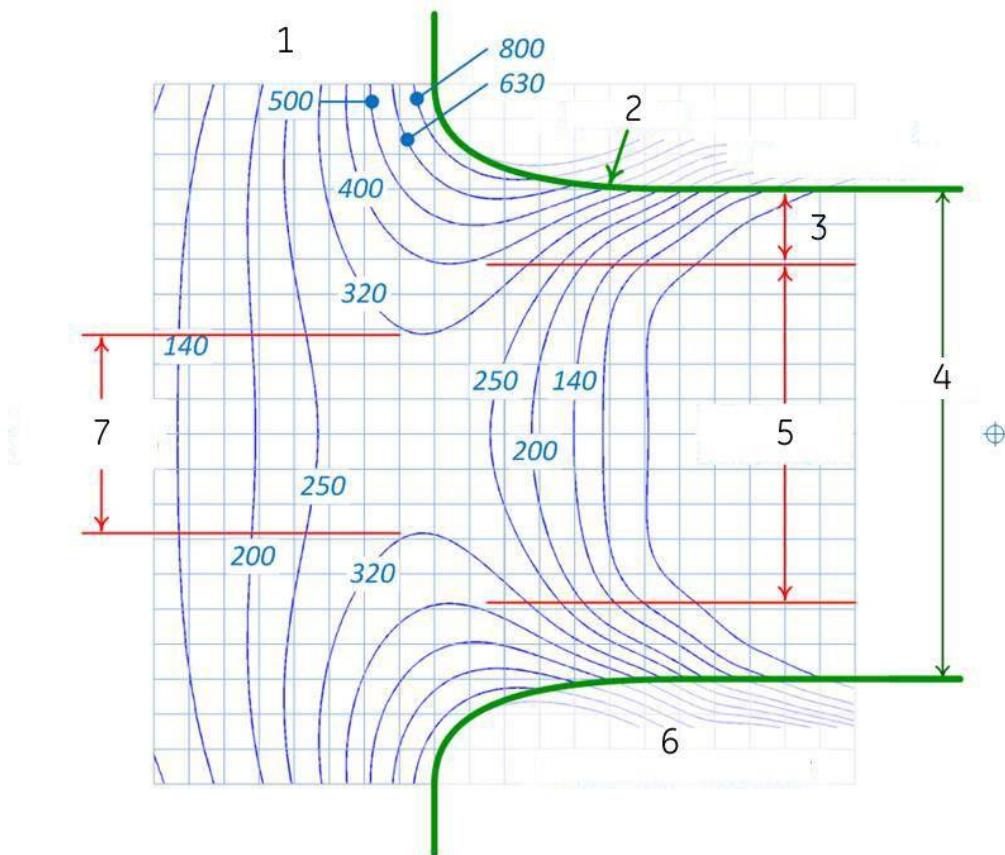


Table 2-26: Image legend

#	Description
1	Spatial gradient (G/cm) (blue lines)
2	Bore wall (green lines)
3	11 cm from 70 cm bore wall

#	Description
4	70 cm bore diameter
5	48 cm gap at 400 G/cm
6	Area inside enclosures
7	28 cm gap at 320 G/cm

Thresholds

There is a lower SG threshold, below which there is no path into the center of the magnet. In this example, there is no path into the magnet that does not pass thru the 250 G/cm contours. We can call this threshold the "entry SG."

There is also an upper threshold where the allowable cylinder is the same size as the bore. In this example, the 800 G/cm contour has at least a 70 cm gap. The tapers near the ends of the bore still require care.

Summary

- There is a lower SG threshold, below which there is no path to get to the center of the magnet.
- There is an upper SG threshold, above which the bore diameter limits the SG exposure.
- Between these thresholds, SG values can be limited by staying within a cylinder, whose diameter increases as the SG values increases.

Outside the bore

Outside of the bore, the spatial gradient exposure can be limited by staying at least a certain distance away from the magnet this is distance **A** in Figure 2-23. This can be visualized as a box around the magnet and its enclosures, with the box sides offset from the enclosure's front, back, and sides.

Since the SG drops off quickly with increasing distance from the magnet and enclosures, the distance **A** is generally small compared to the space around the enclosures.

Distance **A** is set based on two factors:

1. All areas outside the box should have lower SG exposure than the lower SG threshold or "entry SG" described on the previous slide.
2. The distance should be something easy to visualize and remember.

Figure 2-23: A box enclosing all spatial gradients above the entry threshold on an example magnet. View from above magnet with a 20 cm grid overlaid

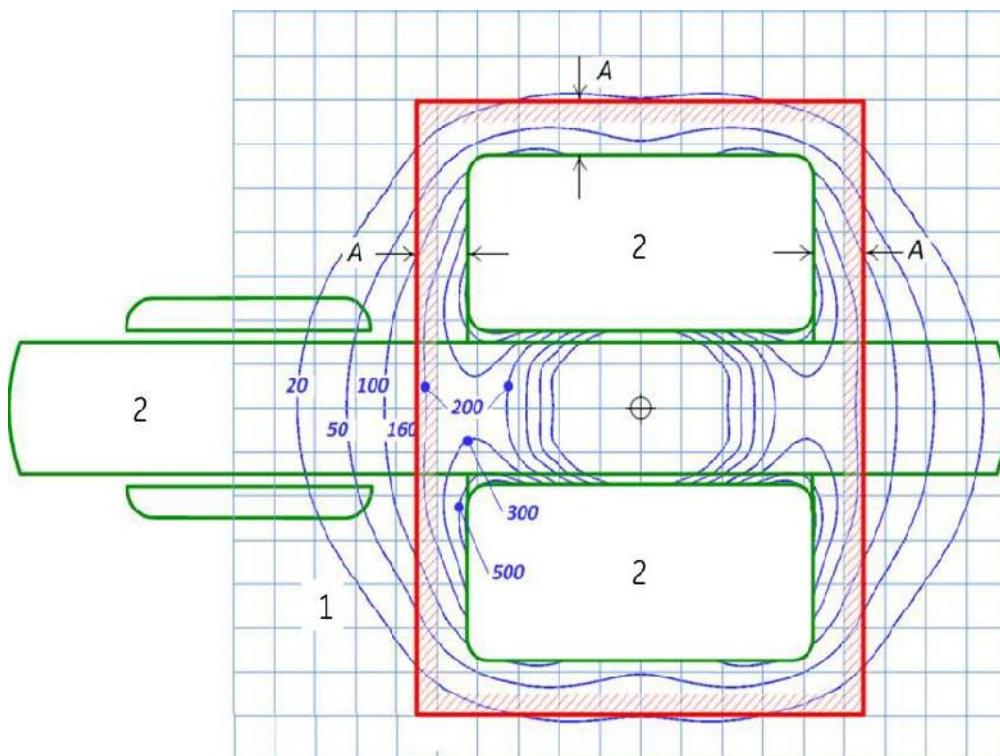


Table 2-27: Image legend

#	Description
1	Spatial gradient (G/cm) (blue lines)
2	Patient table and magnet (green lines)

In this example, the box is sized so that it encloses all the spatial gradient regions above 200 G/cm. This uses a distance of 25 cm (almost exactly 10 inches) from the enclosures.

Everywhere outside of the box, the SG is less than 200 G/cm, which in turn is less than the entry SG threshold at the mouth of the magnet. Therefore, the limiting case for SG exposure will always be at the mouth of the magnet, as opposed to the box around the magnet and enclosures.

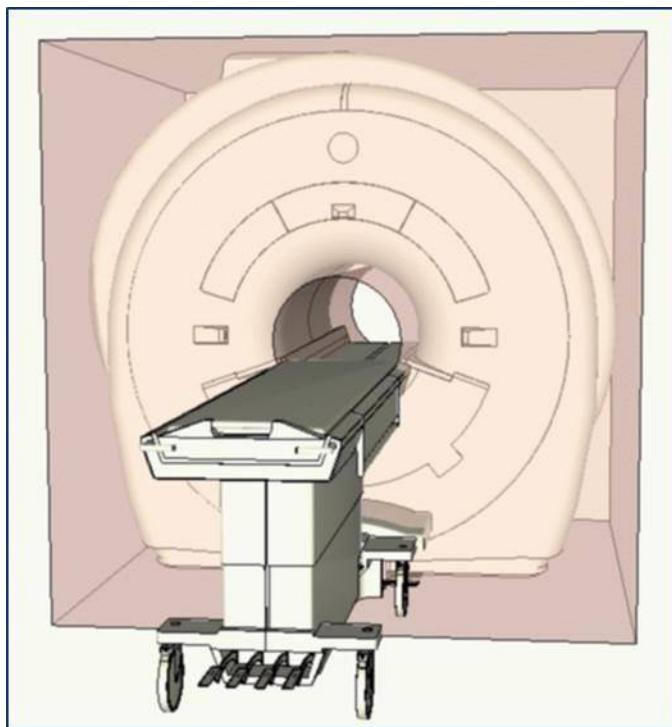
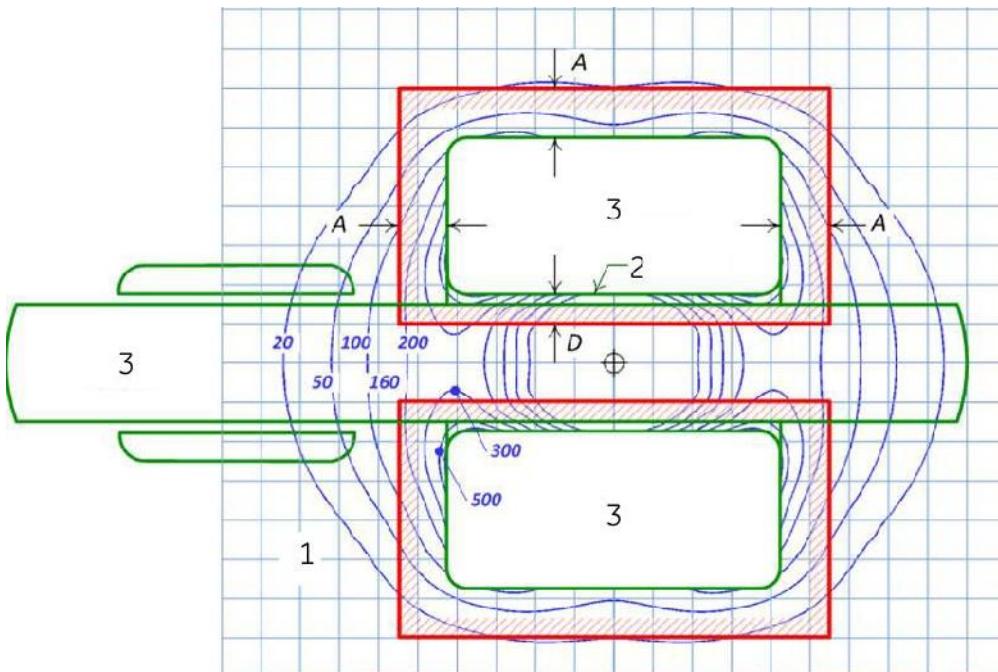
Controlling spatial gradient exposure

The ideas covered in the previous examples can be combined to give a more complete picture of how to control spatial gradient exposure.

Figure 2-24 shows the concept of the box around the magnet, combined with the cylinder inside the bore. The right sketch is a two dimensional diagram, looking down from above, on the plane at the center of the magnet.

The size of the box, given by distance **A** in Figure 2-25, does not change with the SG level. All areas outside the box have low spatial gradient compared to the entry SG. The size of the cylinder does change with SG level. The cylinder diameter increases as SG level increases – or put another way, the distance between the cylinder and the bore wall, which is distance **D** in Figure 2-25, decreases with increasing SG level.

For a specific magnet or system, setting distances **A** and **D** define the areas that need to be avoided to keep spatial gradient exposure below any specific level.

Figure 2-24: A box around the magnet concept**Figure 2-25:** Combining the box surrounding the enclosures with the cylinder through the bore**Table 2-28:** Image legend

#	Description
1	Spatial gradient, G/cm (blue lines)

#	Description
2	Bore wall
3	Patient table and magnet (green lines)

MAGNETIC FIELDS

Field strength and bore comparisons

1.5 vs 3.0T

The spatial gradient for an example 1.5T is in Figure 2-26. Figure 2-27 is an example 3T. Since the main magnetic field doubles between 1.5T and 3T, the spatial gradient of the field will approximately double, given similar magnet designs. Therefore, the SG exposure approximately doubles for 3T compared to 1.5T, for similar locations within the bore.

60 vs 70 cm

Since the magnet designs are similar for 60 cm and 70 cm scanners, the spatial gradient is similar at most locations, relative to the center of the magnet. However, a 70 cm system has a larger bore, and can reach higher SG contours. Therefore, the SG near the bore walls of a 70 cm system are higher than those for a 60 cm system.

This difference is approximately 20%.

Figure 2-26: Spatial gradients for a 1.5T magnet

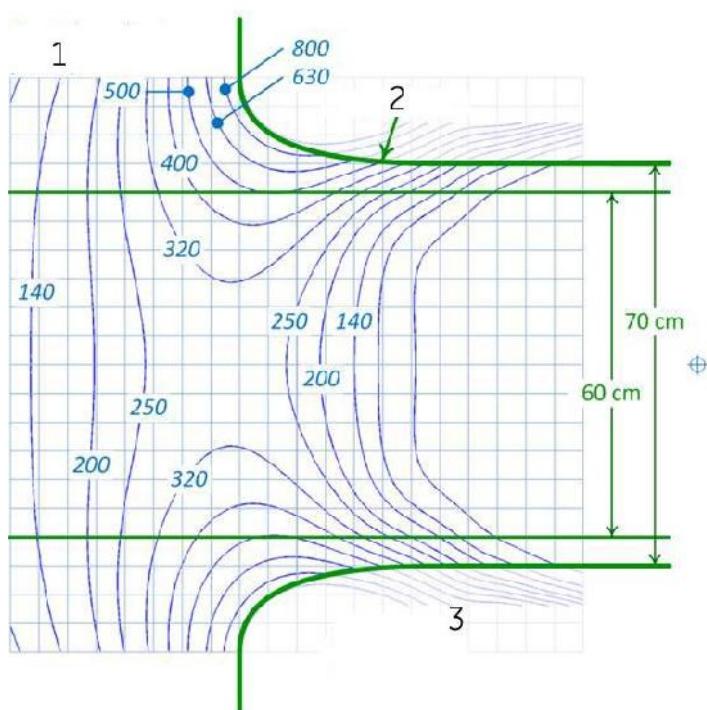
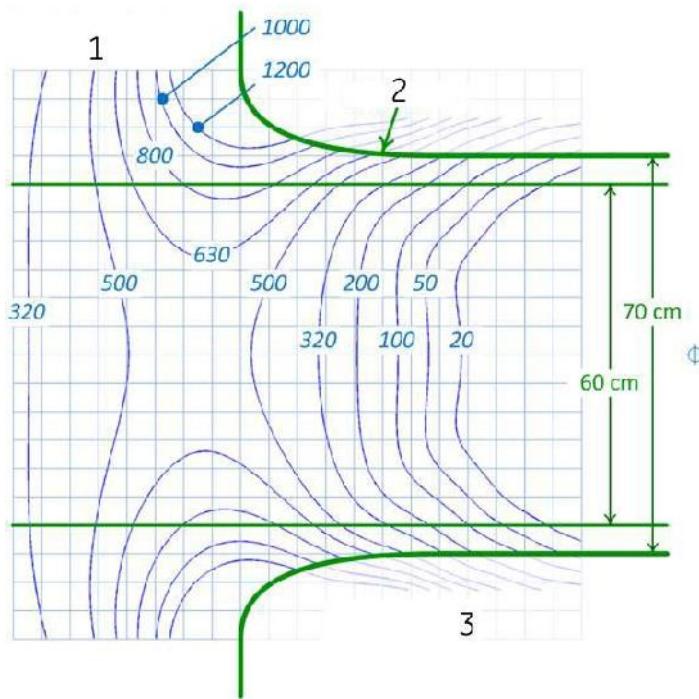


Table 2-29: Image legend

#	Description
1	Spatial gradient (G/cm) (blue lines)
2	Bore wall (bold green lines)
3	Area inside enclosures

Figure 2-27: Spatial gradients for a 3T magnet**Table 2-30:** Image legend

#	Description
1	Spatial gradient (G/cm) (blue lines)
2	Bore wall (bold green lines)
3	Area inside enclosures

MAGNETIC FIELDS**SIGNA Voyager MR system for LCCW magnet**

Go to [About MR Scanner](#) in your system software to understand the magnet configuration.

For a view of the cylinder through the bore, see Figure 2-25.

Distance **A** is the front, sides, and back of magnet = 30 cm

Distance **D** is within the bore as defined in Table 2-31.

Minimum spatial gradient at entry = 270 G/cm

Figure 2-28: Distance D for LCCW magnet

x = Spatial gradient, G/cm

y = Distance, cm

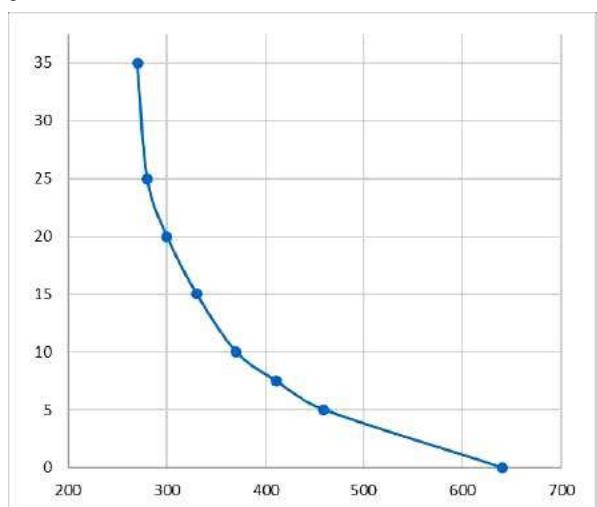


Table 2-31: Image legend

Spatial gradient (G/cm)	Distance D (cm)
270	35*
280	25
300	20
330	15
370	10
410	7.5
460	5
640	0

*Since this is the radius of the bore, there is no path into the bore that does not pass through at least this spatial gradient.

MAGNETIC FIELDS

1.5T MR systems for IPM magnet



Go to [About MR Scanner](#) in your system software to understand the magnet configuration.

Distance **A** is the front, sides, and back of magnet = 25 cm

Distance **D** is within the bore as defined in Table 2-32

Minimum spatial gradient at entry = 263 G/cm

Figure 2-29: Distance *D* for IPM magnet

x = Spatial gradient, G/cm

y = Distance, cm

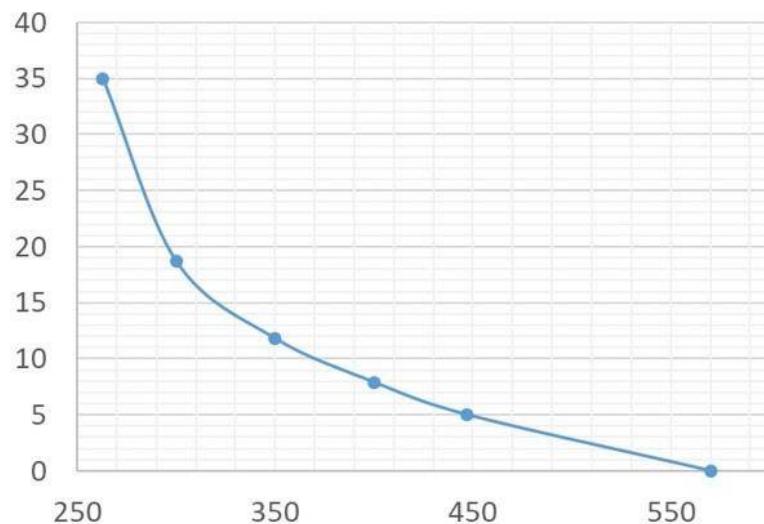


Table 2-32: Image legend

Spatial gradient (G/cm)	Distance <i>D</i> (cm)
263	35*
300	18.7
350	11.8
400	7.9
447	5
570	0

*Since this is the radius of the bore, there is no path into the bore that does not pass through at least this spatial gradient.

MAGNETIC FIELDS

Static spatial gradients on concentric cylinders for LCCW magnet



Go to [About MR Scanner](#) in your system software to understand the magnet configuration.

The static magnetic field might cause forces or torques on some devices near the magnet. The following table shows the maximum magnetic field (B_0), the spatial rate of change of the magnetic field ($\text{grad}(B_0)$), and the product of the magnetic fields and its rate of change ($B_0 \cdot \text{grad}(B_0)$) for infinitely long cylinders concentric with the patient bore. This information may be of use in evaluating risk assuming patients are confined to the cylinder bounds. Note that higher values of these parameters exist on the magnet bore covers (see above).

For example, for the SIGNA Voyager system, use below table to find the peak static gradient field in the 70 cm bore is 6.4 Tesla/m. The peak spatial gradient in the patient bore is located on the 70 cm cylinder surface at $z = 0.735$ m from isocenter. The user then evaluates the risk from the device manufacturer's MR Conditional Labeling, from the characteristics of the scanner, and from other information such as patient history.

- First find that the maximum peak gradient on the magnet covers (from the above table) is 6.4 Tesla/m (640 gauss/cm). This peak occurs at a radius of 0.35 m of axis and a z location 0.74 m from isocenter (typically on the magnet covers). Some risk managers consider this information adequate for determining risk from static spatial gradients.
- Some risk managers may limit the patient to regions contained by cylinders concentric with the patient bore. They may use the table below to find that the maximum spatial gradient in the bore is 6.4 Tesla/m (640 Gauss/cm). The peak spatial gradient in the patient bore is located on the 70 cm cylinder surface at $z = 0.74$ m from isocenter. The user then evaluates the risk from the device manufacturer's MR Conditional Labeling, from the characteristics of the scanner, and from other information such as patient history. In this case the peak static gradient is same as the maximum value on the magnet cover.

Figure 2-30: Static spatial gradients at various radii

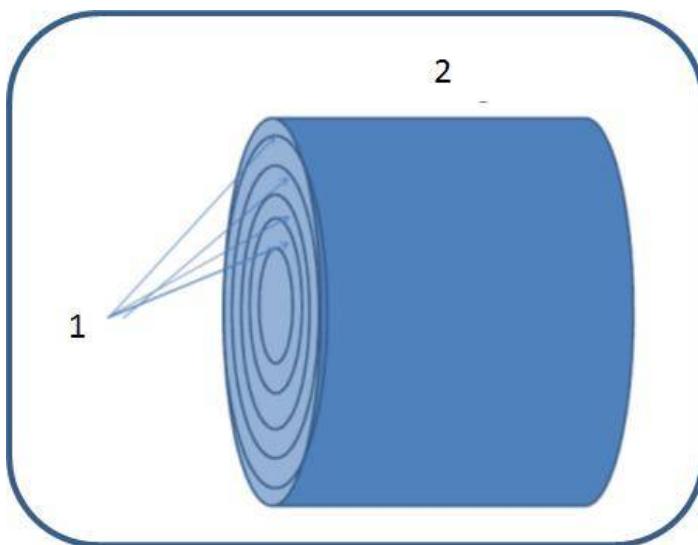


Table 2-33: Image legend

#	Description
1	Concentric cylinders
2	Magnet

Table 2-34: Concentric cylinder data table for LCCW magnet

	On Patient Z Axis		On 20cm Diameter Cylinder surface		On 30cm Diameter Cylinder surface		On 40cm Diameter Cylinder surface	
	Peak	R, Z (m,m)	Peak	R, Z (m,m)	Peak	R, Z (m,m)	Peak	R, Z (m,m)
Bo (T)	1.5	(0,0.23)	1.5	(0.1,0.374)	1.5	(0.15,0.465)	1.5	(0.2,0.525)
Gradient (T/m)	2.7	(0,0.84)	2.8	(0.1,0.836)	3	(0.15,0.81)	3.3	(0.2,0.805)
BxG (T2/m)	2.8	(0,0.77)	3	(0.1,0.763)	3.3	(0.15,0.775)	3.8	(0.2,0.745)
	On 50cm Diameter Cylinder surface		On 55cm Diameter Cylinder surface		On 60cm Diameter Cylinder surface		On 70cm Diameter Cylinder surface	
	Peak	R, Z (m,m)	Peak	R, Z (m,m)	Peak	R, Z (m,m)	Peak	R, Z (m,m)
Bo (T)	1.6	(0.25,0.57)	1.6	(0.275,0.59)	1.7	(0.3,0.6)	2.0	(0.35,0.62)
Gradient (T/m)	3.7	(0.25,0.83)	4.1	(0.275,0.79)	4.6	(0.3,0.75)	6.4	(0.35,0.735)
BxG (T2/m)	4.7	(0.25,0.75)	5.5	(0.275,0.74)	6.5	(0.3,0.72)	11.0	(0.35,0.69)

MAGNETIC FIELDS

Static spatial gradients on concentric cylinders for IPM magnet



Go to [About MR Scanner](#) in your system software to understand the magnet configuration.

The static magnetic field might cause forces or torques on some devices near the magnet. The following table shows the maximum magnetic field (B_0), the spatial rate of change of the magnetic field ($\text{grad}(B_0)$), and the product of the magnetic fields and its rate of change ($B_0 \cdot \text{grad}(B_0)$) for infinitely long cylinders concentric with the patient bore. This information may be of use in evaluating risk assuming patients are confined to the cylinder bounds. Note that higher values of these parameters exist on the magnet bore covers (see above).

For example, for the SIGNA Voyager system, use below table to find the peak static gradient field in the 70 cm bore is 5.7 Tesla/m. The peak spatial gradient in the patient bore is located on the 70 cm cylinder surface at $z = 0.784$ m from isocenter. The user then evaluates the risk from the device manufacturer's MR Conditional Labeling, from the characteristics of the scanner, and from other information such as patient history.

- First find that the maximum peak gradient on the magnet covers (from the above table) is 5.7 Tesla/m (570 gauss/cm). This peak occurs at a radius of 0.350 m of axis and a z location 0.78 m from isocenter (typically on the magnet covers). Some risk managers consider this information adequate for determining risk from static spatial gradients.
- Some risk managers may limit the patient to regions contained by cylinders concentric with the patient bore. They may use the table below to find that the maximum spatial gradient in the bore is 5.7 Tesla/m (570 Gauss/cm). The peak spatial gradient in the patient bore is located on the 70 cm cylinder surface at $z = 0.78$ m from isocenter. The user then evaluates the risk from the device manufacturer's MR Conditional Labeling, from the characteristics of the scanner, and from other information such as patient history. In this case the peak static gradient is same as the maximum value on the magnet cover.

Figure 2-31: Static spatial gradients at various radii

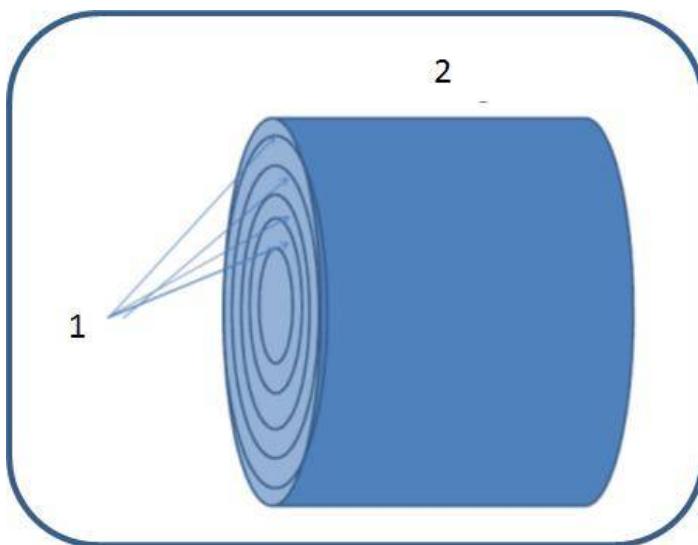


Table 2-35: Image legend

#	Description
1	Concentric cylinders
2	Magnet

Table 2-36: Concentric cylinder data table for IPM magnet

	On Patient Z Axis		On 20cm Diameter Cylinder surface		On 30cm Diameter Cylinder surface		On 40cm Diameter Cylinder surface	
	Peak	R, Z (m,m)						
B0 (T)	1.5	(0.000, 0.000)	1.5	(0.100, 0.000)	1.5	(0.150, 0.000)	1.5	(0.200, 0.000)
Gradient (T/m)	2.6	(0.000, 0.862)	2.8	(0.100, 0.868)	3.0	(0.150, 0.829)	3.2	(0.200, 0.823)
BxG (T2/m)	2.7	(0.000, 0.777)	2.9	(0.100, 0.780)	3.3	(0.150, 0.737)	3.7	(0.200, 0.774)
	On 50cm Diameter Cylinder surface		On 55cm Diameter Cylinder surface		On 60cm Diameter Cylinder surface		On 70cm Diameter Cylinder surface	
	Peak	R, Z (m,m)						
B0 (T)	1.6	(0.250, 0.573)	1.6	(0.275, 0.584)	1.6	(0.300, 0.604)	1.8	(0.350, 0.624)
Gradient (T/m)	3.7	(0.250, 0.835)	4.1	(0.275, 0.781)	4.5	(0.300, 0.813)	5.7	(0.350, 0.784)
BxG (T2/m)	4.5	(0.250, 0.740)	5.5	(0.275, 0.738)	5.9	(0.300, 0.765)	8.5	(0.350, 0.736)

MAGNETIC FIELDS

Cryogen and quench concerns

With superconductive MR systems, another concern related to the static magnetic field is a quench of the cryogens. A superconductive magnet uses cryogens to super-cool the electrical conductor that creates the magnetic field. Temperatures as low as -269°C (-452°F) are achieved to create the proper environment within the magnet. A quench, which is a sudden boil-off of the entire volume of cryogenic liquid, causes a rapid loss of the static magnetic field.

Liquid Cryogen Hazards

Cryogens come in large vacuum containers called dewars. Liquid helium is generally used for cooling purposes, although some service procedures also require liquid nitrogen. Nitrogen dewars weigh from 400 to 500 pounds when full. Helium dewars weigh from 700 to 800 pounds. In addition to large dewars, there may be smaller helium gas cylinders present. This helium gas is used to fill the magnet to proper cryogen levels. Special considerations should be observed when dealing with cryogens.



CAUTION

Leaking helium or nitrogen gas will displace oxygen. The ambient air oxygen concentration may then be insufficient for human respiration. The limit of the air oxygen concentration should meet national laws or regulations.



CAUTION

The following information defines the proper handling of cryogens.

- Dewars and cylinders should not be tipped or heated, nor should the valves be tampered with.
- The cryogens boil off as they cool the magnet wires and must be replenished periodically by qualified personnel. The rate of boil-off should be monitored by checking the cryogen level meter found on the system cabinet.
- Contact with the cryogenic liquids or gas could result in severe frostbite; care should be taken when in proximity to these substances. The wearing of protective clothing is essential during all work in conjunction with liquefied cryogens. Such clothing consists of
 - Safety gloves
 - Work gloves
 - Face shield
 - Laboratory coat or overalls (cotton or linen)
 - Non-magnetic safety shoes
- Dewars should be stored in a well-ventilated area. Cryogens could be accidentally released in gaseous form, resulting in an asphyxiation hazard.
- All dewars and gas cylinders must be non-magnetic.
- Gas cylinders should be stored upright and secured to the wall with a chain with the metal protective top in place. (If a cylinder falls over or the valve is knocked off, the container may act like a rocket; a full cylinder has enough power to penetrate walls.)
- Because the cylinder's metal cap may be magnetic, the cap should always be removed before bringing the cylinder into the magnet room.

- If possible, all personnel should stay out of the magnet room when a qualified service engineer is filling cryogens in the magnet. If personnel must be present, they must wear proper gloves, a face shield, and ear protectors.
- A qualified service engineer should be present any time cryogens are transported within the hospital or added to the magnet.
- It is crucial that ventilation and cryogenic systems be kept in good repair and checked regularly to ensure proper functionality.
- Flammable materials must not be brought near the cryogen containers.
- You are responsible for establishing and following a procedure, in accordance with your local and federal requirements (in the US: OSHA 29 CFR 1910.36), that includes possible evacuation of the MRI area, if flammable materials are identified near cryogenic gases. If grease, oil, or other combustible material is present in the vicinity of the containers, the escape of cryogenic gases can lead to the formation of a potentially combustible liquid due to liquefaction of air and concentration of oxygen.

Quench vent failure hazards

Quenches are indicated by a loud noise, warning message, or the tilting of an image on the display screen. A quench is a hazard only if the vent fails, which would result in the release of white clouds of cryogen vapor into the magnet room. This would present a potential asphyxiation hazard to both the patient and personnel. It is critical to have a well-planned method to quickly evacuate the patient and personnel from the magnet room should a quench occur.



WARNING

In the unlikely event of a quench and vent failure, a procedure needs to be in place to evacuate the patient and all personnel from the magnet room. Failure to follow these precautions can result in serious injury (e.g., asphyxiation, frostbite, or injuries due to panic).

The table below lists the decay time for the 1.5T system to reach 20 mT in the case of a quench or the Emergency Magnet Rundown switch is activated.

Table 2-37: System decay time to reach 20 mT for LCCW magnet

System	Decay time (seconds)
LCCW	120

The table below lists the decay time for the 1.5T system to reach 10 mT in the case of a quench or the Emergency Magnet Rundown switch is activated.

Table 2-38: System decay time to reach 10 mT for IPM magnet

System	Decay time (seconds)
1.5T Platform	60

GRADIENT MAGNETIC FIELDS

Gradient magnetic fields introduction

Gradient magnetic fields produce rapidly changing magnetic fields during scanning. Gradients turn on and off very rapidly to spatially encode the MR signal during a scan. High frequency gradient amplitudes switched very quickly (high dB/dt) may cause nerve stimulation at periphery of body due to induced currents in nerves. Because a current can be induced in any conductive material lying on or near the patient's body, a potential biological hazard exists. The greater the rate of change of the magnetic field (dB/dt , slew rate), the larger the induced current. The muscles, nerves, and blood vessels of the human body are all conductive materials.



WARNING

Ensure occupational exposure to time varying magnetic field caused by the gradients complies with local requirements.

GRADIENT MAGNETIC FIELDS

Calculate maximum gradient output

Let d be the total duration of the gradient ramp (minimum to maximum) or the period of a sinusoidal waveform divided by π . Let f be a fraction (0.8 for Normal Mode or 1 for First Mode). Let c be the chronaxie time in microseconds. Let $d|B|/dt_0$ be the rheobase (rb , infinite ramp duration) value of the time varying gradient magnetic field. Gradient output may be expressed by the following equation;

Maximum gradient output on a cylinder of 0.2 m radius may be found from equation and table below. f is the fraction of the mean stimulation threshold, rb is the infinite ramp duration mean PNS threshold, c is the rheobase value (ramp duration where the mean threshold is $2*rb$), and d is the gradient ramp duration.

$$\left(\frac{d|B|}{dt} \right)_{\text{limit}} = f \left(\frac{d|B|}{dt} \right)_0 \left(1 + \frac{c}{d} \right)$$

Table 2-39: Rheobase and chronaxie constants for various gradient coils

Type	rb (T/s)	C (μs)
VRMw	20	360

Related topics

Contraindications for use

GRADIENT MAGNETIC FIELDS

Gradient output limits

Gradient Output levels are measured as a percentage of the mean peripheral nerve stimulation threshold (PNS).



CAUTION

Continuous patient observation and contact are required in all modes of operation. Medical Supervision is required in the First or Second Level controlled operating modes.

The MR system gradients are capable of operating under several modes:

- Normal: the normal operating mode, admissible for all individuals.
- First Level: controlled operating mode, admissible for patients on whom a medical decision was made ensuring that they can handle the increased gradient output effects or increased SAR. Limits for increased gradient output and SAR are based on current scientific literature related to safety.

The table below lists system operating modes and associated threshold limits.

Product maximum gradient output

The table below gives $d|B|/dt$ for the maximum magnitude values of the vector sum of the field components generated by each of the three GRADIENT UNITS simultaneously at the published peak gradient strength and peak slew rate. The values are in terms of $d|B|/dt$ at various diameters (in meters) from the gradient coil axis. The diameters include 0.2 m, 0.4 m, and the bore diameter minus 0.1 m. The values include no peripheral nerve stimulation limits.

Table 2-40: Maximum $d|B|/dt$ on cylinders of various diameters at the product slew rate

max $d B /dt$ [T/s]	D= 0.2 (m)	D = 0.4 (m)	D = 0.45 (m)	D = 0.5 (m)	D = 0.6 (m)
VRMw (SIGNA Voyager, 70 cm bore)	43.3	57.5	N/A	N/A	86.8

Table 2-41: IEC gradient output limits

Operating mode	PNS Limit
Normal	80% mean nerve stimulation threshold
First Level (controlled mode)	100% of the mean nerve stimulation threshold. Requires you to click the [Accept] button to proceed when the Normal mode dB/dt or SAR limits are exceeded, but Second Level mode has not yet been reached.

GRADIENT MAGNETIC FIELDS

Peripheral nerve stimulation

The concern from time-varying gradient fields is to prevent cardiac stimulation and ventricular fibrillation. Cardiac stimulation in the most sensitive population percentile requires at least 39 times as much energy as is produced with peak gradient amplitude of 0.05 Tesla/meter and Slew Rate of 200 Tesla/meter/sec.

Regulatory bodies use avoidance of painful nerve stimulation to limit gradient output with an adequate safety margin. Painful nerve stimulation typically occurs at approximately double the mean stimulation perception threshold. Some discomfort is experienced about 1.5 times the mean PNS threshold, see figure below.

Peripheral nerve stimulation (PNS) problems are not of concern on systems compliant with IEC 60601-2-33 Normal or First Controlled Operating Modes. The IEC limits PNS to 80% of the mean threshold in Normal Mode (where stimulation should be rare) and 100% for the First Mode (where non-painful stimulation is expected in about half the patients).

If the patient can not tolerate PNS, change to Normal Mode to eliminate the problem. Otherwise change to a lower slew rate pulse sequence to continue scanning the patient. MR workers may experience similar sensations if they are in or very near gradient coils during active scanning, and so keep sufficient distance away from the gradient coils during scanning.

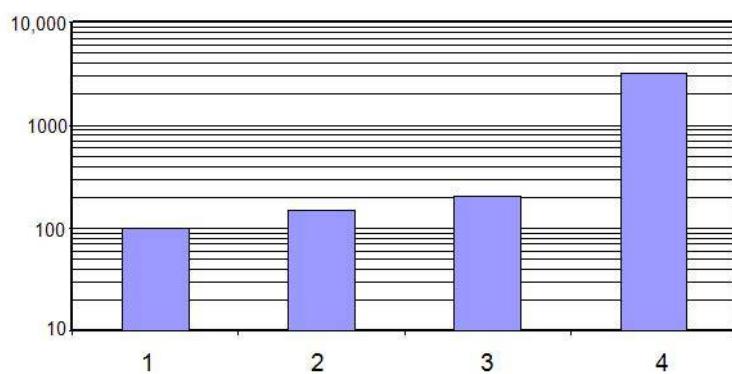
The Anterior/Posterior (A/P) (=Y) gradient axis typically has the lowest stimulation threshold. So it is prudent to keep the gradient waveform most likely to stimulate (the gradient waveform with the highest slew rate for the longest total ramp time) on a physical axis other than Y.

You should remain in constant contact with the patient, especially in the FIRST CONTROLLED MODE, to ensure that the patient does not feel painful stimulation (or high localized heating).

The figure below displays a graph of the relative mean threshold (vertical axis) and discomfort stimulation levels (horizontal axis) where relative means are for perception (100), discomfort (1000), and pain (10,000).

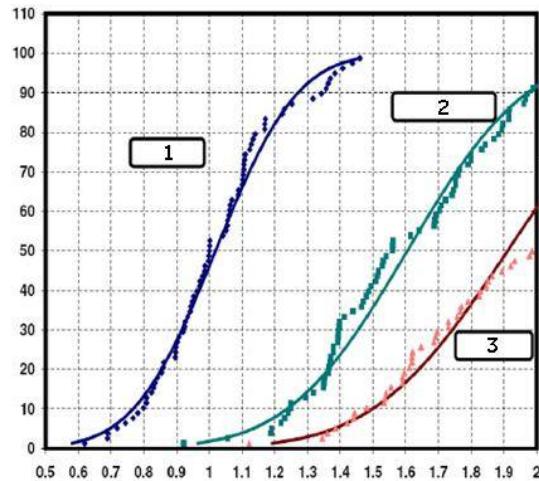
- 1 = threshold
- 2 = uncomfortable
- 3 = intolerable
- 4 = 1% cardiac

Figure 2-32: Relative mean threshold and discomfort stimulation levels



The distribution of those experiencing PNS is illustrated in the figure below; three curves where the horizontal axis is the normalized level and the vertical axis is the% probability of PNS. The curves represent the following:

- 1 = threshold
- 2 = uncomfortable
- 3 = intolerable

Figure 2-33: PNS probability. X axis = Fraction of the Mean Threshold (100% PNS). Y axis = Population percentile.**CAUTION**

To reduce the possibility of PNS, make sure the patient's hands are not clasped or touching and that their feet are not crossed. Either or both of which could form a conductive loop.

**CAUTION**

Due to the rapid rate of change of the magnetic fields (dB/dt) used during some scans, a percentage of patients may experience a non-hazardous tingling or touch sensation. The **PNS probability graph** indicates the type of sensations caused at different percentages of the mean nerve stimulation threshold. Note that stimulation is relatively rare in NORMAL MODE (x-axis=0.8), but occurs about 50% of the time in the FIRST MODE (x axis=1). If this sensation is bothersome or uncomfortable to the patient, stop the scan. Change to NORMAL MODE to continue scanning the patient. The MR worker may experience similar sensations if remaining within the gradient field during active scanning.

**CAUTION**

There is a possibility that mild peripheral nerve stimulation (PNS) may be induced in the MR worker when that person is exposed to the gradients when the system is operating in the First Level Controlled Operation Mode. The MR worker should remain outside the magnet room during scanning in this Mode except when circumstances dictate otherwise.

**CAUTION**

Peripheral nerve stimulation is not harmful. The potential for inducing peripheral nerve stimulation is kept within limitations. The MR system is limited from operating above 80% of the PNS threshold in the NORMAL Mode (100% of the mean PNS threshold in the First Mode) by the software (unless the system is in Second Controlled Mode). The point at which 50% of a population experiences PNS is the PNS threshold. PNS has been

described as a light “touching” sensation felt on various areas of the skin surface. These areas vary depending upon which gradient axis is in use. Some common areas for the sensations are the bridge of the nose, arms, chest, and upper buttock/abdomen. Hands clasped together increase the potential for stimulation by approximately 65%. The potential for PNS is low, but it exists for all sequences in all gradient configurations.



Please report all complaints of patient discomfort that may be associated with PNS during MR examinations (e.g., muscle twitches, tingling sensations, or headaches) to GE. See [Safety information](#) for contact information.

GRADIENT MAGNETIC FIELDS

Acoustic noise

Another potential safety issue associated with gradient switching is the loud noise. The rapid alternations of currents within the gradient coils cause the coil assemblies to vibrate against their mountings, thus generating a loud resonant noise. The acoustic noise produced during scanning can exceed 99 dBA in the bore.



WARNING

The sound level at the operator's console should be limited to comply with local rules.



WARNING

Hearing protection is required for all people, including the MR worker, in the magnet room during a scan to prevent hearing impairment. Acoustic levels may exceed 99 dBA. Patient hearing protection with a noise reduction rating (NRR) of 29 dB or better is required to reduce acoustic level below 99dBA. The A-weighted RMS sound pressure level is measured according to NEMA MS 4: 2010.



CAUTION

All personnel should be trained on the proper use of hearing protection.

- Special attention should be utilized to protect the hearing of neonates, premature infants, and any other condition that does not allow for hearing protection to be applied.
- Patients with increased anxiety may have a lower acceptance to sound pressure (e.g., newborns, infants, young children, elderly, and pregnant women and the fetus).
- Anesthetized patients have less than normal protection against high sound pressure. Hearing protection should not be omitted.
- Typical operator console noise levels are below 60 dBA, so hearing protection is generally not required at the operator console. However, it is important to ensure the sound level complies with all local regulations.
- In some countries, legislation exists that limits employee exposure to noise levels. Ensure compliance with your local regulations by providing additional hearing protection to MR workers for use in the magnet room where required.
- If a music sound system is in use by the patient during scanning, the music sound system must provide > 29dB NRR of attenuation. All hearing protection devices must provide > 29dB NRR of attenuation.

Encourage the routine use of earplugs to prevent problems associated with acoustic noise during MR procedures. GE offers disposable ear protection of various noise reduction ratings. These can be ordered through the GE accessories catalog. The table below, describes the available types of disposable ear protection.

Table 2-42: Disposable ear protection

Description	dB
E8801BA EAR Disposable Foam Earplugs	29
E8801BB EAR Taperfit2 Foam Earplugs	32
E8801BC Max-Lite Foam Earplugs	30

ELECTROMAGNETIC FIELDS

Electromagnetic fields introduction

The Radio Frequency (RF) field is an oscillating electromagnetic field. Pulses of RF energy are used to generate the signal, which cause tissues to absorb RF power. Under certain conditions, this may cause tissue heating. The amount of heating depends on several factors, such as patient size and pulse sequence timing. RF heating of tissues is greatest at the periphery of the skin. The Specific Absorption Rate (SAR) is the estimated amount of heat dose received by the patient. This value is expressed as watts of power per kilogram of the patient's body weight.

ELECTROMAGNETIC FIELDS

Tissue heating

Before the patient is scanned, the computer estimates the level of heating and compares it to the predetermined exposure limits. If the scan is expected to exceed these limits, the system then adjusts the scan parameters before starting the scan. The complete estimate is based in part on patient weight. Therefore, take care to enter the patient's weight correctly to prevent excessive RF exposure or scan abortion.

When patient temperature is not changing, typical skin temperatures are about 33 °C while core temperatures are about 37 °C. Patients dissipate metabolic heat at the same rate it is generated so there are no skin or core temperature changes. Humans subjected to significant radio frequency power deposition (i.e., significant SAR) will normally attempt to dissipate the additional heat load through vasodilatation of skin blood vessels permitting skin to approach core temperature. This action typically causes the skin to flush (turn red) and enables the body to dissipate heat more rapidly. This skin flushing is a normal response to significant radio frequency power deposition. Skin reddening or to a lesser degree the report of a warming sensation without reddening regardless of the method it was created (SAR, Contact, Metal, etc) is not hazardous if it clears in a few hours.

Patient comfort module

A sensor located in the bore of the magnet monitors bore temperature. The sensor posts appropriate messages in the system log that notify you when the magnet bore wall is becoming warm. The temperature inside the magnet room should be set at less than 70°F and the bore fan should be turned on at all times to keep air flowing inside the bore of the magnet.

Thermal hazards

The increase in tissue temperature caused by RF exposure depends on a variety of factors associated with the thermoregulatory system of the individual and the surrounding environment. Thermoregulatory is the ability of the body to maintain regulated heat capacity levels. Observe the following warnings concerning tissue heating:



WARNING

RF power deposition can heat the patient's tissue if delivered faster than the patient's tissues can dissipate the generated heat. The amount of tissue heating depends on the patient's weight, type of pulse sequence, timing factors, number of slices, SAR, and the use of imaging options such as saturation. Power deposition will typically be lower when the NORMAL MODE is selected for SAR. FIRST MODE for SAR offers higher performance but also higher power deposition.



WARNING

A rise in body temperature can be a hazard to a patient with reduced thermoregulatory capacity and increased sensitivity to raised body temperature. These can be caused by pre-existing conditions, such as cardiac impairment that has reduced circulatory function, hypertension, diabetes, old age, obesity, fever, pregnancy, or an impaired ability to perspire. A patient with these complications must be carefully monitored at all times. Consider scanning with NORMAL MODE for SAR for patients that may not tolerate the higher levels.

**CAUTION**

The MR worker who remains in the scan room during a study could be subject to tissue heating caused by RF energy exposure. Care should be taken to limit the time the MR worker remains in the scan room during a study.

**WARNING**

RF can also raise the magnet bore temperature and cause thermal stress; medical conditions can reduce a patient's ability to cope with external temperature increases. If the temperature continues to rise, the scan stops until temperature within the bore is lowered. When the sensor detects temperatures that may cause patient discomfort, the system posts the following messages on the screen or in the error log:

- "The patient comfort level is warmer than normal."
- "The patient may be uncomfortable during the scan."
- "The bore cooling system or magnet room temperature may not be normal."
- "Further increases in temperature will inhibit scanning."

When the temperature drops to a comfortable level, the message is cleared from the screen. If the temperature continues to rise, a second message appears on the screen:

- "Scan inhibited. Patient comfort sensor trip."

To facilitate a return to scanning, make sure the patient fan is ON, room temperature is normal, 21°C (70°F), and air flow through the bore is unobstructed.

When the magnet opening temperature decreases, the system posts this message:

- "New scans can be initiated, but the patient comfort level is still warmer than normal."

**CAUTION**

All patients should be monitored for increased temperature during the scan acquisition. If the patient reports discomfort due to warming, stop the scan. Patients should be provided with the hand-held Patient Alert bulb prior to scanning. The patient should be instructed to communicate any concerns through the intercom or by activating the Patient Alert bulb.

**CAUTION**

RF heating can be caused by:

- Damp clothing.
- Contact of body or extremities against the RF transmit coil surface, contact with metal, tattoos or metallic eyeliner, contact with other body parts.
- Scanning with an unconnected receive coil or other cables in the RF transmit coil during the examination.
- Formation of loops with RF receive coil cables and ECG leads.
- The use of MR Unsafe or MR Conditional (used outside of its conditions for use) ECG electrodes. Never use ECG electrodes past their expiration date.
- The use of MR Unsafe or MR Conditional (used outside of its conditions for use) ECG leads. MR ECG leads have a very high impedance that limits current to below the level of concern.



CAUTION

Extra attention should be utilized when scanning patients who are unconscious, sedated, or may have loss of feeling in any body part (temporary or permanent paralysis). They may not be able to alert you to RF heating.



CAUTION

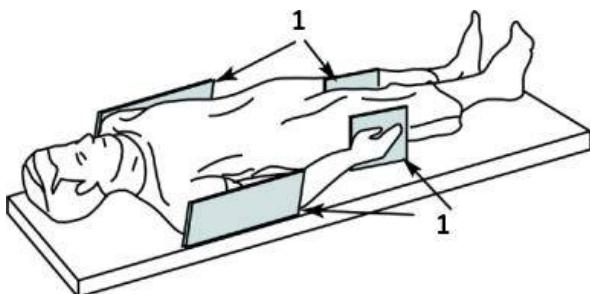
The coil selected should match the coil that is connected. When scanning with a transmit/receive only coil, DO NOT scan using the body coil (or use the Body coil configuration) at any time. Using the body coil can cause RF heating and could result in patient burns. In addition, scanning with the body coil can damage the transmit/receive only coil, requiring the coil to be unusable and returned to the factory for service.

ELECTROMAGNETIC FIELDS

Contact point heating

Patient positioning can affect the safety of the scan procedure. To help prevent a patient burn from closed loops formed by the following examples: clasped hands, by hands touching the body, from thighs contacting, the patient's breasts contacting the chest wall over a small area, etc., insert non-conducting pads at least 0.25 inches thick between touching parts and between the patient and the bore wall and the patient and any coils or conductors.

Figure 2-34: Patient positioned with non-conducting pads (1)



Observe the following warnings concerning contact point heating to protect patients from excessive heating or burns related to induced currents during MR procedures:

**WARNING**

RF can cause localized heating at contact points between the patient/bore and patient/RF coil resulting in discomfort or burns.

**WARNING**

RF can cause localized heating at contact points between adjacent body parts when a loop is formed. Such localized heating can result in discomfort, or burns. This could occur when a patient's hands are touching or when a female patient's breasts are compressed to her chest. Use pads between body parts to avoid creating a loop with adjacent body parts.

**WARNING**

Place appropriate non-conductive padding between the patient and the bore wherever a portion of the body may come into contact with the magnet opening.

**WARNING**

Always place appropriate non-conductive padding between the surface coil and the patient's skin to prevent burn injuries.



WARNING

For shoulder imaging, always place appropriate non-conductive padding between the patient's opposite shoulder or a portion of the patient's body and the bore wherever a portion of the body or opposite shoulder comes into contact with the bore.



CAUTION

RF can cause localized heating at patient contact points. Wet diapers or incontinence products have the same electrical properties as human tissue. All patients with diapers, including adults, should have dry diapers on prior to the start of the scan. If the patient reports discomfort due to warming, stop the scan.

ELECTROMAGNETIC FIELDS

Conductive material heating

Another potential hazard related to the RF field is the heating of implants, devices, and objects of conductive (e.g. metallic) compositions that may cause temperature changes during an MR examination. The induced currents in the conductive (e.g. metallic) objects may cause them to get so hot that they can actually cause burns in adjacent tissues. Therefore, it is very important to determine each patient's work history and thoroughly screen for any accessories containing conductive material.

Observe the following warnings concerning conductive material heating to protect patients from excessive heating or burns related to induced currents during MR procedures:

**WARNING**

Eye makeup that contains metal flakes can cause eye and skin irritation during MR scanning. Instruct patients to wash off removable makeup before the exam to avoid the risk of eye injury. Before scanning, warn patients with permanent eyeliner or other metallic ink tattoos about the risk of skin irritation and instruct them to get prompt medical attention if they experience severe discomfort following an MR exam.

**WARNING**

Metal fragments/slivers can deflect and/or heat in a magnetic field, damaging surrounding tissues. Patients thought to have metallic fragments in the eye should receive an eye exam to detect and remove any metal fragments that could deflect and damage the eye.

**WARNING**

Jewelry, even 14-karat gold, can heat and cause burns. RF can heat (even non-ferrous) metal and cause burns.

**WARNING**

Medicinal products in transdermal patches may cause burns to underlying skin.

**WARNING**

The use of MR Unsafe or MR Conditional (used outside of its conditions for use) stereotactic frames and RF blankets is not recommended.

ELECTROMAGNETIC FIELDS**Specific Absorption Rate (SAR) limits**

It is necessary to measure the RF absorption in tissues since RF exposure cannot be measured by the system. Energy dissipation through absorption by the body can be described in terms of Specific Absorption Rate (SAR). SAR is a rate, meaning it is a measure of the amount of RF power absorbed per unit of mass of an object in watts per kilogram (W/kg). There are several types of SAR, listed in the table below, that must be understood.

Table 2-43: SAR definitions

SAR type	Definition
Whole body	SAR averaged over total patient body mass over any six-minute period for Body and Receive Only surface coils, which use body transmit.
Partial body	SAR averaged over the exposed mass in the coil averaged over any six-minute period.
Head	SAR averaged over the mass of the patient's head over any six-minute period.
Extremity	SAR averaged over the estimated mass of the patient's extremity over any six-minute period for small volume and Transmit/Receive coils.
Short term	The SAR averaged over any 10-second period.

The MR system SAR operating modes:

- **Normal:** the normal operating mode, admissible for all individuals assuming MR Conditional requirements are met.
- **First Level:** controlled operating mode, admissible for patients on whom a medical decision was made ensuring they can handle the increased SAR effects. Increased SAR levels are based on current scientific literature related to safety. There is a potential risk for increased tissue heating and nerve stimulation when operating above Normal mode.
- **Second Level:** controlled operating mode, admissible for customers with a propriety license agreement with GE and with Investigational Review Board clearance for the investigational protocol. IRB review must include explicit approval of the SAR limits. There is a potential risk for increased tissue heating and nerve stimulation when operating above Normal mode.

**CAUTION**

Continuous patient observation and contact is required in all modes of operation. Medical Supervision is required in the First or Second Level controlled operating modes.

**CAUTION**

SAR may be controlled by Local Approval.

**CAUTION**

For sites which need to comply with IEC60601 2nd or local safety standard YY 0319-2008, this MR equipment shall not be used in the normal operating mode when the scan room temperature is greater than 24 °C or relative humidity about 60%.

**WARNING**

The magnet room temperature shall not be more than 21°C per the manufacturer's requirements and the relative humidity shall not be more than 60%. Temperatures above 21°C and humidity above 60% could result in lowering the system SAR limit.

The derating temperature is 25°C for relative humidity less than 60%. For each 10% increase of the relative humidity in excess of 60%, the temperature is reduced by 0.25°C, e.g., 24°C at 100% relative humidity.

For each degree of environmental temperature that exceeds the SAR-derating temperature, the whole-body SAR limit is reduced by 0.25 W/kg until the SAR is 2 W/kg or 0 W/kg for the First Level controlled operating mode or for the Normal mode, respectively.

**WARNING**

The RF power monitor and SAR limitations help prevent excessive RF exposure to the patient; SAR values are calculated based on the patient's weight. To help avoid injury, enter the patient's correct weight to set operating limits and prevent excessive RF exposure.

**WARNING**

The SAR algorithms for the MR systems calculate SAR values and set a limit on the number of slices/echoes per second in order to limit RF power deposition. The power monitor and SAR algorithm limit SAR, regardless of the patient weight or pulse sequence used. SAR limits are conservatively estimated from worse-case patient positioning as a function of weight.

The legacy power monitor module limits the RF amplifier output power thus limiting the patient SAR in case of a catastrophic failure. This module monitors peak power based on the patient's weight, duty cycle, and pulse sequence parameters. The peak power limits prevent you from using incorrect patient weights.

**WARNING**

The average power monitor and SAR algorithm limit SAR based on patient weight and RF transmit coil used. SAR limits are conservatively estimated from worse case patient positioning as a function of weight. The power monitor limits the RF power, which in turn limits the patient SAR to within controlled limits over time.

Pulse sequence SAR predictions (estimated SAR) are based on patient weight at the worst-case landmark. To minimize nuisance power monitor trips caused by patient-to-patient variability, pulse sequence predicted SAR is the mean plus 1.96 standard deviations (typically the normalized standard deviation is about 18% at the worst-case landmark). The expected worst-case nuisance trip rate is approximately 2.5%. If you experience a significant number of power trips above the 2.5% frequency, please consult your local field service representative. The power monitor measures actual power and limits SAR appropriately. The power measuring accuracy of the power monitor is about +/-12%.

Errors in patient weight do not result in excessive SAR. Low patient weight entries result in power monitor trips below the SAR limit. High patient weight entries result in fewer slices/images per unit time than would have been permissible.

SAR limits

The MR system's RF power monitor helps prevent excessive RF exposure due to equipment failure. Since the monitor protects the patient, it must be operational at all times, even when a scan is not in progress. If it detects an equipment

failure, it immediately disables the RF system. This system must be repaired or adjusted by qualified service personnel.

Table 2-44: SAR operating limits

System	Normal mode (W/kg)	First level (W/kg)	Second level (W/kg)
1.5T	Head = 3.2 Body = 2.0	Head = 3.2 Body = 4.0	Head > 3.2 Body > 4.0



Patient acceptance of High SAR scanning can be increased by giving the patient breaks to cool down, providing light clothing, and limiting room temperature to $18 \pm 3^\circ\text{C}$, and by maximizing air flow.

The following table provides a bound for maximum B1rms (in micro-tesla) for body transmit coils and head transmit coils at 1.5 T. Values are shown for the limits at 1.5 T for the head transmit coil and for the body transmit coil with the patient's umbilicus at isocenter.

Table 2-45: B1rms limit (μT)

Coil	1.5T
Body Coil Umbilicus Landmark	3.6
Body Coil Chin Landmark	N/A
Head Coil	7.2

CLINICAL HAZARDS

Clinical hazards introduction

Maintaining good patient contact and education can help reduce patient anxiety reactions and clinical scanning hazards in the MR environment and during procedures.



CAUTION

Continuous patient observation and contact are required in all modes of operation.

You need to be aware of the conditions and risks associated with the following:

- High-Risk Patients
- Scanning Hazards

CLINICAL HAZARDS

High risk patients

Several conditions are associated with high-risk patients, who may be at a greater risk of developing complications during an MR examination. Observe these warnings and be prepared to manage the needs of such patients during the examination.



WARNING

Patients with the following conditions are at the greatest risk of complications during MR scanning:

- Patients likely to develop seizure or have claustrophobic reactions.
- Greater than normal potential for cardiac arrest.
- Patients who are unconscious, heavily sedated, or confused and patients with whom no reliable communication can be maintained.



WARNING

Patient screening is required for patients who are going to be imaged on an MR scanner.

Some patients may experience feelings of fear or claustrophobia when undergoing an MR procedure. This could be related to the confining conditions of the magnet, the length of the examination, the acoustic noise, or the temperatures within the bore of the magnet. Discuss the procedure with the patient and be prepared to manage the needs of the patient during the examination.



CAUTION

The confining conditions of the MR system can precipitate claustrophobia in some patients. To prevent injuries due to panic, provide instructions and comfort the patient as needed to alleviate anxiety.



WARNING

Since direct observation from the operator's console can be partially obscured by the magnet enclosure, be sure to more closely monitor these types patients at all times to quickly identify and respond to medical emergencies. In some cases, emergency personnel should remain with the patient or be on standby alert to help prevent serious complications or death.

Related topics

[Contraindications for use](#)

[Clinical screening](#)

[Screen patients and personnel](#)

[Patient emergencies](#)

CLINICAL HAZARDS

Scanning hazards

During scan set-up, acquisition, and conclusion, be aware of the following scanning hazards:



WARNING

Do not use Projection Images for localization.



WARNING

Do not use 3D views only to perform voxel value, distance, angle, or area measurements. Always refer to 2D baseline views.



CAUTION

Measurements are more reliable when done on 2D views. Always check on the 2D reformatted views where exactly the points have been deposited.



CAUTION

Most multiple-channel receive only coils are designed to function best with adult patients. For smaller patients using the multiple-channel receive only coil the patient positioning is critical for optimal image quality. For small patients use appropriate non-conductive padding to place patient anatomy of interest in the center of the coil.

For example, the Head Neck Array coil is a multiple-channel receive only coil. Use appropriate non-conductive padding to place the patient's head in the center of the coil.



CAUTION

Make sure the patient connected IV lines, oxygen tubing, urinary catheters, and any other tubing and cables are long enough to allow full travel of the system and will not become entangled, pinched, or pulled.



CAUTION

Following the exam, your patient may need assistance when getting off the table. After lying in a prone position for a length of time, your patient may experience light-headedness upon sitting up.



CAUTION

If the magnet room door is open, the scan cannot be started. If the scan is already in process and the door is opened, the scan will pause. Close the door and press resume.

If the magnet room door is opened when attempting to start a scan, close the door and try again.

International regulations require the system to function in this manner.



CAUTION

Always base evaluations on all images in the data set and on the clinical history. Information from only a single image should not be used to evaluate a patient.

EQUIPMENT HAZARDS

Equipment hazards introduction

There are also general equipment concerns in the MR environment. Make sure you are familiar with your MR equipment and the accessory equipment manufacturer's guidelines and precautions. Specifically, you need to be aware of the hazards associated with the following MR equipment:

- Laser Alignment Lights
- Cables and Equipment Connections

Also observe the following general equipment hazards:



WARNING

The MR staff must consult the GE Pre-installation Manual before installing any furniture or making any changes in the scan room. Failing to do so may hinder the servicing of the scanner and present a dangerous safety hazard to the service engineer.



CAUTION

Using equipment that is damaged or has been compromised, can put the patient and/or operator at risk of injury.



CAUTION

The MR system applications run on equipment that includes one or more hard disk drives, which may hold medical data related to patients. In some countries, such equipment may be subject to regulations concerning the processing of personal data and the free circulation of such data. It is strongly recommended that access to patient files be protected from all persons not in medical attendance.



CAUTION

Any application of physiological monitoring and sensing devices to the patient shall be made under the clinical staffs direction and is the clinical staff's responsibility. Use only MR Safe and MR Conditional (used within its conditions for use) devices. Devices with conductors or ferromagnetic parts may introduce safety concerns. For medical devices that are labeled as MR Safe or MR Conditional consult the device manufacturer's documentation.

EQUIPMENT HAZARDS

Laser alignment lights

The MR systems use semiconductor laser alignment lights for patient land marking. This type of alignment light casts a thin red light on the patient for the purpose of positioning and land marking. The laser lights can cause eye injury. The figures below display the safety labels for laser products and are located near the laser alignment light. Labels such as these provide safety information about laser radiation.

Figure 2-35: Laser safety label



Figure 2-36: Laser safety label



Figure 2-37: Chinese laser safety label for other MR systems



Your system may have a slight variation of these labels.

The eyes must be protected from laser radiation. The patient needs to be instructed to close their eyes when landmarking and the laser light is turned on. Exposing eyes to the laser alignment lights may result in eye injury.



CAUTION

Exposing eyes to laser alignment lights may result in eye injury.

- Do not stare directly into the laser beam.
- Instruct patients to close their eyes to avoid eye exposure to the alignment light.
- Closely monitor all patients and prevent them from accidentally staring into the beam. Do not leave the laser beam on after you position the patient.

EQUIPMENT HAZARDS

Cables and equipment connections

Various equipment and accessories are used in the MR environment for specific types of examinations that include cables and require connections to the MR system or the patient.

Application of MR conditional physiological monitoring and sensing devices to the patient should be made under your organization's direction and is the sole responsibility of your organization.

To avoid trip hazards, you should install yellow and black trip hazard indicator covers over any cables routed on the ground of the equipment room.



WARNING

The following general warnings should be followed when using cables and accessory connection equipment:

- For medical devices that are labeled as MR Safe or MR Conditional consult the device manufacturer's documentation.
- Use only GE or GE-authorized accessory coils, cables, monitoring and gating equipment that is labeled as MR Safe or MR Conditional (used within its conditions for use). Failure to restrict the use of such equipment not labeled for MR applications may result in patient burns or other injuries.
- Use only accessories, coils, and cables that are in good condition. If you suspect that an accessory is not in good condition, discontinue its use and contact your GE Service Engineer.
- Auxiliary devices indicated as MR Conditional may still cause patient injuries if the conditions for use are not explicitly followed. Never use equipment unless it is accompanied by the use instructions.
- Remove unplugged surface coils or unused accessory devices from the magnet bore; a patient burn can result.
- RF can heat non-compatible surface coils and MR Unsafe or MR Conditional (used outside of its conditions for use) gating cables, damaged surface coils/gating cables, surface coils that are not properly plugged in, and improperly routed cables can cause burns.
- The use of cable-connected surface coils, photopulse sensor for peripheral gating (PG), or electrocardiogram (ECG) gating accessories for patient scanning can result in localized heating, leading to a burn or fire if proper scan preparation is not followed. The cables often extend into the high intensity region of the RF field and it is possible that induced electrical currents in the cables may cause arcing.
- Always bring the cable directly out of the magnet bore with no slack. Place cables under the cushion whenever possible to separate the cable from the patient.
- Keep the length of cable in the bore to a minimum. Avoid bending the cable 180° and route the cables out of the bore in the most direct way.
- Route cables through the center of the magnet bore. Place cables under the cushion whenever possible to separate the cable from the patient. Routing near the sides of the bore increases the likelihood of cable heating (from induced currents).
- Do not cross or loop cables. Arcing and patient burns could result.

In addition to the warnings above, there are specific warnings related to Cardiac Gating Equipment and Accessory Coils you need to understand to maintain a safe MR environment.

Cardiac gating equipment

Electrocardiogram (ECG) gating (triggering) may be performed in an MR environment to synchronize the MR scan acquisition with the patient's heart beat. Only MR Safe and MR Conditional (used within its conditions for use) electrodes and high-impedance leads should be used in the MR environment to ensure patient safety. For medical devices that are labeled as MR Safe or MR Conditional consult the device manufacturer's documentation. The ECG

triggering feature on the system should only be used for cardiac gating and must not be used for patient monitoring. It is important to use only GE recommended disposable electrodes and GE High Impedance ECG Cables.



WARNING

Observe the following warnings when using ECG or peripheral gating:

- The MR cardiac gating feature is intended for use solely in acquiring MR images using cardiac gating/triggering, not for physiological monitoring. The patient's condition may not be reflected, resulting in improper emergency treatment.
- Do not use monitoring equipment when conductors are in the bore and touching the patient; burns can result.
- Do not use leads with broken shields or exposed conductors. Only use accessories in good condition. If you suspect that an accessory is not in good condition, discontinue its use and contact your GE Service Engineer.
- Check to see that the cardiac or peripheral gating cable does not pass under or near the surface coil or surface coil cable.
- Check to see that only the peripheral gating sensor touches the patient. Keep cables from coming in contact with the patient.
- Do not use equipment that has not been specifically tested and approved for use in the environment of a MR system.
- Physiological monitoring and sensing devices should be used solely under the operators direction and it is their responsibility to ensure patient safety.



WARNING

Do not use waveforms for physiological monitoring. Patient condition may not be reflected, resulting in improper treatment.



WARNING

Do not use expired or dried electrodes. They do not properly conduct the signal, which can lead to image degradation, create intermittent triggering, and can cause burns to the patient.



WARNING

GE High Impedance ECG Cables shall only be used under the conditions described below.

Non-clinical testing has demonstrated this device is MR Conditional and can be scanned safely only under the following conditions:

- Static magnetic field: 1.5T or 3T only
- Maximum spatial gradient: 1650 Gauss/cm
- Maximum whole body average SAR: 4 W/kg
- The ECG lead signal may be visible in the images

Under the scan conditions defined above, GE High Impedance ECG Cables is expected to produce a maximum temperature rise of less than 4°C after 15 minutes of continuous scanning.

Accessory coils

It is important you familiarize yourself with the operating instructions for each accessory coil used in your MR environment. Follow the recommended guidelines and precautions by the manufacturer.



WARNING

Observe the following warnings when using surface coils:

- Do not use surface coils with exposed coils or damaged insulation. Skin contact with metal conductors can cause burns.
- Do not allow the surface coil cable to touch the patient; patient burns can result. Use a thermal resistant material or pad to keep the cable from touching the patient.
- When using the 1.5T Breast Coil, make sure the patient's back and arms do not touch the magnet bore. Use thermal resistant material or padding between the patient and the magnet to prevent burns that could be caused by patient contact with the interior of the magnet bore.

CLINICAL SCREENING

Clinical screening introduction

To avoid potential health hazards in the MR environment, personnel and patient screening procedures should be established in your imaging facility. Every person working or entering the magnet room or adjacent rooms with a magnetic field needs to be instructed about the dangers. This should include all MR workers, maintenance, service, and cleaning personnel, as well as the local fire station team.

All MR workers need careful assessment prior to engaging in operation of the MR system. Additionally, all patients undergoing the MR examination need careful assessment prior to the procedure. Screening helps identify anything that might create a health risk or interfere with MR imaging. It also assists you in determining if the patient has any specific needs or limitations. Additionally, if another person accompanies the patient undergoing the MR examination, they should be screened and managed in the same manner as the patient. The aim of screening is to safely obtain high-quality images so an accurate diagnosis can be made. Maintaining a controlled and safe environment can be achieved by careful questioning patients, visitors/family members and all personnel.



Screen each patient thoroughly for pertinent medical history and conditions that contraindicate scanning before initializing an examination. If proper scanning can not be performed, postpone MR examinations until the screening can be completed.

A documented screening procedure should be followed by a review of the completed form and a verbal conversation to verify the form information and provide the patient time to express his or her questions or concerns. The review and discussion should be conducted by MR safety-trained personnel to ensure there is no miscommunication about the MR safety issues.

A written screening form must be completed each time a patient is to have an MR examination. Even if the patient undergoing previous MR examinations and/or has completed the screening form previously, does not assure the patient another safe examination.

Related topics

[Contraindications for use](#)

[High risk patient](#)

[Screen patients and personnel](#)

[Patient emergencies](#)

CLINICAL SCREENING

Screening form

A comprehensive, printed screening form should be used to assess the patient and document the information. The form can be customized for your MR suite and might consist of three sections:

- Section 1: General Information
- Section 2: Hazardous Items Checklist
- Section 3: Magnet Room Pre-Entry Checklist

**WARNING**

Patient screening is required for patients who are going to be imaged on an MR scanner.

General information

Section 1 of a patient screening form contains general information concerning patient demographics and the patient's medical and work history. Relevant patient-related information is valuable for obtaining current medical conditions and information on prior diagnostic studies that may be helpful in evaluating the patient's state.

Determining the patient's work history is important for those who work in machine shops or similar environments. These individuals may have small metal slivers or fragments of steel embedded in their eyes. If metal fragments are suspected, the patient should receive an eye examination to detect and remove hazardous materials before scanning.

Section 1 of a screening form also contains questions needed to help identify high-risk patients, i.e., those with conditions posing higher risk of complications during the MR exam. Questions explore risks due only to the condition of the patient (e.g. elevated risk of seizure or cardiac arrest) and also those due to the elevated SAR possible when operating in First Level Controlled Mode (e.g. for patients with compromised thermoregulatory capacity.)



MR workers may be at risk if previous occupational, recreational or other life experiences have resulted in the accidental implantation of metallic substances, such as slivers or fragments. Page 2 of the patient screening form should be completed by each MR worker to ensure the magnetic field does not pose a hazard to their well-being.

This section also contains questions for female patients concerning matters that may affect the MR examination. Pregnant patients must be identified before they are permitted to undergo an MR procedure. A physician should carefully compare and discuss the risks and benefits of the MR examination versus alternative procedures before scanning to control risk to the patient.

Hazardous items checklist

The Hazardous Items Checklist, in section 2 of a patient screening form, is valuable in identifying various implants and devices that may be hazardous to the patient undergoing the MR examination. Items that may produce image artifacts, can also be detected through this section of the screening process.

Some patients, including those suffering from forms of dementia, may not be aware of having a pacemaker. On such patients, palpate the upper torso and abdomen to make sure no pacemaker is present. Pacemakers may be implanted in any of several locations in the chest and abdomen. Pacemaker lead wires are sometimes left in place after removal of the pacing mechanism. The wires can induce current, producing heat during the MR procedure. Therefore, checking for lead wires is also important.

The best way to ensure a metal-free environment is to have patients change into patient examination attire. The checklist also includes items the patient may externally possess. Do not limit your inspection to only ferrous objects alone. Even non-ferrous items, such as gold jewelry, can heat during a scan and burn a patient. Make sure the patient

removes all of these objects. In addition, be sure to check small children for safety pins and snaps on diapers or undershirts.

Section 2 of a form also contains an anatomical figure of the human body for patients to mark the location of objects they have inside or on their body. This information can be useful in determining the approximate area of objects that may be hazardous or produce artifacts.

Magnet room pre-entry checklist

The last section of a screening form lists metal or magnetic-sensitive items with which the patient can not enter the magnet room. Ensure the patient removes the checked items prior to magnet room entry. Also obtain signatures to document the person who completed and reviewed the screening form.

CLINICAL SCREENING

MR compatibility

Review the following information related to spatial magnetic field data:

- [Contraindications for use](#)
- [Spatial magnetic field data](#)

A device is labeled as MR Conditional if it has been demonstrated to pose no known hazards in a specified MR environment with specified conditions of use. Field conditions that define the MR environment include static magnetic field strength, static spatial gradient, time rate of change of the magnetic field (dB/dt), RF fields, specific absorption rate (SAR), and coil to be used. Additional conditions, including specific configurations of the item (e.g., the routing of leads used for a neurostimulation system), may be required.



WARNING

The attractive force of the magnetic field of the MR system can cause ferrous objects to become projectiles, which can cause serious injury. Post the Security Zone warning sign on the entrance to the magnet room and keep all hazardous objects out of the magnet room.



WARNING

GE shall not be responsible for assessing the proper function of any device. The user of the device must consult the device manufacturer to ensure the device is MR Safe or MR Conditional. Then the user must ensure the MR Conditions are met. Finally, the user must determine what is appropriate.



DANGER

Devices compatible at one field strength, such as 1.5T, may not be compatible at another field strength, such as 3.0T. Prior to patient scanning, confirm with the device manufacturer that the device is compatible at your field strength.

Patient emergencies

You must become very familiar with the location and proper use of certain emergency buttons and releases should an emergency occur in the MR environment. Advanced planning and being accustomed to your site's procedures and surroundings are necessary to ensure a safe environment.

Before you begin any scanning procedure, explain the use of the Patient Alert System to your patient. Make sure he or she understands its purpose and use. Remember that implants, pacemakers, and ferromagnetic life-support systems cannot be brought into the magnet room.*

Be sure to closely monitor patients with a increased potential for cardiac arrest or claustrophobia, or patients who are unconscious or extremely ill. Always maintain visual contact with the patient. Be familiar with your site's predetermined location outside the magnet room where you can transfer patients if it becomes necessary for emergency personnel to intervene.

The figure below displays a general layout of an MR magnet room. You should always be able to maintain visual contact with your patient from the operator's console.

*In general, patients with conductive (e.g. metallic) implants are contraindicated for MR scans. Some implantable devices have been labeled as MR Conditional under certain operating conditions. Only use quadrature transmit for MR Conditional devices. MR Safe implants will have the MR Safe symbol in their implant documentation.

When evaluating whether to proceed with MR scanning on patients with such implants, consult the implantable device's labeling.

Figure 2-38: Magnet room layout

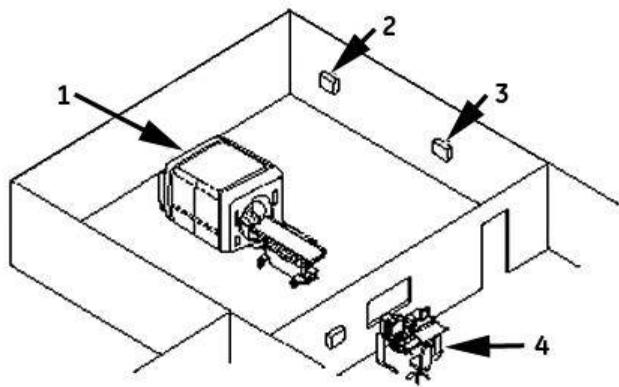


Table 2-46: Magnet room layout image legend

#	Description
1	Magnet and magnet enclosure
2	Oxygen monitor remote sensor (optional)
3	Emergency magnet rundown
4	Operator's console

Emergency medical procedures

Your site should define and implement specific procedures to follow in case of a medical emergency. These procedures should take account of the existence of the magnetic field. For example, they should instruct how to use the **Table Transport Emergency Release** to remove a patient rapidly from the magnet's influence. Other product features useful in an emergency are described on the pages following.

PATIENT EMERGENCIES

Patient alert system

Your MR system has a Patient Alert system that enables the patient to alert you at the console by squeezing a bulb.

Figure 2-39: Patient alert system

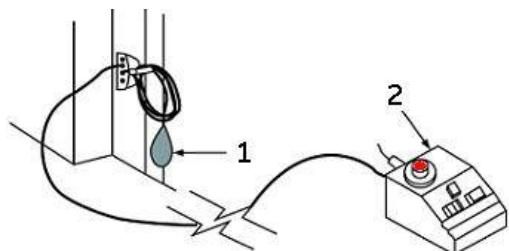


Table 2-47: Patient alert system image legend

#	Description
1	Patient alert bulb
2	Control box

Squeezing the Patient Alert bulb causes the control box to light up and emit an audible signal. A switch on the control box allows you to set the signal for intermittent or constant light and sound.

Your MR system also has an intercom system that enables you to maintain verbal contact with the patient throughout the examination.



CAUTION

Provide all patients with the Patient Alert bulb. This can be especially important for procedures that require the concerted attention of the technologist/operator at the MR or Advantage Workstation (AW) operator console, e.g., fMRI sequences.



CAUTION

THIS PRODUCT CONTAINS NATURAL RUBBER LATEX WHICH MAY CAUSE ALLERGIC REACTIONS.

The black Patient Alert bulb and the Respiratory bellows contain latex. If the patient is aware of a sensitivity/allergy to latex or if the patient is unsure and concerned about the possibility of an allergic reaction, cover the bulb or the bellows with a towel, cloth, or plastic bag to shield the patient from the latex.

The gray Patient Alert bulb is made of PVC and does not contain natural rubber latex.

PATIENT EMERGENCIES

Emergency stop

The **Emergency Stop** button is located on the keyboard and on both the right and left sides of the magnet enclosure. This function cuts off electrical power from equipment located in the magnet room that may present a hazard to the patient in an emergency situation.

You can press the **Emergency Stop** button to stop a scan in a patient emergency situation. To quickly recover from an Emergency Stop situation, you can press the **Reset** button. You should not be afraid to press the **Emergency Stop** button because it may shut the system down for an extended length of time. This is not required to shut down the magnet coldhead.

Figure 2-40: Emergency Stop buttons.



The **Emergency Stop** button disables the following systems:

- RF
- Gradient power supply
- Magnet room unit
- Table and patient support subsystem



WARNING

The Emergency Stop button does not remove the magnetic field, turn off the computer cabinets, operator's console, or camera.

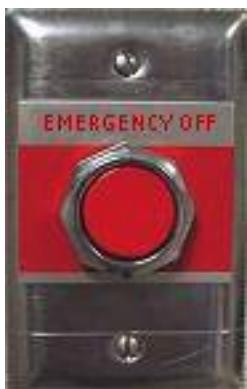
PATIENT EMERGENCIES

Emergency off

The **Emergency Off** button is located on the wall next to all computer equipment and next to the MR magnet room doors. It removes ALL electrical power from ALL components of the system, including any power sources from uninterrupted power supply (UPS) devices.

The **Emergency Off** button not only stops a scan in a patient emergency, but also in the event of a serious equipment fault or hazards such as fire/water in the vicinity of the MR equipment. The entire MR system is to be turned OFF except for the static magnetic field and the magnet rundown unit used to shut down the magnetic field.

Figure 2-41: Emergency Off button



Use this button only in a major emergency in the computer or MR magnet room. For example, use this button when you notice fire, sparks, or loud noises not associated with normal operation of the system.



To restore power after emergency stop, the main circuit breaker must be reset before rebooting the system. Always contact a service engineer before restoring power.



WARNING

The Emergency Off button does not turn off the magnetic field. To avoid personal injury or equipment damage, do not bring any ferromagnetic equipment into the magnet room. Assume that equipment is magnetic unless it is clearly labeled otherwise.

PATIENT EMERGENCIES

PDU main breaker

The PDU Main Breaker turns off power to system components other than the Magnet Rundown Unit, cryogen compressor, scan room lights, chillers and magnet cryogen monitor. Typically, service uses this power off switch and the MR customer does not.

Figure 2-42: PDU power off button



Table 2-48: Image legend

#	Description
1	ISC cabinet
2	Main Breaker in On position, fully horizontal.

PATIENT EMERGENCIES

Magnet rundown concept

The Magnet Rundown operates as follows and is located inside the magnet room:

- Rapid reduction of the magnetic field in about two minutes
- Boil-off of cryogens, accompanied by loud hissing sound
- Several days of down time to replace the cryogens

Figure 2-43: Magnet rundown unit



WARNING

The Magnet Rundown should only be used to free someone pinned to the magnet or to remove a large ferromagnetic object captured by the magnetic field when injury to persons is imminent. A controlled magnet rundown should be performed by a GE Service Engineer in non-emergency situations.

Related topics

[Magnet Rundown Unit test procedure](#)

[Primary magnet rundown procedure](#)

[Secondary rundown procedure](#)

[Quench with vent failure procedure](#)

PATIENT EMERGENCIES

Table emergency release

In an emergency, the patient cradle can be manually pulled out of the magnet. Grasp the handle and squeeze the lever to pull the cradle to the end of the table. The figure below displays the cradle release handle on the patient table.

Figure 2-44: Cradle release handle



The table can be lowered and raised with foot pedals in normal conditions. However, when the manual cradle release lever is used, the foot pedals no longer work to raise and lower the table because the cradle driving mechanism is retained in the magnet.

Figure 2-45: Table pedals



Image legend

#	Description
1	Up pedal
2	Down pedal

! **IMPORTANT!** The patient table of the SIGNA Voyager system is permanently fixed to the magnet system. Always have a non-ferrous gurney placed outside the magnet room for emergency patient transportation.

! **IMPORTANT!** Do not use the **Magnet control buttons** after the table emergency release procedure is completed. Wait until the table is re-engaged to the system before you use the Magnet control buttons.

Re-engage cradle after table emergency release

Use these steps to re-engage the cradle. It is required for the normal operation after the cradle is released.

1. Grasp the handle and squeeze the lever to unlock the cradle from the home position.
2. Slowly push the cradle toward the magnet until the cradle attaches to the cradle drive.
 - Push the cradle a little harder until it the cradle engages with the cradle drive.
3. Use the **Magnet control buttons** to make sure the cradle moves in and out.

ADDITIONAL WARNINGS AND CAUTIONS

Scan and Display introduction

This section includes additional warnings and cautions for the following areas:

Scan and equipment

- CD/DVD handling
- Dielectric pads
- IDEAL Imaging Option
- IV pole
- MR Conditional
- MR-Touch
- Multi-echo FGRE/FSPGR
- Patient orientation
- Patient transfer
- Patient weight
- Post-contrast scans
- Prescan
- PA coil

Display or post processing

- Add/Subtract images
- Applications
 - VIBRANT Flex and LAVA Flex
- Imaging Option
 - IDEAL
- ReadyView
- Volume Viewer
 - Annotation
 - Filter Floaters
 - Measurements
 - Reformat
 - Threshold

ADDITIONAL WARNINGS AND CAUTIONS

Scan

This section contains additional scan warnings and cautions.

AutoPaste



WARNING

Do not use Pasting post process application with images that demonstrate metal implants.

BrainWave paradigm



WARNING

When creating paradigms, if you do not create a unique paradigm number, paradigm string, and paradigm name/filename, the Brainwave Hardware may fail to communicate with BrainWaveRT. After editing paradigms, always be sure BrainWave communication with the clinical software is intact.

CD/DVD handling



CAUTION

To avoid image loss, never touch the recording surface of a recordable CD (CD-R). Handle the disk only by the outer edge or central hole. Do not place it face down on a hard surface. Fingerprints or scratches will make the disk unusable.

Filters



CAUTION

Images filtered for uniformity with PURE may contain residual signal variation arising from sources other than tissue contrast. Such variation can be more apparent in PURE filtered images than in unfiltered images, because default window width values display more contrast after PURE. Please refer to [Filter considerations](#) for more detail.



CAUTION

Images filtered for uniformity with SCIC or SCENIC may contain hyper- or hypo-intense signal areas that are not apparent on unfiltered images. SCIC filtering is derived from the image itself, and the results can therefore be affected by tissue shape and contrast.

Flex Imaging Option



CAUTION

Verify that the FOV includes all anatomy. If not, phase wrap will cause water/fat signal to swap.



CAUTION

Images labeled as water may include signal from fatty tissue, and images labeled as fat may include signal from water. This error may occur in regions of high magnetic field variation, in spatially isolated tissue, due to patient or tissue motion, due to phase wrap artifacts, due to similar water and fat intensity in T2-weighted Flex scans, due to TE values beyond recommended limits, and/or in images with low signal-to-noise ratios. The presence of fat tissue in images labeled as water, or vice versa, may occur within single images or throughout an entire stack of slices. By default, both sets of images (labeled fat and labeled water) will be reconstructed and inserted into the database for review. Proper calibration and center frequency selection will reduce the occurrence of this error. Complete elimination of this error may not be possible and thus interpretation of MR images must be completed by trained personnel.

IDEAL Imaging Option



WARNING

Computed R2* values are affected by the presence of contrast agents in tissue, and results may be incorrect. Do not utilize post-contrast images for generating R2* maps. Affected applications include multi-echo FGRE/FSPGR acquisitions such as IDEAL IQ, and any post process applications that create R2 star maps such as StarMap and READY View R2 Star.



CAUTION

Make sure that the FOV includes all anatomy. Phase wrap will cause water/fat signal swap.

IV pole



Pinch Point CAUTION

Do not move the patient into the magnet with the MR table's IV pole in use. To avoid any pinch points from the MR table's IV pole, remove the IV pole from the table, store it, and use a non-ferrous free standing IV pole.

MR Conditional



WARNING

Susceptibility artifacts, such as those related to MR Conditional metal implants, will result in incorrect 3D Geometry Correction. Please carefully verify images.



WARNING

If the calibration scan covers a region containing MR Conditional metal implants, the calibration images are expected to have distortion and signal void artifacts. Therefore, PURE and ASSET images that have MR Conditional metal present should not be used for post processing.



WARNING

READY View fusion does not function reliably if MR Conditional metal implants are present and a reference image other than the original image is used. READY View Fusion should not be applied on series if the image area includes MR Conditional metal implants. Strong B0 and B1 distortion caused by MR Conditional metal implants will cause image distortion and signal void in images. Reference images may have different level of distortion (e.g., MAVRIC SL versus non-MAVRIC SL) with functional series, and mis-registration will occur.



WARNING

Due to the strong magnetic field disturbance in a region containing metal, do not use the RF Drive Mode parameter: Optimized.



WARNING

Do not use the PURE¹ image filter when acquiring scans in the vicinity of metallic implants or devices. Signal distortion effects are not predictable and will result in incorrect images.



WARNING

The tests commonly employed to determine MR Conditional implant heating safety (standard, ASTM F2182, ASTM.org), require quadrature excitation. Heating results for non-quadrature excitation (such as parallel transmit, MultiDrive, or elliptical drive) are unknown.

For patients with MR Conditional implants or devices, applying Preset or Optimized RF Drive Modes may violate the MR Conditional specifications.

¹Phased array UnifoRmity Enhancement



CAUTION

Safe scanning of patients with MR Conditional devices or implants may be complex. Health care professionals that scan patients with MR Conditional devices or implants should consult the implant or device manufacturer for instructions with respect to safety guidelines.

MR-Touch



CAUTION

When setting up an MR-Touch exam, to avoid entanglement of the Patient Driver tube with the patient's neck, always orient the driver so that the tube is routed towards the patient's feet.



CAUTION

MR Touch has only been evaluated for use on adults. There is insufficient information to establish the safety and effectiveness of MR Touch for use on pediatric patients.



WARNING

Never place the active acoustic driver in the magnet scan room.



WARNING

To avoid tripping over the tubing, route the tubing on the side of the table that is opposite the scan room door.



Coil CAUTION

There is a potential hazard of crossing or looping coil cables that may exist, which will or can cause minor personal injury or property damage if the instructions are ignored.

MAGiC



WARNING

MAGiC artifacts may simulate pathology, which has the potential to lead to misinterpretation. Exercise caution when reviewing CSF spaces, its adjacent tissues and the posterior fossa, particularly for cases involving subtle pathology.

MAGiC creates novel artifacts that are unique to synthetic images. Specifically, hyper-intensity or CSF suppression artifacts may be present on MAGiC T2 FLAIR. Hyper-intense signal may display as an artefactual edge enhancement between CSF and adjacent tissue. CSF suppression artifacts may appear as an

unexpected bright signal. If in doubt, it is advisable to acquire a conventional 2D or 3D T2 FLAIR series or a MAGiC series in a different orientation for cross-sequence comparison.

Presentation of traditional artifacts (such as motion) may not appear the same in conventional imaging due to signal sampling differences. For example, the appearance, frequency, and location of artifacts may be unconventional. Artifacts from patient movement, (e.g., due to sneezing, tremor, etc.) will propagate through all contrasts. Artifacts from physiological motion, such as arterial and CSF pulsations, ghosting, and any other interference during MAGiC acquisition, will impact all synthetic contrasts. Heightened attention to proper patient stabilization or immobilization is advised. Conventional troubleshooting via comparison to other sequences may not be appropriate.

Figure 2-46 illustrates an example of differences between a MAGiC T2 FLAIR image compared with a conventional T2 FLAIR.

Figure 2-46: Conventional T2FLAIR image head versus a MAGiC T2W FLAIR image

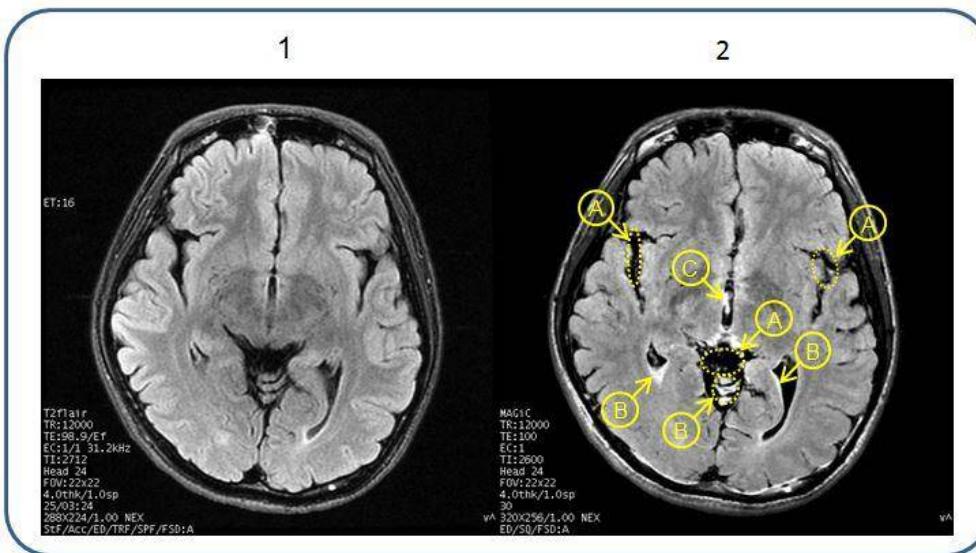


Table 2-49: Image legend

#	Description
1	Conventional T2 FLAIR
2	MAGiC T2W FLAIR A = Hyperintense Vessel Sign (HVS) B = High signal intensity at the edge of Cerebral Spinal Fluid (CSF) C = CSF

! It may occur that a given MAGiC series does not display anatomy in exactly the same way as the conventional series. It is for this reason that the user is advised to consider all possible contrast weightings generated by MAGiC when performing image evaluation.

Multi-echo FGRE/FSPGR



CAUTION

Measurement of relaxation time by Multi-Echo FGRE/FSPGR is very sensitive to the result of gradient shim (Auto-Shim) in the slice direction. Auto-Shim with shim-volume setting is recommended.



CAUTION

It is possible that READY View results of the calculated T2* and R2* values have an error with acquisitions that have a large slice number value.

Navigator



CAUTION

Motion compensation accuracy may be affected by the presence of contrast agents, resulting in decreased image quality.

Patient orientation



WARNING

Ensure that the Patient Position selection matches the actual patient orientation. Making a selection that does not match the patient's actual position results in incorrectly annotated and/or rotated images, possibly resulting in improper medical treatment.

Patient transfer



CAUTION

The arm boards are not to be used as a seat or shelf. The arm board is not designed as a weight bearing device and there is a possibility for failure and the patient or load falling.



CAUTION

Following the exam, your patient may need assistance when getting off the table. After lying in a prone position for a length of time, your patient may experience lightheadedness upon sitting up.

Patient weight



CAUTION

The patient's weight determines the SAR. Entering a weight more than the actual patient weight could potentially harm the patient. Patient weight is not pulled with the other patient information from the ConnectPro worklist. You must manually enter the weight.

Post-contrast scans



WARNING

With post-contrast imaging using inversion-prepared pulse sequences, there is a potential that lesion conspicuity may be reduced and some lesions may not be apparent in comparison to T1-weighted spin-echo imaging.

Prescan



CAUTION

Auto prescan is used to calibrate the flip angle and to accurately estimate SAR levels. Do not manually adjust the transmit gain for GRE, SPGR, FGRE, FSPGR and FIESTA scans since excessive SAR may result if the TG is set too high. Using Auto prescan rather than manual prescan insures that accurate SAR limits are used.

Radiation oncology table tops



Pinch Point CAUTION

Do not use the arm boards at a height above horizontal. Due to the increased width needed for the flat top and lok-bar, there is a possibility for collision and a pinch hazard if the arm boards are used above the horizontal plane.



CAUTION

Do not use the coil positioning braces for a hand hold when getting the patient on the table, or as a handle for moving the table around. This feature is not designed as a weight bearing device, and could fall or break.



Pinch Point CAUTION

When moving the Express GEM cradle in and out of the magnet bore, keep the patient's and your hands away from pinch points. Place the patient's hands on the top of the thighs or above the head to avoid pinch points during positioning.

Synthetic DWI

Synthetic DWI is commercially known as MAGiC DWI.



WARNING

Before you acquire a MAGiC DWI scan review the following:

- MAGiC DWI images may show different contrast from images acquired directly with DWI due to different TE, Intra-Voxel Incoherent Motion effect (in liver), and in the brain, restricted diffusion effect.
- MAGiC DWI may show artifacts or incorrect image calculations in moving organs.
- MAGiC DWI may show artifacts due to diffusion distortion. Thus, to minimize the artifact, it is recommended to select Real Time Field Adjustment scan parameter from the Details tab .
- MAGiC DWI should not be used in ADC calculation in READY View, FuncTool, or any other 3rd party tools.
- Diagnosis should not be made by only reviewing the synthesized images.

GEM coil



CAUTION

Never use an incompatible legacy coil with the GEM table. The curved bottom of the coil placed on the flat surface of the GEM table can lead to patient injury.



CAUTION

When using the AA with the PVA in a feet-first orientation, be sure to run the AA cable over the center housing of the PVA, pull it taut, and secure it to the PVA clip to prevent the AA cable from becoming warm.



CAUTION

The AA coil may not fit in the bore when used on patients with large torsos. To avoid injuring the patient or damaging the coil, watch carefully as the table moves into the bore. Stop advancing the table if the AA coil comes into contact with the top of the bore.



CAUTION

Do not carry any of the coil components by the cable. Damage to the coil component may occur. The coil may not work if damaged.



CAUTION

The coil contains sensitive electronic components that may become damaged. Do not spray or pour cleaning solution directly onto the coil. Do not submerge the coil in any solution. Under no circumstances should the

coil be placed into any type of sterilizer.

**CAUTION**

Do not place a coil directly on the table surface over the GEM PA area. Be certain that the pads are on the table before using a coil. For example, only place the wrist coil on the table surface with the pads in place. Placing a coil directly on the PA area of the GEM table results in coil-to-coil contact, which can result in poor image quality.

**CAUTION**

RF can cause localized anterior coil warming when it is positioned close to the top of the bore. Place non-conductive padding between the coil and the bore in order to keep the coil positioned away from the bore wall.

**CAUTION**

Ensure that no hair or fabric is caught between the components. Failure to comply may cause artifacts and decreased image quality.

**CAUTION**

Do not pick up or carry the Head Component by the mirror attachment. To avoid damaging the coil, pick up and carry the Head Component using two hands on the bottom of the coil.

**CAUTION**

Users should place a service call any time the coil is dropped or mishandled. A GE Service Representative should inspect the coil after it has been dropped or mishandled to ensure it is safe to use.

**CAUTION**

Looped cables may cause RF coupling and degrade the scan performance of the coil. Do not cross or loop cables.

**Pinch Point CAUTION**

To avoid injuring the patient or damaging the coil, watch carefully for pinch points as the table moves into the bore. Stop advancing the table if the patient or any part of the coil comes into contact with the bore.



WARNING

Do not use accessories (e.g. pads or straps) that have not been specifically tested and approved for use in the MR environment (i.e., MR Safe or MR Conditional). Use of MR Unsafe or MR Conditional (used outside of its conditions for use) accessories may result in patient burns or injuries or image degradation. Even auxiliary devices labeled as MR Conditional are capable of causing injury if the manufacturer's conditions are not followed.



WARNING

Electric shock may occur if the coil is attached to the system during cleaning or when it is still wet. Detach coil connector from the scanner before attempting to clean the coil. Do not touch connectors with bare fingers. Never press sharp objects against connector surface. Do not reattach connector after cleaning until the coil has dried completely.



WARNING

Electric shock hazard. No user serviceable parts. Refer service to qualified service personnel.



WARNING

All coil components must be plugged in when they are in the scanner. This includes coil components that should be plugged into the system and coil components that should be plugged into another coil component. Leaving components unplugged can damage the coil, or cause harm to the patient.



WARNING

Do not allow the coil cables to touch the patient. Use a thermal resistant material or pad to keep the cable from touching the patient. Failure to comply may cause patient burns.



WARNING

Prior to patient placement in the coil, assure that any breached or compromised patient skin surfaces that come in contact with the coil have been adequately bandaged or covered.

ADDITIONAL WARNINGS AND CAUTIONS

Display

This section contains additional warnings and cautions related to image display and post processing.

AutoPaste



WARNING

Do not use Pasting post process application with images that demonstrate metal implants.

Add/Subtract images



CAUTION

Since "COMB" series contain images resulting from a combination of images from different locations in the patient's body, the absolute anatomical coordinates accompanying these series (shown both in the Browser and on the displayed images) are not accurate. Only relative geometric measurements (i.e. distance, angle, or area) are accurate.

Applications

VIBRANT, VIBRANT-Flex and LAVA-Flex



CAUTION

Images labeled as water may include signal from fatty tissue, and images labeled as fat may include signal from water. This error may occur in regions of high magnetic field variation, in spatially isolated tissue, due to patient or tissue motion, due to phase wrap artifacts, due to similar water and fat intensity in T2-weighted Flex scans, due to TE values beyond recommended limits, and/or in images with low signal-to-noise ratios. The presence of fat tissue in images labeled as water, or vice versa, may occur within single images or throughout an entire stack of slices. By default, both sets of images (labeled fat and labeled water) will be reconstructed and inserted into the database for review. Proper calibration and center frequency selection will reduce the occurrence of this error. Complete elimination of this error may not be possible and thus interpretation of MR images must be completed by trained personnel.



WARNING

It is possible that a spatial distortion can be seen on 3D data sets, especially in the lateral-most VIBRANT images. The distortion can be demonstrated in sagittal versus axial data sets. There is a potential risk for lesion localization misregistration during biopsy procedures, which could result in a re-biopsy of the patient.

Imaging Option

IDEAL



CAUTION

Images labeled as water may include signal from fatty tissue, and images labeled as fat may include signal from water. This error may occur in regions of high magnetic field variation, in spatially isolated tissue, due to patient or tissue motion, due to phase wrap artifacts, and/or in images with low signal-to-noise ratios. The presence of fat tissue in images labeled as water, or vice versa, may occur within single images or throughout an entire stack of slices. By default, both sets of images (labeled fat and labeled water) will be reconstructed and inserted into the database for review. Proper calibration and center frequency selection will reduce the occurrence of this error. Complete elimination of this error may not be possible and thus interpretation of MR images must be completed by trained personnel.

READY View



Care should be taken when using quantitative measures of cerebral blood flow from 3DASL in clinical populations. Differences in CBF values may be seen when the same subject is scanned on different systems and coils. Diagnostic and treatment decisions should not be based solely on these absolute values.



WARNING

Do not use 3D views only to perform voxel value, distance, angle, or area measurements. Always refer to 2D baseline views.



Diffusion Tensor images attempt to characterize behavior of water molecules in imaged tissue. Therefore, fiber tracking representation actually displays algorithmically predicted water molecule direction. These displays may be only representative of the actual white matter anatomy. A trained neuro radiologist is required to make the association between the rendered tract display and the actual patient's anatomy.



CAUTION

Failure to place the ROI as described will negatively impact the output measurement.



CAUTION

Always click **Compute** again to re-compute the functional maps after making changes to the input parameters. The changes are not taken into account automatically.



CAUTION

It is possible that READY View results of the calculated T2* and R2* values have an error with acquisitions that have a large slice number value.

**WARNING**

Under no circumstances should the pixel value from saved functional maps be used by any software applications that rely on Hounsfield values. This applies, in particular, to dose computation software applications.

Volume Viewer

Annotation

**CAUTION**

When saving images for diagnostic purposes, always make sure the patient name is displayed on all views.

Filter floaters

**WARNING**

Floater filtering removes all 3D objects from the displayed 3D volume that have a size equal to or smaller than the selected filter size. Before applying a filter, make sure that the selected filter size will not result in removing pathologies or other essential anatomical structures.

Measurements

**CAUTION**

Measurements are more reliable when done on 2D views. Always check on the 2D reformatted views where exactly the points have been deposited.

**CAUTION**

Post processing results may be affected by the presence of MR Conditional implants. Consider the following related to post-processing MAVRIC SL images on your MR¹, PACS² or AW³ systems:

If an image includes susceptibility artifact, such as from MR Conditional metal implants, measurements made on the image may be incorrect due to distortion of actual physical locations.

¹Magnetic Resonance. The absorption or emission of electromagnetic energy by nuclei in a static magnetic field after excitation by a suitable RF pulse.

²Picture Archiving Communications System

³Advantage Workstation



CAUTION

Distance, angle, and area measurements are valid only if all trace segments are longer than the inter-slice distance.

Reformat



WARNING

A curved VOI can introduce distortion in the shape of objects. To prevent misinterpretation of the shape of an object, always verify the cursor position by correlation with the baseline and reformatted views.

Threshold



WARNING

The use of thresholding for the building of the 3D model excludes all voxel values outside the selected range from the 3D model. Before applying the threshold(s), make sure that the selected threshold settings will not result in removing pathologies or other essential anatomical structures from the 3D model.

Summary table



WARNING

While ROI statistics are calculated on displayed volumes in volume viewer (segmented or not), the summary table only displays statistics calculated from original volumes (non-segmented).

SYSTEM MAINTENANCE

System maintenance introduction

Maintaining a controlled environment also involves routine preventative maintenance checks by the service engineer and site personnel. Careful planning and diligent upkeep of an MR facility can provide a safe environment for both patients and employees. Your system requires maintenance at specific service intervals in which many of the maintenance checks should be performed by a qualified service engineer. There are several checks you can perform. Be aware of required maintenance and the personnel responsible for meeting each requirement.

After-sale service of MR systems under GE warranty or service-contract shall be done by GE engineers or GE-assigned qualified people.

GE makes available, on request, such information as circuit diagrams and component lists to assist your technical personnel in the repair of equipment classified by GE as repairable. Where there are no user serviceable parts, adhere to this warning and refer service to qualified service personnel.

**WARNING**

Electric shock hazard. No user serviceable parts. Refer service to qualified service personnel.

**WARNING**

When installing and maintaining the products, follow lockout and tagout procedures, and adhere to MR safety requirements, high voltage and radio frequency prevention requirements. If these instructions are ignored, damage to the equipment and patient/personnel injury can result.

SYSTEM, COIL AND ACCESSORY MAINTENANCE

General cleaning and disinfection

Cleaning and disinfection of patient contact surfaces is recommended following each use.

Non-patient contact surface cleaning and disinfection should be conducted following internal housekeeping procedures unless otherwise indicated in the following instructions.



Inspect pads for peeling or cracking. To prevent a biohazard, replace cracked or peeling pads before using.

Cleaning and disinfection recommendations for the MR system, Coils and most Accessories

- **Clean** with commercially available wipes that contain 0.525% minimum sodium hypochlorite as the only active ingredient. If commercially available wipes are not available, then follow one of these instructions.
 - Clean with a lint free cloth saturated with a 1:10 dilution of commonly available bleach containing a recommended minimum sodium hypochlorite of 5.25%. Dilute the bleach with tap water.
 - Use a lint free cloth that has been saturated with a 70% isopropyl alcohol solution made from 100% isopropyl alcohol and 30% tap water.
 - Use a lint free cloth with a commercially prepared solution of 70% concentration isopropyl alcohol.
 - Regardless of the method used, inspect to ensure visual cleanliness prior to disinfection. Repeat the cleaning process until all visible soil has been removed.
- **Disinfect** with commercially available wipes that contain 0.525% minimum sodium hypochlorite as the only active ingredient following the manufacturer's instructions. If commercially available wipes are not available, then follow these instructions.
 - Disinfect with a lint free cloth, a 1:10 dilution of commonly available bleach containing a recommended minimum sodium hypochlorite of 5.25%. Dilute the bleach with tap water.
 - For general disinfection or disinfection following cleaning of blood and/or body fluids, 5 minutes contact time is recommended.
 - Refer to internal procedures or refer to publications such as "CDC Guideline for Disinfection and Sterilization in Healthcare Facilities," 2008 or latest revision, for guidance. Disinfectant may need to be reapplied to ensure surfaces remain wet for the duration of the selected contact time.
- After you have cleaned and disinfected with bleach (sodium hypochlorite), wipe surfaces with a disposable lint free wipe that has been dampened with purified water to remove any remaining bleach residue.



CAUTION

To avoid possible damage to equipment, do not use solutions containing amines, strong alkalis, quaternary ammonium chloride compounds, esters, iodine, aromatic or chlorinated hydrocarbons, or ketones. Do not use autoclaves or the industrial washers and dryers found in most hospitals or professional laundry services.



WARNING

Electric shock may occur if the coil is attached to the system during cleaning or when it is still wet. Detach coil connector from the scanner before attempting to clean the coil. Do not touch connectors with bare fingers. Never press sharp objects against connector surface. Do not reattach connector after cleaning until the coil has dried completely.



CAUTION

The coil contains sensitive electronic components that may become damaged. Do not spray or pour cleaning solution directly onto the coil. Do not submerge the coil in any solution. Under no circumstances should the coil be placed into any type of sterilizer.

SYSTEM MAINTENANCE

Exhaust fan

The magnet (RF-shielded) room exhaust fan, vent, and duct system are intended to evacuate the magnet room of cryogenic gas at the MR product specified rate. Over time, the exhaust fan system may become blocked with lint, hair, and other air-borne particles. It is important for personnel safety reasons that the exhaust fan system (vent, exhaust fan, ducts, etc.) be kept clean to make sure the exhaust fan system operates properly and exhausts cryogenic gas to an outside area.

In the unlikely event of a magnet quench or a cryogen gas leak, it is important that this exhaust fan system performs at or above the specified airflow to remove the cryogen gas from the magnet room. The magnet room exhaust fan and air inlet must be sized for a minimum of 1200 CFM (34 m³/minute) and minimum of room 12 air exchanges per hour. The minimum air flow and air exchange rate for mobile, transportable, and relocatable systems are different from those for fixed sites and varies depending on the type of site. Any blockage or obstruction could prevent the exhaust fan system from providing the required airflow. If the exhaust fan system fails to operate at or above specification, accumulation of dangerous levels of helium or nitrogen within the RF screen room could occur.

It is important that this exhaust system vent be cleaned regularly as part of the normal room cleaning. Regular customer inspection, cleaning, and testing of the exhaust fan system (vent, exhaust fan, ducts, etc.) are needed to make sure all equipment and parts of the system are always in good working order and able to perform to specification. It is recommended the exhaust fan system be cleaned and inspected annually to make sure the specified air flow rate can be met and thus ensures proper performance.

SYSTEM MAINTENANCE

Maintenance services

The planned maintenance (PM¹) services prescribed in the PM schedules represent the current manufacturer's recommendations. Specific customer requirements and/or your site environment may necessitate more or less frequent intervals for PM service. An agreement to perform PMs less frequently than these recommendations can be made with the understanding that a reduction of system performance may result.

The PM service schedules in the **Maintenance Service** Schedules, list all the PM procedures and the frequency they should be completed by qualified service personnel. There are different schedules for each system type.

You should perform the maintenance services shown in the table below.

Table 2-50: Operator services

Item	Required maintenance	Service interval
General	Clean	4 months
	Check the table emergency release.	4 months
Patient cradle and pads	Check for cleanliness of pads and clean the inside of the cradle.	Daily
Patient table	Check the table alignment and proper operation.	6 months
Coils, pads, and straps	Clean with non-abrasive cleanser. Clean coil anti-skid pads with water and mild detergent only.	Daily
Coils and coil cables	Check for defects or damage, worn cable or exposed wires.	Daily
Image quality	Perform quality assurance and functional checks.	As recommended

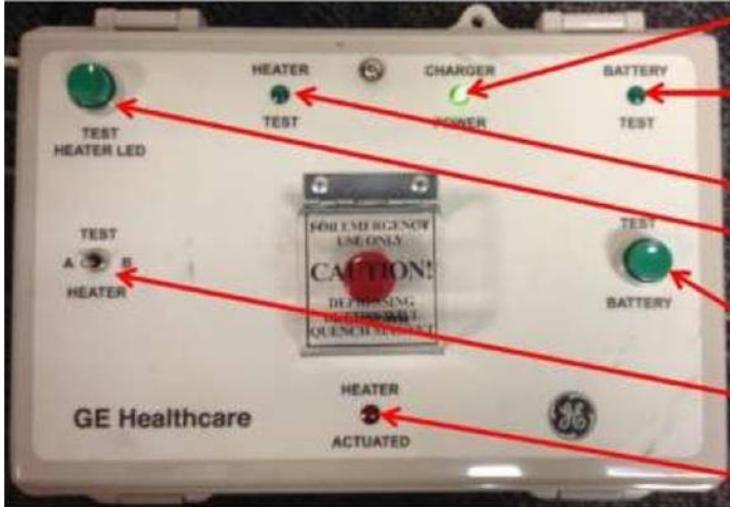
¹Planned Maintenance

SYSTEM MAINTENANCE**Magnet Rundown Unit test procedure**

MRU type I reference number is 5196918 or 5196918-2.

Table 2-51: MRU type 1

#	Description
1	CHARGER POWER LED
2	BATTERY TEST LED
3	HEATER TEST LED
4	TEST HEATER LED switch (for use by GE Service Representative)
5	TEST BATTERY button
6	TEST HEATER switch
7	HEATER ACTUATED LED



The photograph shows the front panel of a MRU type 1 unit. It features several green LED indicators and buttons. Red numbers 1 through 7 are overlaid on the image, each pointing to a specific component: 1 points to the 'CHARGER POWER LED' at the top right; 2 points to the 'BATTERY TEST LED' below it; 3 points to the 'HEATER TEST LED' further down; 4 points to the 'TEST HEATER LED switch' on the left; 5 points to the 'TEST BATTERY button' on the right; 6 points to the 'TEST HEATER switch' below the battery button; and 7 points to the 'HEATER ACTUATED LED' at the bottom center.

**WARNING**

If the magnet rundown unit test does not perform as described in each step, with the specified LED lighting in each step, GE strongly recommends that you stop using the system and immediately call your GE Service Representative.

Procedure

Use these steps to confirm that the MRU is connected to the magnet and operating properly by performing this test on the MRU every week.

1. Verify that the green CHARGER POWER LED (1) is illuminated.
2. Depress and hold the TEST BATTERY button (5) for 15 seconds.
 - The green BATTERY TEST LED (2) illuminates and remain lit while the TEST BATTERY switch is depressed.
3. Place the TEST HEATER toggle switch (6) in the A position.
 - The green HEATER TEST LED (3) illuminates.



Wait at least 5 seconds before toggling the TEST HEATER switch between position A and B. Not doing so may cause the red HEATER ACTUATED LED (7) to illuminate.

4. Place the TEST HEATER toggle switch (6) in the B position.
 - The green HEATER TEST LED illuminates and it remains lit until the toggle is released.



WARNING

The magnet will not quench if the red HEATER ACTUATED LED illuminates due to toggling the TEST HEATER switch. GE strongly recommends that you stop using the system and immediately call your Qualified Service Representative if this occurs.

Related topics

[Magnet rundown concept](#)

[Secondary ramp down procedure](#)

[Magnet cover removal procedure](#)

[Quench with vent failure procedure](#)

PROCEDURES

Procedures introduction

This section provides the step-by-step instructions for working safely in a magnetic field environment. Specifically, it describes how to:

- Eliminate Magnet Hazards
 - Protect the security and exclusion zones
 - Screen patients and personnel
- Prepare the patient
- Protect the patient from RF burns
- Protect the patient's eyes and ears
- Respond to Emergencies
 - Patient emergencies
 - Equipment or environmental emergencies
 - Magnet emergencies
 - Quench with vent failure
- Check the Cryogen Levels
 - Systems with a helium level meter
 - Systems with a magnet monitor unit
- Handle contact with liquid cryogens



IMPORTANT!: You should understand the following definitions before continuing:

- A substance that is ferromagnetic has a large positive magnetic susceptibility, meaning it is very easily magnetized (example: Iron).
- An item that is ferrous can possess intrinsic magnetic fields and become a projectile in an applied magnetic field (examples: Iron, nickel, and cobalt).

Safety checklist

It is recommended that your site develop a safety check list based on your local, regional and country regulations.

This can be used before system acceptance (site readiness) after installation and should be considered for periodic review. A check list includes reviewing the following suggested topics:

- Safety Areas
 - Exclusion zone
 - Security zone
- Patient screening
- Patient emergencies
- Clothing screening of anyone who enters the magnet room
- Equipment screening that enters the magnet room
- Cleaning supplies for the MR room, equipment, and accessories
- Cryogens

- **Magnets**
- **Gradients**
- **RF**

A suggested list of reviewers of the safety check list includes the following:

- MR staff
- Physicians
- Nursing staff
- Administrative staff
- Service staff
- Support staff
- Cleaning staff
- Fire department
- Police department

PROCEDURES

Protect the security and exclusion zones procedure

It is vital to have supervised and controlled access within the MR environment to keep it safe from ferromagnetic items and to guard against accidents, injuries, or damage to MR systems. Keep in mind that even a paperclip inside the bore of the magnet can cause image artifacts or a patient burn. All personnel should be aware of the following important steps.

1. Keep the door to the MR environment and the magnet door closed.
 - The doors should not be held open for other people or propped open.
 - Only essential personnel should be allowed to enter the magnet room.
2. Limit and monitor access to the MR environment and magnet room.
 - Personnel trained in MR safety should be present at all times during the operation of your MR facility to ensure that no unaccompanied or unauthorized individuals are allowed to enter the MR environment or magnet room.
 - Personnel trained in MR safety are also responsible for performing thorough screening of patients and other individuals before allowing them to enter the magnet room.
3. Supervise non-MR personnel when working in the magnet room.
 - Everyone who needs to enter the MR environment on a regular or periodic basis should be educated regarding the potential hazards related to the magnetic field.
4. Prominently display the Security and Exclusion Zone warning signs to make all individuals and patients aware of the risks associated with the MR system.
 - The Security Zone sign must be posted on the entrance to the magnet room.*
 - These signs warn patients about the strong magnetic field and stresses the presence that no pacemakers, metallic implants, neurostimulators, or loose objects are allowed.
 - The Exclusion Zone sign must be posted at the 5 gauss boundary.*
 - This sign warns against the strong magnetic field and stresses the presence of no pacemakers, metallic implants, or neurostimulators.

*In general, patients with conductive (e.g. metallic) implants are contraindicated for MR scans. Some implantable devices have been labeled as MR Conditional under certain operating conditions. Only use quadrature transmit for MR Conditional devices. MR Safe implants will have the MR Safe symbol in their implant documentation.

When evaluating whether to proceed with MR scanning on patients with such implants, consult the implantable device's labeling.

5. Test all items for ferromagnetic properties before taking them into the magnet room.
 - Use a hand magnet to test items.
6. Remove ferrous items from the immediate vicinity of the magnet room.
 - This can reduce the chance that someone might carry a ferrous item into the magnet room.
 - Replace ferrous items that must remain in the vicinity of the magnet room with non-ferrous versions whenever possible.
7. Tag ferrous items that remain at the facility so that all personnel know the item cannot be taken into the magnet room.
 - Tag all ferrous items with the same label to be consistent in identifying items that are not to be in the magnet room.

8. Do a pocket check before entering the magnet room.
 - Check for loose metal objects, such as keys, and remove.
9. Keep the magnet door in sight at all times.
 - When working in the magnet room, do not stand between the door and the magnet or turn your back to the door.
10. Do not turn your back on the patient or anyone else in the magnet room.

PROCEDURES

Screen patients and personnel

For your safety and the safety of the patient, an MR safety-trained health care worker at your facility should carefully screen for hazards before patients and personnel enter the Exclusion Zone. All personnel must be aware of and comply with your facility's screening procedure.



WARNING

Patient screening is required for patients who are going to be imaged on an MR scanner.

1. Use a Patient Screening form routinely before bringing patients or other personnel into the Exclusion Zone.
 - Thoroughly review all safety information and considerations before starting a scan with patients that have an MR Conditional implant. In general, patients with conductive (e.g. metallic) implants are contraindicated for MR scans. For patients with implants that are labeled as MR Safe or MR Conditional consult the implant device manufacturer's documentation.
 - Every patient, individual, and employee must be carefully screened prior to admission to the magnetic field. Refer to the [Screening form](#) topic.
2. Review the completed screening form and evaluate the individual prior to entry.
 - Identify circumstances that contraindicate admission to the Exclusion Zone or items that need to be removed before entering the Security Zone.
 - In addition to safety issues, metal objects or materials containing metal may distort the magnetic field and detract from the image quality.
3. Discuss the items on the screening form with the patient or other individual.
 - Verbally interview the patient to verify the information on the form and ensure the patient understands each question he/she is answering.
 - Allow discussion of any question or concern that the patient may have.
4. Examine all patients with diapers or incontinence products, including adults, should have dry diapers on prior to the start of the scan.
5. Examine or X-Ray patients who are at risk for metal eye slivers.
 - Serious injury may occur as a result of movement or heating of the metallic foreign body as it is attracted by the magnetic field of the MR system.
 - Follow your departmental clinical screening policy.
6. Require that patients change clothes.
 - Provide clothes without metallic fasteners and pockets.
 - Patients should not wear shoes into the magnet room as they may have collected metal on the soles.
7. Instruct the patient to wash off non-permanent make-up.
 - Follow the precautions for patients with permanent make-up such as permanent eyeliner, which can cause tissue heating.
8. Keep metal out of the bore.*

- A metal-free bore prevents burns and image artifacts.

*In general, patients with conductive (e.g. metallic) implants are contraindicated for MR scans. Some implantable devices have been labeled as MR Conditional under certain operating conditions. Only use quadrature transmit for MR Conditional devices. MR Safe implants will have the MR Safe symbol in their implant documentation.

When evaluating whether to proceed with MR scanning on patients with such implants, consult the implantable device's labeling.

Related topics

[Contraindications for use](#)

[High risk patient](#)

[Clinical screening](#)

[Patient emergencies](#)

PROCEDURES

Prepare the patient procedure

Some patients undergoing an MR procedure may experience feelings of fear, anxiety, or claustrophobia. The following techniques may help reduce or eliminate these sentiments. Use the following techniques for all patients, even if your patient does not exhibit signs of fear or claustrophobia. Larger patients can feel anxious due to a confined feeling in the magnet. Degradation of image quality can also occur. Verify that the patient's weight does not exceed the table weight limit as defined in your MR system's documentation. Consult your system operator manual for details.

1. For safety reasons, patients must be thoroughly screened prior to scan preparation.
 - Screen for pertinent medical history and conditions that contraindicate scanning.
 - If proper screening cannot be performed, postpone the MR examination until screening can be done.
 - Review **Contraindications for use** before scanning the patient.
2. Determine scan protocol and enter the patient's information in advance.
 - This saves time during the preparation for the procedure so the patient is not left waiting for the examination to begin.
3. Provide the patient an information booklet to read.
 - Educating the patient concerning specific aspects of the MR examination is an effective way to prepare for the situation and explain what is about to happen.
4. Have the patient use the restroom prior to the examination.
 - Fewer interruptions during the scanning procedure can help you stay on schedule and keep the patient focused on holding still during the examination.
5. Examine all patients with diapers or incontinence products, including adults, to make sure the patient has dry diapers and dry clothing on prior to the start of the scan.
6. Discuss the procedure with the patient.
 - The length of the examination
 - What can be seen during the examination
 - What can be heard during the examination
 - What can be felt during the examination
7. Transfer the patient to the MR table.
 - Refer to your specific MR system operator manual for patient transfer details.



CAUTION

Position the patient's limbs, hair, and clothes completely on the table to avoid risk of injury when the table is moving.

8. If the patient was transported into the magnet room via the MR table and the IV pole connected to the table is in use, once the table is docked, replace the MR table's IV pole with a non-ferrous free-standing IV pole.

**Pinch Point CAUTION**

Do not move the patient into the magnet with the MR table's IV pole in use. To avoid any pinch points from the MR table's IV pole, remove the IV pole from the table, store it, and use a non-ferrous free standing IV pole.

9. Let the patient see the MR system while you explain the features of the bore.
 - Soft lighting
 - Good ventilation
 - A microphone and speaker to enable the patient to hear and be heard at all times
10. Demonstrate the use and function of the Patient Alert System.
 - This system is patient-activated and allow the patient to signal for assistance during a scan.
11. Explain the use of straps. See your system operator manual for details.
12. Ensure the patient is comfortable.
 - Use sponges and wedges to relieve pressure points and support the body in the correct position.
 - Ask if a blanket is needed while being aware that once the scan begins, a blanket may increase patient warming.
13. Explain the need for hearing protection.
 - Use recommended earplugs (>/= 29dB NRR) to minimize the noise from the gradient magnetic field.
 - Alternatively, use recommended MR-compatible headphones (>/= 29dB NRR) to provide relaxing music to the patient and minimize the noise.
14. Stress the need for cooperation to attain a diagnostic study.
 - It is extremely important the patient not move during the examination.
15. Stay in constant verbal and visual communication with the patient throughout the examination.
 - Some patients may require the physical presence of an family member or nurse in the magnet room.
16. See the following procedures for details regarding:
 - **Protect the patient from RF burns**
 - Protect patient's eyes and ears
 - Patient emergencies

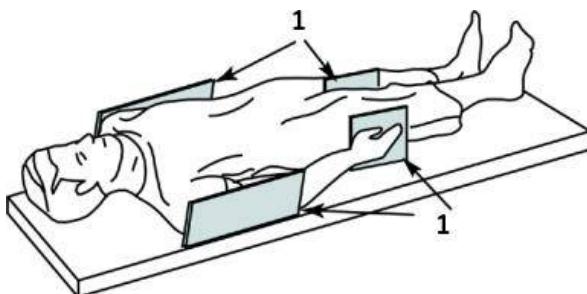
PROCEDURES

Protect the patient from RF burns procedure

All personnel should be aware of several factors to protect a patient from burns and peripheral nerve stimulation. The following steps should be observed by all personnel that position patients for scanning.

1. Remove any accessory devices from the bore of the magnet that are not required for the procedure.
 - This includes any unplugged electrically conductive materials such as surface coils, cables, etc.
2. Examine all patients with diapers or incontinence products, including adults, to make sure the patient has dry diapers on prior to the start of the scan.
3. Position the patient to prevent direct contact between the patient's skin and the bore of the magnet or an RF surface coil.
 - Before connecting halves of a split coil, take care that the patient's body (for example, ear, jowl, neck, finger, hand, etc.) is not trapped or pinched by coil parts.

Figure 2-47: Patient positioned with non-conducting pads (1)



- Use additional pads to immobilize the patient and make them comfortable.
- Preventing patient warming is one of the most important safety measures you must take into consideration as you prepare a patient for an MR exam. Appropriate RF padding and proper patient positioning are the most effective means of preventing injury related to RF heating. The following are a few golden rules to remember as you position and pad your patients:
 - Only use GE-approved RF padding.
 - Use non-conductive padding that is at least 0.25 inches (0.635 cm) thick between the patient's skin and the magnet bore.
 - Appropriate padding must be used EVERY time without exception
 - Sheets and gowns are not a substitute for approved RF padding.
 - Never allow your patient's skin to come in direct contact with the scanner bore or any surface coil or cable.
 - Never allow skin-to-skin contact.
 - If a patient does not fit in the MR scanner bore with the required padding, another modality should be used to scan the patient.
- While some of these rules may seem a little tough to follow at times, remember that RF injury, which can in extreme cases include burns such as the one you see below, can happen very quickly and your patient may not have time to warn you in time to prevent an injury.

Patient padding

Figure 2-48: Elbow RF burn



- The following are a tips that will assist you in properly positioning and applying RF padding to your patients. Should you need more information on prevention of patient warming than what is provided here, refer to your surface coil and refer to Tissue Heating in this manual. If you need help beyond the documentation please do not hesitate to reach out to your local Applications Specialists.

Whole body padding

Although the photos are from a Discovery system, the safety padding guidelines apply to all MR systems.

- An important consideration when padding your patients is that you will need to double check the position of the pads once the patient is in the bore. Table movement may dislodge padding and expose skin to the scanner bore.

Figure 2-49: Padding between patient and bore. 1 = bore pads



- Notice that padding is positioned not only at the patient's sides to prevent their arms from touching the bore, but that padding is also placed between the hands and thighs and between knees and ankles to prevent forming conductive loops.

Figure 2-50: Patient padding



Surface coil padding

Although the photos are from a Discovery system, the safety padding guidelines apply to all MR systems.

- Padding with a surface coil presents different challenges from a patient RF padding perspective.
 - First rule of thumb is to remember to use all manufacturer provided padding to prevent motion and the patient's skin from coming in contact with the coil, and to also use additional padding if appropriate to secure an opposing extremity to prevent contact with the coil which could also lead to burns or motion artifacts.
 - Just as with the whole body RF padding demonstration, you'll need to make certain that the patient's skin does not come into contact with the scanner bore and that padding is placed between the hands and thighs to prevent conductive loops.

Figure 2-51: Extremity padding



- A final safety consideration for surface coils is to ensure that the patient does not come into contact with the coil cable, therefore you may need to use additional RF padding to protect the patient.

- Care should also be taken to ensure the cable is not looped in the bore and that it is routed down the center of the scanner bore.

Figure 2-52: Coil cable with no loop



PROCEDURES

Protect the patient's eyes and ears procedure

During scanning gradients produce noise that can exceed 99 dBA in the bore. Hearing protection is required to prevent hearing impairment. Patients must close his or her eyes when the alignment light is on during positioning. Follow these guidelines to ensure proper eye and ear protection for your patient.

1. Provide the patient with hearing protection.
 - Earplugs or a headphone system with stereo music. For details, see [Acoustic Noise](#).
 - Earplugs reduce the intensity of the sound, while allowing your patient to hear normal conversations.
 - Headphone systems soften acoustic noise, but may impede verbal communication with patients while the system is operating.

Table 2-52: Disposable ear protection

Description	dB
E8801BA EAR Disposable Foam Earplugs	29
E8801BB EAR Taperfit2 Foam Earplugs	32
E8801BC Max-Lite Foam Earplugs	30



WARNING

Hearing protection is required for all people in the magnet room during a scan to prevent hearing impairment. Acoustic levels may exceed 99 dB(A).

2. Make sure that the hearing protection device is worn properly.
 - Earplugs should be comfortable for the patient and inserted fully. Pliable earplugs compress when they are rolled between the fingers and conform to the ear after they are inserted.
 - The headphone system should be audible and comfortable for the patient.
3. Instruct the patient to close his or her eyes when the alignment light is on.
 - The Laser Alignment Lights for patient positioning can cause eye injury.



CAUTION

Turn off the laser light after positioning the patient.

PROCEDURES

Patient emergencies procedure

Dealing with patient emergencies requires special planning in the MR environment because of the magnetic field. Certain equipment used for resuscitation does not function in a magnetic field, and ferrous items can become projectiles. If a patient needs emergency medical attention during the scanning session, follow these guidelines:

1. Press **Emergency Stop** on the operator's console or magnet enclosure.
 - The scan aborts.
 - The power disables the patient-handling and scan-related equipment.
2. Notify emergency personnel, if necessary.
 - Since ferromagnetic life support and related equipment cannot be brought into the magnet room, it must await the patient outside the magnet room.
3. Quickly bring the patient out of the magnet bore. Refer to your specific product operator manual for details on cradle emergency release.
4. Transfer the patient onto a non-ferrous gurney or transport and remove the patient from the magnet room as quickly as possible.
 - It is important to have an assigned emergency area outside of the magnet room where you can take a patient so that the emergency team can use the necessary equipment.
5. Follow your facility's emergency protocol.



WARNING

The Emergency Stop button does not remove the magnetic field, turn off the computer cabinets, operator's console, or camera.

PROCEDURES

Equipment or environmental emergencies procedure

If you experience a serious equipment fault (system overheating, smoke, or odor associated with the system) or hazards such as fire/water in the vicinity of the MR equipment, you may need to perform a system shutdown with the Emergency Off button. The entire MR system turns OFF with this button, except for the static magnetic field and the Magnet Rundown Unit used to shutdown the magnetic field.

Use this procedure to perform an emergency shutdown on your system during an equipment or environmental emergency.

1. Press the **Emergency Off** button located on the wall next to the computer equipment or next to the magnet room door.
 - This stops power to the magnet room, removing all electrical power from all components of the system.
 - This button also removes any power sources from UPS devices.
2. Evacuate the patient.
 - Follow the guidelines in the Patient Emergencies procedure.
3. Evacuate the MR suite.
 - Follow your facility's emergency protocol.
4. Call the fire department, if appropriate.
 - When the fire department arrives, evaluate the need for an emergency MRI magnet quench.
 - If the firefighters need to take ferromagnetic equipment into the MRI magnet room, quench the magnet.
5. Contact a service engineer before restoring power.
 - To restore power after an Emergency Off, the main circuit breaker must be reset before rebooting the system.
6. After service has examined the system, document the correct cause of the emergency.
 - Keeping the events documented allows you to reference this information in the future and may help prevent similar incidents.



WARNING

The Emergency Off button does not turn off the magnetic field. To avoid personal injury or equipment damage, do not bring any ferromagnetic equipment into the magnet room. Assume that equipment is magnetic unless it is clearly labeled otherwise.

PROCEDURES

Primary magnet rundown procedure

The content in this topic applies to all magnets.

In addition to patient and equipment emergencies, magnetic field emergencies can also occur. Examples of magnetic field emergencies include instances where the presence of the magnetic field may cause injury or harm, if someone is pinned between the magnet and ferromagnetic object or there is a fire in the magnet scan room. All personnel should be familiar with how to respond to magnet emergencies.



WARNING

Personal Injury or Equipment Damage

This emergency magnet rundown procedure may create dangerous situations or damage equipment.

Perform this emergency magnet rundown procedure only in emergency situations (such as when a person is trapped between a magnetic object and the magnet).

In situations where there is no immediate threat, contact your GE Service Representative for non-emergency rundown procedures.

Use this procedure to perform an emergency magnet rundown on your system during a magnetic field emergency.

1. Ensure all ventilation systems are on and the scan magnet room door(s) is open.
2. Follow your facility's emergency protocol and evacuate the patient and all other personnel from the scan magnet room unless they are actively providing first aid to the entrapped person.
3. Press the Magnet Rundown button located in the scan magnet room or located remotely (if provided), whichever is easiest to access.
 - Only activate the Magnet Rundown switch in an emergency situation.
 - This results in a rapid reduction of the magnetic field in about two minutes.
 - There is a boil-off of cryogens, accompanied by crackling and hissing sounds.



Notify your Qualified Service Representative that a quench occurred.

Related topics

[Magnet rundown concept](#)

[Magnet Rundown Unit test procedure](#)

[Secondary rundown procedure](#)

[Quench with vent failure procedure](#)

PROCEDURES

Secondary magnet rundown procedure



This secondary quench method should be attempted only after other approved methods of rundown have been attempted and in the event of a life threatening condition. Performing this procedure will take the magnet out of service for at least one month.



WARNING

Personal Injury or Equipment Damage

This emergency magnet rundown procedure may create dangerous situations or damage equipment.

Perform this emergency magnet rundown procedure only in emergency situations (such as when a person is trapped between a magnetic object and the magnet).

In situations where there is no immediate threat, contact your GE Service Representative for non-emergency rundown procedures.

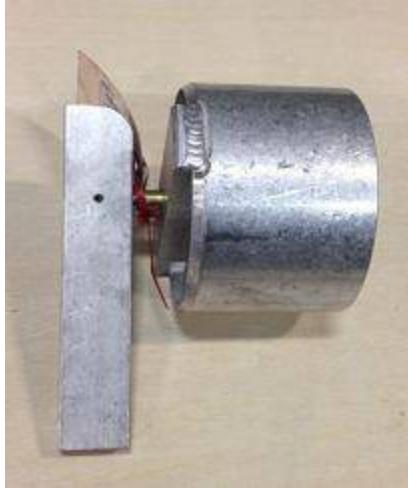
Use these steps with the Vacuum Break Tool to break the magnet vacuum for a magnet rundown.

1. If possible, call your Qualified Service Representative.
2. Locate the Vacuum Break Tool (46-260852G3).



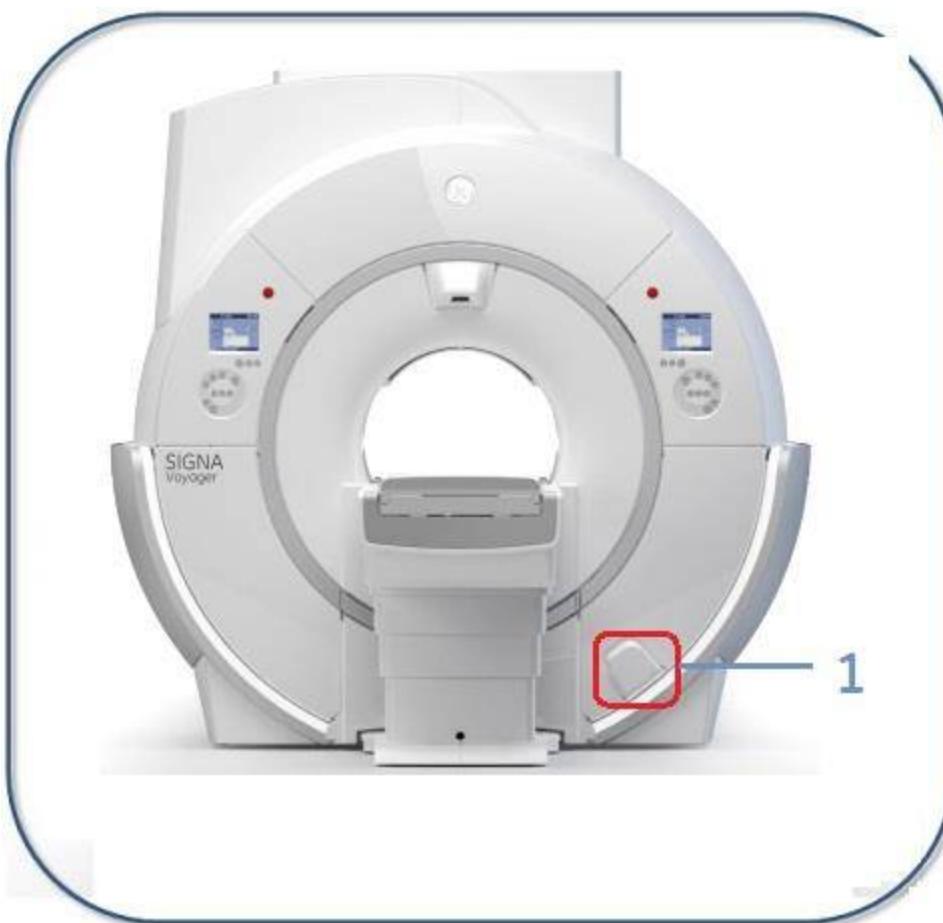
This tool is for emergency only and should be stored in a safe and easily accessible location. Ensure that all operators are informed of this tool's location.

Figure 2-53: Vacuum Break Tool



3. Ensure all room ventilation systems are on and the scan magnet room door is propped open.
4. Locate the vacuum port access cover on your magnet cover.

Figure 2-54: SIGNA Voyager vacuum port access on the magnet cover



5. Remove the vacuum port access cover from the magnet cover to expose the vacuum port.



You should be able to remove the access cover with your finger or non-magnetic tool.

Figure 2-55: Example of an access cover off and the vacuum port exposed



6. Remove the protective dust cover from the vacuum port.



The magnet cover in Figure 2-56 (below) is shown removed for illustration purposes only.

Figure 2-56: Dust cover removed



7. Screw the handle of the Vacuum Break Tool into the plug of the vacuum port by turning it clockwise.
 - At least three full turns are required to ensure thread engagement.
 - If you are unable to turn the handle, either call a GE Service Representative for further assistance or remove system enclosure cover.

Figure 2-57: Vacuum Break Tool screwed into vacuum port plug



8. Lift the Vacuum Break Tool handle until it is parallel to the floor. Leave the handle in this position.

Figure 2-58: Vacuum Break Tool parallel with floor



- There will be an inrush of air into the magnet and the magnet will quench in about 30 seconds.

Related topics

[Primary magnet rundown procedure](#)

[Magnet Rundown Unit test procedure](#)

[Magnet rundown concept](#)

[Quench with vent failure procedure](#)

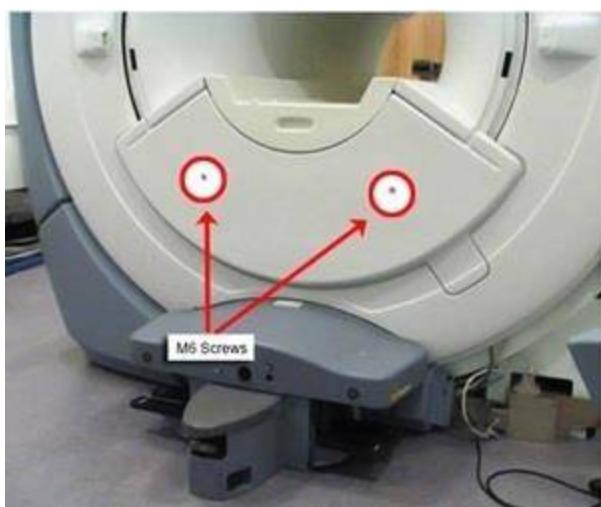
PROCEDURES

Magnet cover removal procedure

Use these steps to remove the magnet cover if you are unable to turn the emergency Vacuum Break Tool in the plug of the vacuum port in a clockwise direction.

1. Use a non-magnetic 5 mm Allen Wrench to remove the two M6 screws that secure the magnet cover.

Figure 2-59: Front Bridge Cover Screws



2. Remove the front bridge cover.
 - If you cannot remove the cover, then undock the patient table and position it away from the magnet and then remove the cover.
 - For a fixed table configuration, it is possible to remove the front bridge cover without removing the table. If the table needs to be removed, call a Qualified Service Representative for further assistance.

Related topics

[Magnet rundown concept](#)

[Magnet Rundown Unit test procedure](#)

[Secondary ramp down procedure](#)

[Quench with vent failure procedure](#)

PROCEDURES

Quench with vent failure procedure

A magnet quench can result in the release of cryogen vapor into the magnet room if the vent fails; white clouds of vapor appear in the magnet room. Cryogens released during a quench can cause asphyxiation, frostbite, or injuries due to panic. Magnet quenches are indicated by a loud noise, warning message, or the tilting of an image on the image screen. It is critical to have a well-planned method to quickly remove the patient and all personnel from the magnet room if a quench should occur.

1.5T and 3T magnets contain approximately 1850 liters of liquid helium. If 100% of the 1850 LHe fills the minimum sized scan room, a properly functioning emergency exhaust fan with 1200 CFM and 12 scan room air exchange / per hour would evacuate that minimum sized scan room in about 2 hours. After that time it would be assumed safe for a qualified GE Field Service Engineer to enter the scan room and measure the O₂ levels. It remains the customer responsibility to approximate the time to evacuate 1850 LHe for use in the site specific emergency procedures.

Use your site specific magnet room evacuation procedure. The following steps are guidelines for a site procedure in case of a sudden cryogen release into the magnet room.

1. Do not panic.
 - Staying calm helps you remain focused so you are able to safely remember and follow your site planned method of action.
2. Using the intercom, tell the patient to stay calm and remain on the table.
 - Tell the patient that someone will be in shortly to offer assistance.
3. Turn on the magnet room exhaust fan.
 - The exhaust fan is designed for 1200 cubic feet per minute, which exchanges the total volume of air in the room 12 times per hour. The time for the helium to be near a safe level is based on the amount of helium within a magnet,
4. Prop open the door between the operator room and hallway or if in a mobile unit, open the door to the outside.
 - This promotes air circulation.
5. Prop open the door to the magnet room.
 - If the magnet room door does not open, follow your site specific emergency procedure to open the door.
6. Enter the magnet room and assist anyone present to exit from the room.
 - If a gurney or wheelchair is needed to remove the patient, make sure it is a non-ferrous type.
 - When exiting, stay near the floor where the oxygen will be and immediately exit the magnet room.
7. Close the MR scan room door when all have been evacuated.
 - If the magnet room door is left open, there is a potential that helium gas will spread to other areas, including heating and cooling vents.
8. Evacuate all personnel from the area until the air is restored to normal.

Related topics

[Magnet rundown](#)

[Magnet Rundown Unit test procedure](#)

[Magnet emergencies procedure](#)

[Secondary ramp down procedure](#)

PROCEDURES

Check cryogen levels procedure

Systems with a Helium Level Meter

It is very important to check and record the helium level. Sufficient helium is necessary to avoid accidental quench. If the helium levels fall below 60%, or the level your service engineer says is acceptable, contact a service engineer immediately.

Use this procedure to check cryogen levels.

1. Turn on the Helium Meter power switch.
 - This switch is located at the system cabinet.
2. Press Update on the system cabinet.
 - An updated reading of the helium level posts.
3. Record the percent of helium reading.
 - Keep a logbook to record readings daily.
 - It is crucial that cryogenic systems be checked regularly to be sure they are properly functioning.
4. Turn off the Helium Meter power switch when complete.

Systems with a Magnet Monitor Unit

It is very important to check and record the helium level. Sufficient helium is necessary to avoid accidental quench. If the helium falls below 60%, or the level your service engineer says is acceptable, contact a service engineer immediately.

Use this procedure to daily check cryogen levels of a system with a Magnet Monitor Unit.

1. Locate the magnet monitor, which is typically in the equipment room. Push the sample button on the Magnet Monitor Unit and hold it for approximately 10 seconds.
 - An updated reading of the helium level posts.
2. Record the He Level value when it displays on the monitor.
 - The reading also toggles to the magnet pressure. Monitor any change in pressure. Normal pressure is between 3.9psi and 4.1psi.
 - Keep a logbook to record readings daily.
 - It is crucial that cryogenic systems be checked regularly to be sure they are properly functioning.
3. If the alarm LED is illuminated, contact your service engineer.

PROCEDURES

Handle contact with liquid cryogens procedure

Since the cryogen gasses are odorless, tasteless, and colorless, it is particularly important to have specific procedures in place to avoid frostbite if there is ever an accident in which the liquid or gaseous cryogen contacts human skin. Such procedures should be established and made readily available to all personnel.

Use this procedure immediately in the unlikely event that someone comes in contact with a liquid cryogen.

1. Promptly flush the area with large volumes of tepid water.
 - Tepid water is 105° to 111°F or 41° to 46°C.
 - For cold burns, immerse affected area in tepid water for at least 15 minutes.
2. Calm the victim.
3. Avoid aggravating the injury.
 - Do not rub or massage the affected parts of the body.
4. Cover the area with a sterile dressing.
 - You may also use a clean sheet if the exposed area is large.
 - This protects the area from further trauma.
5. Consult a physician immediately.
 - Maintain the affected area at normal body temperatures until a physician arrives.

PROCEDURES

Safety review

Table 2-53: Safety review table

Situation	Procedure
Fire, sparks, a loud noise or other emergency condition in the magnet room not associated with normal operation of the system.	Press an Emergency Off button, either in the computer equipment room or at the magnet room door. Remove the patient from the magnet room.
Magnet quench, indicated by a loud noise, warning message, dense white vapor with vent failure, helium meter dropping considerably or the tilting of an image on the image screen. Oxygen monitor is activated indicated by a loud sound.	Evacuate the patient and personnel from the magnet room and close the magnet room door. Follow your site's overnight procedure. All helium vapor should automatically be vented outside of the magnet room.
Magnetic-field emergency, e.g., a person pinned between the magnet and a ferromagnetic object.	Press the Magnet Rundown button in the magnet room. Remove the patient from the scan room.
Fire, sparks or a loud noise, indicating a severe system malfunction in the computer equipment room.	Press an Emergency Off button, either in the computer equipment room or at the magnet room door. Remove the patient from the magnet room.
Fire or severe condition relating to the power distribution unit (PDU) or service outlets.	Press an Emergency Off button, either in the computer equipment room or at the magnet room door. Remove the patient from the magnet room.
Overtemp indicator lights up at the remote power panel (RPP) or at the PDU, and an error message appears on the scan console's System Status Display area.	Remove the patient from the magnet room. Check the PDU vent for obstructions. If the vent is obstructed, or if the overtemp light or message remains on, perform a system shutdown and then press an Emergency Off button, either in the computer equipment room or at the magnet room door.
Patient needs medical attention.	Press the Emergency Stop button on the console or magnet and remove the patient from the magnet room.
Hydraulic failure of the table.	Make certain the cradle is fully retracted on the transport (the home position) before undocking the transport. Keep all personnel (including patients) away from any spill. Keep patients on the table until safe transfer is possible. Check for oil leaks and if any exist, clean them up to prevent anyone from slipping on the oil. If the table latch is stuck and the table cannot be removed, pull the Table Transport Emergency Release. Remove the table from clinical use until it is repaired.
Imaging functions are lost without warning.	Follow your facility's emergency procedures during this type of occurrence.



In all cases, notify a GE Service Engineer as soon as possible.

The ACR Guidance Document for Safe MR Practices may be found at ACR.org. GE does not necessarily endorse the document, but provides the reference for information.

MR COMPATIBILITY

MR compatibility test guidelines

Introduction

This section document describes a set of specifications and standards that can be used to evaluate the Magnetic Resonance (MR) compatibility of hand-held, non-electronic equipment used in conjunction with the MR system.

MR compatibility standards

The American Society for Testing and Materials, International (ASTM) has developed the following MR compatibility standards (and are developing more):

- F1542 Specification for the Requirements and Disclosure of Self-Closing Aneurysm Clips
- F2052 Test Method for Measurement of Magnetically Induced Displacement Force on Medical Devices in the Magnetic Resonance Environment
- F2119 Test Method for Evaluation of MR Image Artifacts from Passive Implants
- F2182 Measurement of Radio Frequency Induced Heating Near Passive Implants During Magnetic Resonance Imaging
- F2213 Measurement of Magnetically Induced Torque on Medical Devices in the Magnetic Resonance Environment
- F2503 Practice for Marking Medical Devices and Other Items for Safety in the Magnetic Resonance Environment

These may be ordered online at <http://www.astm.org>.

SERVICE SCHEDULE

PM service schedules introduction

Specific customer requirements and/or your site environment may necessitate more or less frequent intervals for PM¹ service. An agreement to perform PMs less frequently than these recommendations can be made with the understanding that a reduction of system performance may result.

To further enhance productivity, the PM procedures have been divided into four types:

- Type 1 – Safety and Regulatory
- Type 2 – Image Quality
- Type 3 – Other (System not available for patient scans)
- Type 4 – Other (System available for patient scans)

The PM matrices list all the PM procedures and the frequency they should be completed, according to schedules listed below. The schedules indicate the procedures that are performed during each visit. They also show the type (1 - 4) for each procedure. The services should be completed at the indicated intervals and should be performed only by qualified service personnel.

Four/year PM schedule

- A = 0 to 3 months
- B = 4 to 6 months
- C = 7 to 9 months
- D = 10 -12 months

¹Planned Maintenance

SERVICE SCHEDULE

MR system PM service schedule

The PM¹ service schedule lists all the PM procedures and the frequency they should be completed according to schedules A -D. The checks are on a sequential yearly schedule, for example A is the first three months, B is the second three months, etc.

- A = 0 to 3 months
- B = 4 to 6 months
- C = 7 to 9 months
- D = 10 to 12 months

GE Healthcare Lifecycle Maintenance

GE Healthcare equipment is designed and manufactured to be of the highest quality. Likewise, the maintenance requirements in this manual are designed to help maintain safe, high quality performance of this equipment for its expected life.

GE Healthcare Customer Service Manuals, and Customer Operations Manual/User Guides, are designed with the intent that customers or service providers can utilize them to perform standard maintenance on the equipment (such as planned maintenance, which is typically time-based) without proprietary service tools or methods. Please note, alternative original equipment manufacturer planned maintenance schedules may be utilized, and other routine maintenance efficiencies may be attained, based on GE Healthcare's (or its approved partners') use of proprietary service tools and methods, including data analytics and back office capacity. These GE Healthcare proprietary service tools and methods accomplish the prescribed and necessary routine maintenance activities identified in the Customer Service Manual, and/or the Customer Operations Manual/User Guides.

**CAUTION**

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Table 2-54: MR system PM service schedule

Test Purpose	Location	Check performed	A	B	C	D
Image quality tests						
Image Quality	Magnet	Laser Light Alignment	X			
Image Quality	Magnet	LVShim(PM Mode)	X	X		
Image Quality	Magnet	EPI White Pixel (PM Mode)	X	X		
Image Quality	Magnet	SPT (PM Mode)	X	x		
Image Quality	Magnet	PM Check (Service Contract Customers Only)	X	x	X	x
Image Quality	MR system	Confirm that the application software revision installed on the system is the same or at a later version of the Software revision required in the "ePM form data" tab that is located in Software matrix DOC1667089. This document is available from the Common Documentation Library.	X	X	X	X

¹Planned Maintenance

Test Purpose	Location	Check performed	A	B	C	D
		Confirm that the service pack revision installed on the system is the same or at a later version than the service pack revision required in "ePM form data" tab that is located in Software matrix DOC1667089. This document is available from the Common Documentation Library.				

Magnet Room tests

Safety	Magnet	Cardiac Gating Cable	x	x		
Safety	Magnet	Operation of Oxygen Monitor(if present and included in GE Service Contract)		x		
Safety	Magnet	Pneumatic Patient Alert System	x			
Safety	Magnet	PAC Leakage Current Test			x	

Magnet test

Check	Magnet	Inspect Cryogen Vent		x		
Safety	Magnet and Cryogens	Test GE Magnet Rundown Unit (MRU). Perform Quarterly Service Test found in the MRU manual 5265188 or 46-318393	x	x	x	x
Safety	Magnet and Cryogens	Test GE Magnet Rundown Unit (MRU). Perform Yearly Service Test found in the MRU manual 5265188 or 46-318393				x
Replace	Equipment	Inspect Cryocooler System	x			
Check	Magnet	Inspect for discoloration the inside of the bore and the front and back of the magnet discoloration	x			

ISC test

Safety	Equipment	UPM Head Functional Check			x	
Safety	Equipment	UPM Body Functional Check			x	

Patient Handling test

Safety	Equipment	Cradle egress functionality Safety		x		x
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Coil test

Clean	Magnet	P-Port Cleaning and Lubrication				x
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ICC test

Check	Equipment	Check GCU fluid levels and top off	x		x	
Replace	Equipment	GCU Coolant Deionization			x	
Check	Equipment	Check CCU fluid levels and top off	x		x	
Replace	Equipment	CCU Coolant Deionization			x	
Check	Equipment	FPU Filter Cleaning	x		x	
Check/Clean	Equipment	Body Coil Blower and Air Filter	x		x	
Check/Clean	Equipment	Patient Blower and Air Filter	x	x	x	x

PDU tests

Safety	Equipment	Leak Sensor Functionality Check			x	
Safety	Equipment	Emergency Off and Stop Circuits Indicator Lights			x	

Test Purpose	Location	Check performed	A	B	C	D
Computer tests						
Check	Operator	Set Time	X	X	X	X
Clean	Operator	Clean Dust	X		X	
Check	Operator	Save info	X		X	

SERVICE SCHEDULE

SIGNA Voyager: Planned Maintenance Plan

GE Healthcare MR Systems Lifecycle Maintenance

GE Healthcare equipment is designed and manufactured to be of the highest quality. Likewise, the maintenance requirements in the Customer Operations Manual/User Guides, and the Customer Service Manuals, are designed to help maintain safe, high quality performance of your equipment for its expected life.

GE Healthcare Customer Operations Manual/User Guides and Service Manuals are designed with the intent that customers or service providers can utilize them to perform standard maintenance on the equipment (such as planned maintenance, which is typically time-based) without proprietary service tools or methods. Please note, alternative original equipment manufacturer planned maintenance schedules may be utilized, and other routine maintenance efficiencies may be attained, based on GE Healthcare's (or its approved partners') use of proprietary service tools and methods, including data analytics and back office capacity. These GE Healthcare proprietary service tools and methods accomplish the prescribed and necessary routine maintenance activities identified in the Customer Operations Manual/User Guides or Customer Service Manuals.

Maintenance and repair work shall be carried out by qualified personnel, trained in maintenance and repair of this medical device in accordance with the manufacturer's standards within the manufacturing enterprise. Customers should contact their local GE Healthcare Service Sales if they desire to have GE Healthcare perform the PMs with the Advanced (Proprietary) Service Methods and OEM¹ trained service team.

In addition, GEHC systems have required customer, equipment operational checks that the customer should be performing on a periodic basis to ensure correct system operation or image quality before scanning. The details can be found in the Customer Operator Manuals.

Planned Maintenance Schedules

Planned Maintenance (PM²) tasks (and recommended schedules) are developed from design requirement and operations/use assumptions to provide for the minimum maintenance needed to ensure specified equipment design performance, image quality, and safety. Specific customer requirements or site environment may necessitate more frequent PM service. Service agreements can account for increased PM frequency or additional specific tasks, but those are made with the understanding that the minimum technical PM requirements of the Service Manual are met.

The life cycle PM matrices in the Service Schedules list all the PM procedures and the recommended frequency they should be completed once the equipment is beyond GE Healthcare (GEHC) warranty. The services should be completed at the indicated intervals and should be performed only by qualified service personnel.

GEHC introduces the following concepts tied to your MR System planned maintenance.

A. Warranty IB PM Schedules: Warranty PM Service requirement is different than the lifecycle Out of Warranty (IBOW) PM Service requirement due to manufacturing, installation checks, the newness of the equipment in the first 12 months after install.

Warranty IB PM concept is introduced to ensure the specified system performance and image quality for the customer, while maximizing system availability to the customer.

Warranty PM tasks and schedules ensure specified engineering operational performance throughout the warranty period in the 12 months following install, and in the equipment lifecycle after warranty. Because of the investment in installation checks, the newness of the equipment, and the other contractual service covered by the 12-month warranty period following install, the warranty PM plan allows for more customer up-time. The recommended PM tasks during the Warranty period require approximately 6 hours of applied

¹Original Equipment Manufacturer

²Planned Maintenance

maintenance time per year, divided into two Warranty PM schedules. The respective tasks for these schedules are included in the GEHC Service Manuals. The warranty PM is applicable only for the newer platform products.

B. Out of Warranty (IBOW) PM Schedule Concept: Once systems are beyond the 12 month after install warranty period, those systems adopt the lifecycle “out of warranty” (IBOW, or post-warranty) PM schedules. If the customer does not utilize a service contract, then refer to the PM schedules given in the system operator manual, see [MR system PM service schedule](#).

For customers with GEHC service contracts, the GEHC Field Engineer will follow GEHC recommended PM tasks as per the GEHC proprietary Advanced Service Methods Manual, to include Remote system performance or condition check options that support the customer in maintaining specified performance and image quality, in concert with maximized system availability.

C. Equipment Operation Check (EOC): Magnet Rundown Unit (MRU) LED check is defined as the Equipment Operation Check (EOC) for all GEHC MR Products. EOCs are not PMs, but rather are operational checks required by both customer operators and GEHC Field engineers (if the equipment is under GEHC contract) to ensure safety or equipment performance. EOCs are typically Customer Operator procedures, and procedure or finalization procedures that a GEHC Field engineer performs (if the equipment is under GEHC contract) IF they are present on-site and have performed maintenance.

China RoHS label directive

The following product pollution control information is provided according to SJ/T11364: Marking for the Restriction of the use of Hazardous Substances in Electrical and Electronic Products.



This symbol indicates the product contains hazardous materials in excess of the limits established by the Chinese standard GB/T 26572: Requirements of concentration limits for certain restricted substances in electrical and electronic products. The number in the symbol is the Environment-friendly Use Period (EFUP), which indicates the period during which the toxic or hazardous substances or elements contained in electronic information products will not leak or mutate under normal operating conditions so that the use of such electronic information products will not result in any severe environmental pollution, any bodily injury or damage to any assets. The unit of the period is "Year".

In order to maintain the declared EFUP, the product shall be operated normally according to the instructions and environmental conditions as defined in the product manual, and periodic maintenance schedules specified in Product Maintenance Procedures shall be followed strictly.

Consumables or certain parts may have their own label with an EFUP value less than the product. Periodic replacement of those consumables or parts to maintain the declared EFUP shall be done in accordance with the Product Maintenance Procedures.

This product must not be disposed of as unsorted municipal waste, and must be collected separately and handled properly after decommissioning.

Table 2-55: Table of hazardous substances' name and concentration (SJ/T 11364).

Component name	Hazardous substances' name					
	(Pb)	(Hg)	(Cd)	(Cr(VI))	(PVBB)	(PBDE)
Magnet	X	O	O	X	O	O
Patient Table	X	O	O	X	O	O
Systems Cabinet	X	O	X	X	O	O
Coils	X	O	O	X	O	O
Global Operating Console (GOC)	X	O	X	X	O	O
Chiller	O	O	O	O	O	O
Accessories (Uninterruptable Power Supply)	X	O	X	X	X	X
LCD Monitor	O	X	O	O	O	O

O: Indicates that hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.

X: Indicates that this hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572.

Data listed in the table represents best information available at the time of publication.

Applications of hazardous substances in this medical device are required to achieve its intended clinical uses, and/or to provide better protection to human beings and/or to environment, due to lack of reasonably (economically or technically) available substitutes.

Chapter 3: Equipment

This chapter includes information related to the MR system hardware.

[MR system startup and shutdown and TPS reset](#)

[Daily Automated Quality Assurance](#)

[Equipment components](#)

[TDI coils](#)

[System management](#)

[Guided Install](#)

STARTUP/SHUTDOWN

System startup and shutdown introduction

This section contains information on how to turn on and off and log into and out of your MRI system. It also includes quality control information to make sure your system is operating before scanning a patient and how to reset a subsystem of your scanner to safely recover from errors and various conditions.

Procedures

[Startup MR system](#)

[Logon/logout of the MR system](#)

[Change system default logon password procedure](#)

[System shutdown procedure](#)

[System power off/on](#)

[Emergency shutdown](#)

[Restart MR system](#)

[TPS reset](#)

[DAQA](#)

[Acquire a DAQA scan](#)

[Execute the DAQA SNR test](#)

[Execute the DAQA system test](#)

[View DAQA test trends](#)

[DAQA messages](#)

STARTUP/SHUTDOWN

System startup procedure

Startup from an extended shutdown

Use these steps if you have performed an [extended shutdown](#) procedure.

! The equipment room is typically used by service engineers to service the equipment. Use caution when inside the equipment room.

! Do NOT open any GE MRI System Cabinets or protective covers. There are dangerous high voltages within the cabinets.

There are several Cabinets and components within the equipment room used by the GE MRI System.

- The Main Disconnect Panel (MDP) is the in-coming Power for the MRI System. Do **NOT** turn off power to this component.
- The ISC¹ contains the PDU² for the MRI System.

Figure 3-1: ISC



¹Integrated System Cabinet

²Power Distribution Unit

Table 3-1: Image legend

#	Description
1	ISC
2	Main Breaker in On position, fully vertical.
3	EMO ¹ Reset button.

1. From the ISC, complete the following:
 - a. Open the small access door to view the Main Breaker and EMO button. See Figure 3-1.
 - b. Reset the breaker. Move the breaker from horizontal to On position (fully vertical). See 2 in Figure 3-1.
 - c. Press the **EMO Reset** button. See 3 in Figure 3-1
 - The EMO Reset button turns on power to the high voltage components and results in a blower and relay noise.
 - The system computer should automatically turn on.
2. If the computer does not automatically turn on, then complete the steps below in the Standard startup procedure.

Standard startup

Considerations

There are times during a system startup or reboot, that the MR system executes a thorough file integrity check (correcting corrupted files, bad blocks, capturing file system information for better analysis of issues, etc.). The startup or reboot can take as long as 40 minutes. The following criteria determines the check:

- If the system is not shut down in an orderly fashion, for example a power outage shuts down the computer.
- Every 120 days the system executes this thorough file integrity check.

Use these steps to turn on your MRI system.

1. Press the on/off button to turn the power on to the **computer**.
 - When power is on, the power indicator light is illuminated.
 - A message appears with a count-down to logon.
 - If you change your mind and decide to shut down at this point, click **System > Halt** from the Logon window.
2. Wait until all messages are removed from the screen to enter your logon name and password.
 - a. In the Logon Name field, type **sdc**.
 - b. In the Password field, type your password.
 - The GE system default password is **adw2.02.0**.
 - Your site can change the default password. For details, see [Change system default logon password procedure](#).
3. Select **Logon** from the Operation menu on the logon screen.
4. Select your name from the Username menu, type in your password, and click **OK**.
 - Use **Emergency logon** only if you do not have a user profile set up on the system.

¹EMergency stOp

- After a period of inactivity, you are automatically logged off. When you or another user logs back in, the system returns to its last known state.
- To manually log off, click **Tools icon arrow** and select **Lock Screen** from the menu.



If the ISC has been powered off, once power has been restored, wait 20 minutes before you begin scanning. Allowing 20 minutes for the electronics to warm up results in optimum system performance and image quality.



The default password changes to **adw2.02.0** in PX26.2 or later.

Related topics

[Shutdown MR system](#)

[Restart MR system](#)

[System startup and shutdown orientation](#)

STARTUP/SHUTDOWN**SIGNA Voyager: emergency stop recovery procedure**

Use these steps to recover normal system operation after an emergency-stop has occurred. For emergency stop details, see [Emergency stop](#) procedure.

1. Go into the equipment room and locate the ISC cabinet.



The equipment room is typically used by service engineers to service the equipment. Use caution when inside the equipment room.



Do NOT open any GE MRI System Cabinets or protective covers. There are dangerous high voltages within the cabinets.

2. From the ISC cabinet, press the EMO Reset button. Then the system will power on.

Figure 3-2: ISC



Table 3-2: Image legend

#	Description
1	ISC
2	Main Breaker in On position, fully vertical.
3	EMO ¹ Reset button.

¹EMergency stOp

3. Return to the operator console and complete a TPS Reset. For details, see [TPS reset](#).
4. After the TPS Reset is finished, the emergency-stop condition should be recovered. If the emergency-stop condition remains after the TPS Reset is finished, call your service engineer.

Related topics

[Shutdown MR system](#)

[Restart MR system](#)

[System startup and shutdown orientation](#)

STARTUP/SHUTDOWN

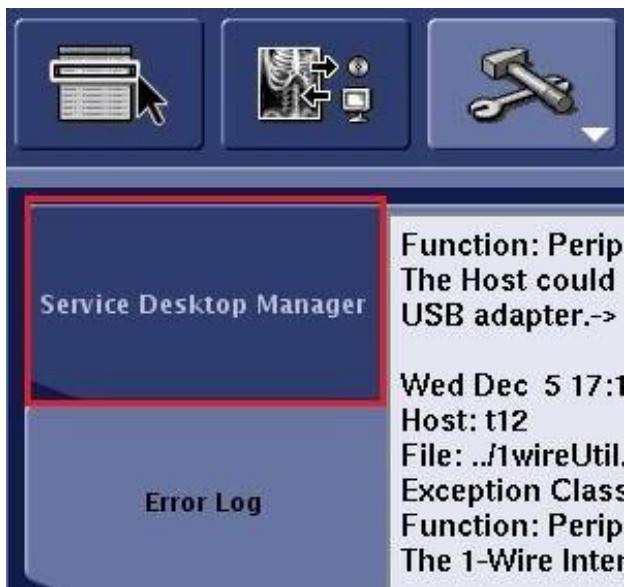
Skip system cool down shutdown procedure

Use these steps to turn off the system in an emergency when you want to skip the 60 minute cool down time.

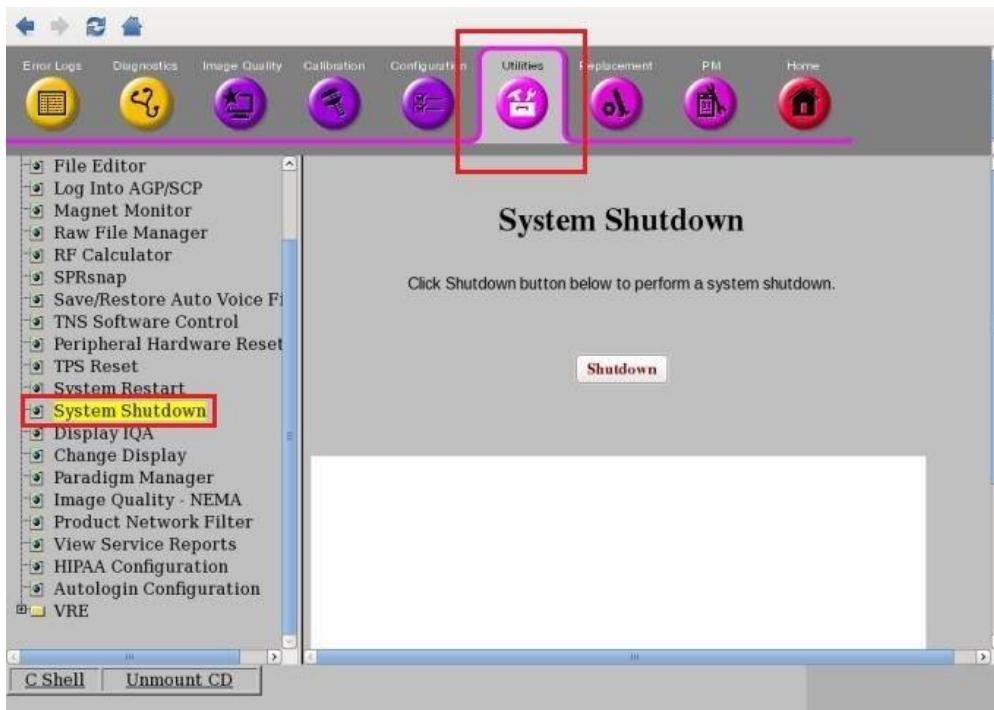


1. From the header area of the screen, click the *Tools icon*.
2. Click the *Service Desktop Manager* tab.

Figure 3-3: Service Desktop Management tab



3. From the Service Desktop Manager screen, click *Utilities* tab.
4. Select *System Shutdown*.

Figure 3-4: System Shutdown on Utilities tab

5. Complete the steps in Extended shutdown.



To restart the system, follow the steps in [Startup from an extended shutdown](#). Wait 60 minutes after the startup before you start to scan. Not waiting the 60 minutes could impact image quality.

Related topics

[Emergency shutdown](#)

[System startup and shutdown orientation](#)

Mobile startup procedure

Once the system has been configured, it does not need to be done again. Instead, you can start up the system following the steps below.

1. [Start up MR system](#).
2. Click the *Service Desktop manager* tab.
3. On the Service Desktop Manager, click **Guided Install**.
4. Select **GI: Mobile** in the program list and click **Start**.
5. At the root password prompt, type your password and press **Enter**.
 - operator is the default password. If your facility has changed the password, consult your site administrator.
6. Select a hospital/facility from the list at the Mobile Site Setup screen.
7. Click **Activate** on the Mobile Site Setup window.
8. Click **Activate Site**.

9. Click **Reboot** and press **Enter**.

10. [Start up MR system.](#)

Related topics

[System Startup and Shutdown orientation](#)

STARTUP/SHUTDOWN

System logon procedures

The logon feature requires you to log on to access your system. It can be turned on or off by your administrator.

How your site uses this feature depends on if your site has a central user repository to which the system is connected. Sites with networks are referred to as enterprise systems, those without are referred to as stand-alone systems. This feature can be used with either configuration, although some features are more applicable to enterprise systems.

After a period of inactivity set by your administrator, or after a user locks the screen, the system splash screen displays. Use these steps to log back in.

1. Type your logon Name.

2. Type your password.

3. Click **Logon**.

- Logging off does not prohibit other users from logging in. Logout is designed to protect patient privacy, not stop approved users from logging in.
- When you or another user logs back in, the system returns to its last known state.
- Note the GE logo area content changes based on your MR system
- If you have administrator privileges, when you log on you are asked if you wish to perform administrative tasks or scan. Do not click the button next to the Enter admin screen if you only want to scan.

Figure 3-5: Example of a Startup screen



Logon Name:

The Logon Name for your system. The default Logon Name is SDC. Your administrator can set-up a unique Logon ID for you through your hospital Enterprise system.

Password

A password assigned to you by the system administrator.

Related topics

[System logout procedure](#)

[System emergency logon procedure](#)

[System startup and shutdown introduction](#)

STARTUP/SHUTDOWN

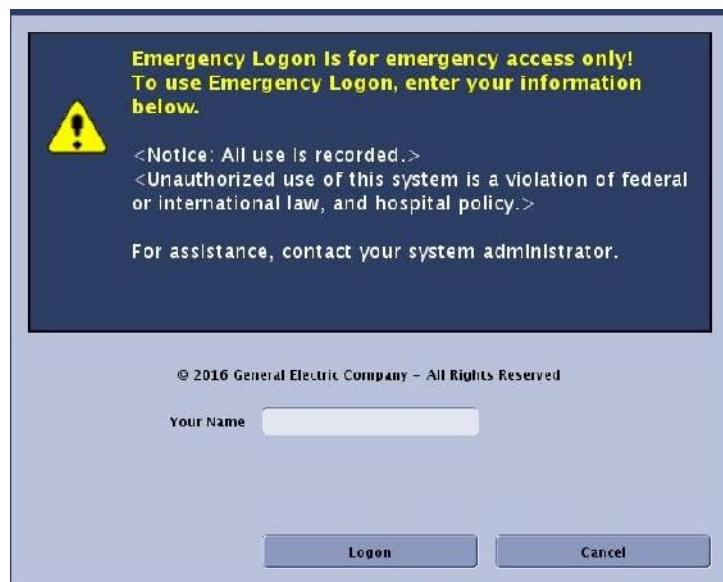
System emergency logon procedure

The splash screen may or may not display the Emergency Logon button. Turning this option on or off is set by your system administrator. When using Emergency Logon, you are prompted to enter your name, but there is no password.

Use Emergency Logon only if you do not have a valid account set up.

1. From the Emergency Logon screen, type any name in the **Your Name** text field.
2. Click **Logon**. One of two actions occurs:
 - The screen unlocks and displays the desktop that was last visible right before the screen was locked.
 - The system starts-up or re-boots.

Figure 3-6: Emergency logon



Related topics

[System logout procedure](#)

[System startup and shutdown introduction](#)

STARTUP/SHUTDOWN

System logout procedure

The procedure for logging out of the system has changed. Use these steps to lock the screen and switch the user of the system. When you or another user logs back in, the system returns to its last known state.

1. From the header area of the screen, click the **Tools icon**.
2. From the System Management work area, click the Service Desktop Manager tab.

Figure 3-7: Service Desktop Manager



3. From the Service Desktop Manager, click ***Lock Screen Switch User***.
 - The Logon screen displays for you to log on to the system.
 - Only users with valid accounts set up by the system administrator can log on to the system, unless the Emergency Logon Allowed feature is enabled.

Related topics

[System logon procedures](#)

[System startup and shutdown introduction](#)

STARTUP/SHUTDOWN

Change operating system password procedure

Use these steps to change the default GE password to a unique password for your facility. This is only required for systems that do not have the Signa Secure Advanced option.



1. In the header area, click the arrow next to the **Tools icon**.

Figure 3-8: Tools menu



2. From the Tools menu, click **Command Window**.
 - a. Type **su** to change to a root user.
 - b. At the Password prompt, type **operator**, which is the initial default.
 - c. If you do not want to change the password, then in step 3 proceed to sub-step c.
3. From the Command or C-shell window complete the following:
 - a. Type: **passwd <enter>**
 - Read the Attention message:



Please follow the documented procedure for changing and reporting this password. Failure to do so may inhibit the proper account access by authorized users and GE support personnel.

- b. Respond to the prompt, "Enter 1 to continue, 2 to cancel" and type: **1** <enter>
- c. Respond to the prompt for your existing password: **adw2.02.0** <enter>
- d. Type your new password using the guidelines below: **XXXX** <enter>
 - Must be 8 characters minimum.
 - Cannot be blank or left as the default.
 - Should contain a mix of numbers, alpha, and special characters.
 - Must not be made up solely of dictionary words.
 - Should not be the same value at different sites.
- e. Retype the new password: **XXXX** <enter>
 - Read the Attention message:



Please contact your local System Administrator, your local Service Representatives and your InSite Support Representative and inform them of this change. Please update all other hosts that share this account, change is effective for local host only.

4. To exit sdc level, type: **exit** <enter>



Note that once you change the password from the default "adw2.02.0" you cannot go back to that password.



The default password changes to **adw2.02.0** in PX26.2 or later.

Related topics

[Data Privacy introduction](#)

[System startup and shutdown introduction](#)

STARTUP/SHUTDOWN

System restart procedure

Considerations

There are times during a system startup or reboot, that the MR system executes a thorough file integrity check (correcting corrupted files, bad blocks, capturing file system information for better analysis of issues, etc.). The startup or reboot can take as long as 40 minutes. The following criteria determines the check:

- If the system is not shut down in an orderly fashion, for example a power outage shuts down the computer.

Use these steps to restart your MR system.

1. Make sure all of the images have reconstructed and are available for display from the Patient List.
2. Click **End Exam**, if necessary.
3. Wait for all Archive and Network functions to complete.
4. If you have a legacy MOD, detach and remove it from the MOD disk drive.
5. From the header area of the screen, click the Tools icon arrow and select **System Restart**.

Figure 3-9: Tools menu



- It may take up to 30 seconds for the system to respond.
6. When prompted, click the reason for the system restart: **Daily**, **Service**, **Other**, or **Cancel** to exit the restart of your system.

- The system displays a blue screen with the icon/status area at the beginning of shutting down.
- Wait for the Welcome to... logon window to appear. This indicates restart completion.

Related topics

[System startup and shutdown introduction](#)

STARTUP/SHUTDOWN

System shutdown procedure

Standard shutdown

Use these steps to perform a system shutdown, which terminates power to the system electronics in an orderly fashion so image files are saved. This procedure does not turn off power to the MRI magnet.

1. Make sure all images have reconstructed and are available for display from the Patient List.
2. End an exam, if necessary.
3. Wait for all archive, network, filming, CD/DVD, etc. functions to complete.
4. Remove any archive media, if necessary.
5. From the header area of the screen, click the **Tools** icon arrow and select **System Power off**.

Figure 3-10: Tools menu



6. When prompted, click **Yes**.
 - The applications begin to shut down, which can take up to 60 minutes. A pop-up window displays.
 -  System power off preparation takes up to 60 minutes for system cool down. During that time, please do not power off the system.

- When the shutdown is completed, the screen goes blank and the computer turns off.

Extended shutdown

Use these steps to execute an extended power shut down once the computer has successfully shutdown and the computer power is off.

! The equipment room is typically used by service engineers to service the equipment. Use caution when inside the equipment room.

! Do NOT open any GE MRI System Cabinets or protective covers. There are dangerous high voltages within the cabinets.

The Main Disconnect Panel (MDP) is the in-coming Power for the MRI compressor in the Integrated Cooling Cabinet (ICC). Do **NOT** turn off power to this component. It must remain on to keep the helium at the proper temperature to maintain correct magnet pressure.

- Confirm that the computer is turned off.
- From the ISC¹ complete the following:
 - Open the small access door to view the Main Breaker. See Figure 3-11.
 - Move the breaker to the horizontal position. See 2 in Figure 3-11.
 - Only the ISC is turned off. The ISC contains the Power Distribution Unit (PDU) for the MRI System. It results in noise as the relays and switches open.
 - Sumitomo compressor and coldhead remain on.

Figure 3-11: ISC

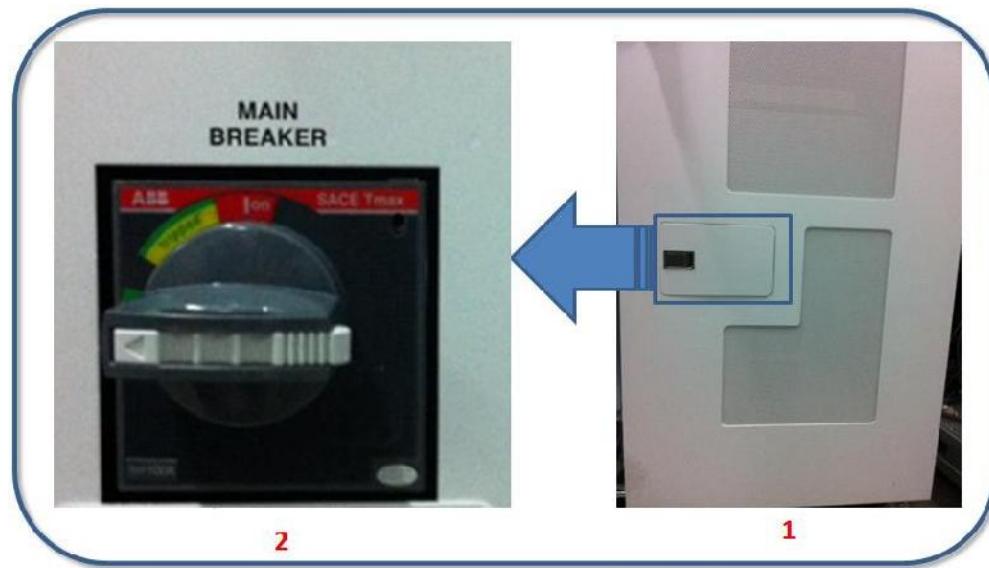


Table 3-3: Image legend

#	Description
1	ISC
2	Breaker in off position, fully horizontal.

¹Integrated System Cabinet

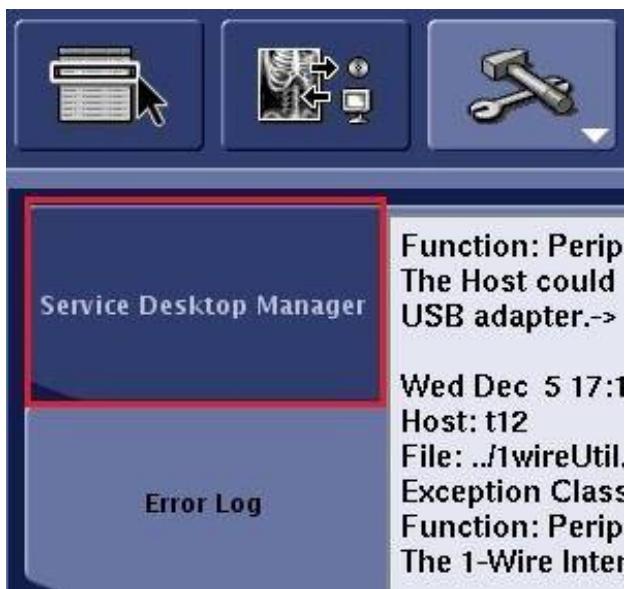
Skip system cool down shutdown

Use these steps to turn off the system in an emergency when you want to skip the 60 minute cool down time.

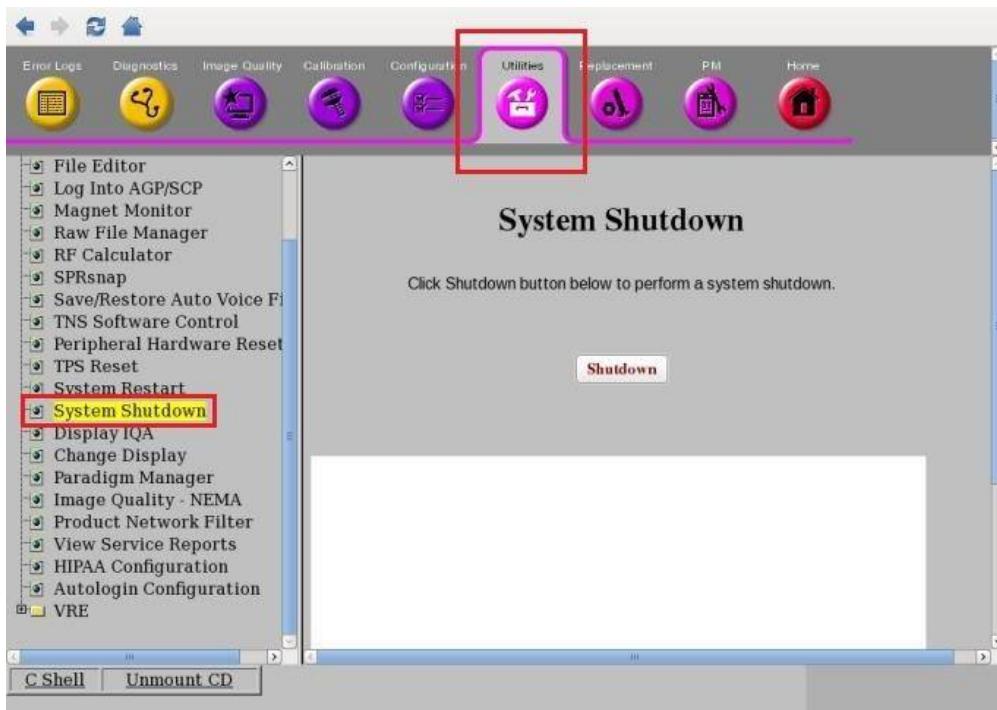


1. From the header area of the screen, click the *Tools icon*.
2. Click the **Service Desktop Manager** tab.

Figure 3-12: Service Desktop Management tab



3. From the Service Desktop Manager screen, click **Utilities** tab.
4. Select **System Shutdown**.

Figure 3-13: System Shutdown on Utilities tab

5. Complete the steps in Extended shutdown.



To restart the system, follow the steps in [Startup from an extended shutdown](#). Wait 60 minutes after the startup before you start to scan. Not waiting the 60 minutes could impact image quality.



The default password changes to **adw2.02.0** in PX26.2 or later.

Related topics

[Emergency shutdown](#)

[System startup and shutdown orientation](#)

STARTUP/SHUTDOWN

System Power Off/On procedure

Use these steps to save energy when the system is not expected to be in use for extended periods of time, such as evenings, weekends and holidays.

Power off or Overnight mode

1. Make sure all images have reconstructed and are available for display from the Patient List.
2. End an exam, if necessary.
3. Wait for all post processing, archive, network, filming, CD/DVD, etc. functions to complete.
4. Remove any archive media, if necessary.

5. From the header area of the screen, click the *Tools* icon arrow  and select **System Power Off**.

Figure 3-14: Tools menu



6. When prompted, click on the reason for the system shutdown: **Daily**, **Service**, **Other** or **Cancel** to exit the shutdown of your system.
7. From the computer housing, press the power button as indicated in Figure 3-15.
 - The application begins to shut down, which can take less than 15 minutes. A pop-up window displays.

-  System power off preparation takes less than 15 minutes for system cool down. During that time, please do not power off the system.
- The system displays a timer screen to count down until the system power is off.
- When the shut down/count down is completed, the screen goes blank and the computer turns off.

Power on

1. From the computer housing, press the button on the computer housing as indicated in Figure 3-15 (below).

Figure 3-15: Button restores power to computer



2. Wait until all messages are removed from the screen to enter your logon name and password.
 - a. In the Logon Name field, type **sdc**.
 - b. In the Password field, type **adw2.02.0**.
3. Select **Logon** from the Operation menu on the logon screen.
4. Select your name from the Username menu, type in your password, and click **OK**.
 - Use **Emergency logon** only if you do not have a user profile set up on the system.

STARTUP/SHUTDOWN

Emergency shutdown procedure

System overheating, smoke, or odor associated with the system are good reasons for an emergency power down.

1. Press any **Emergency Stop** button ([magnet cover](#), or [keyboard](#)) to remove power from the magnet room.
2. Evacuate the patient and all other personnel from the MRI suite.
3. Call service.
4. After service has examined the system, the cause of the emergency should be written down for future reference.



The MR Safety Guide operator manual that is shipped with your system contains more instructions on responding to patient emergencies.

Related topics

[System logon/logout procedures](#)

[System startup and shutdown orientation](#)

STARTUP/SHUTDOWN**TPS reset procedure**

Use these steps to reset the TPS when instructed by either a system message or an InSite technician.



1. In the header area of the screen, click the **Tools icon** to display the **System Management work area**.
2. Click the **Service Desktop Manager** tab.
3. From the Service Desktop Manager, click **TPS Reset**.
 - TPS reset aborts realtime or normal scanning.
 - During TPS Reset, the Scan desktop and Graphic Viewport are locked. This means that you cannot view/edit, save, cut, copy, paste, or download any series in the Workflow Manager.
 - The Rx state may change after a TPS reset.
 - The following warning message is displayed after TPS Reset has been selected if all images have not been reconstructed, "Image reconstruction is in progress. Pending images may be lost. Are you sure you want to start TPS Reset?".
 - For a multi-station group, if some (not all) series in that group have been scanned and then TPS Reset is started, all the series in that group will be locked and they cannot be downloaded or scanned again.
4. Click **OK**.
 - The TPS reset aborts reconstruction of pending images, Manual Prescan, Auto Prescan, Spectroscopy Prescan, Reference Scan, Prep Scan, and Normal Scan.
 - The bore fans and lights turn off during the TPS reset. When the reset completes, bore fans and lights return to their previous state.
5. Wait for the "TPS successfully reset" message in the system status display message box.
 - If the TPS reset fails, the following messages display:
 - "TPS Reset Failed. Please see the message log for more details".
 - "TPS/APG communication failed (s) A re-download of TPS may be necessary."
 - Click **OK** to acknowledge your response to the message.
 - If the TPS reset fails two consecutive times, the exam is automatically ended.
6. Continue scanning where the system left off.

Related topics

[Restart MR system](#)

[System startup and shutdown orientation](#)

DAQA

Scan phantom procedure

The DAQA¹ procedure provides a means for you to track overall system or RF² coil functionality. The application supports all GE coils that have the coil ID feature.

Considerations

! To obtain meaningful, reproducible data for a given RF coil, consistency and repeatability is key. Always use the same phantom, the same positioning of the phantom in the coil and the same landmark at the same location on the phantom/coil.

Table 3-4: Phantoms used in DAQA tests

Phantom name	Part number
1.5T TLT Head Sphere (Green)	46-265826G6
Body TLT Sphere Phantom	2135650
Body TLT Loader	2135652

1. Set up the desired coils and the phantom on the table. The coil and phantom you choose will depend on whether you are going to perform the **SNR** or **System** test.
 - a. Place the coil on top of the cradle and place the phantom holder and phantom inside the coil - in this example, the TDI Head Neck Array coil.

Figure 3-16: Place coil on cradle



- b. If you are using the body coil, use the Body TLT phantom and Loader. Follow the pictorial guidelines below to transport the phantom.

¹Daily Automated Quality Assurance

²Radio Frequency

Figure 3-17: Correct phantom transportation**Figure 3-18:** Incorrect phantom transportation

2. Landmark the coil and phantom.
3. Press **Advance to Scan**.
4. From the **Worklist Manager**, click the **New Patient icon**  to begin a scan.
5. In the New Patient area of the Worklist Manager, type **geservice** as the patient ID and **111** lbs (or 50 kg) as the patient weight.
 -  A higher weight than 50 kg for the phantom scan could cause system damage.
6. Click **Show Protocols** to open the Protocol screen.
7. Move a 3-plane localizer protocol from the Protocol list to the Multi-Protocol Basket and click **Accept**. For example, click **Template > 3-Plane 2D Localizer > FGRE**.
8. Click **Start Exam**.
9. Scan the 3-plane localizer.

10. When complete, click ***End Exam*** from the scan session tab.
11. Perform either the **SNR** or **System** test.

Related topics

[View DAQA test trends](#)

[System startup and shutdown orientation](#)

DAQA

SNR test procedure

The phantom remains in the magnet for this test. This test can be run with a variety of coil/phantoms/holders. The test will fail if you do not have the right coil/phantom/holder combination.

1. [Open the Service Desktop Manager.](#)
2. From the Service Desktop Manager, click **Service Browser**.
3. From the Image Quality tab, select **Daily Automated Quality Assurance**.
4. Click **Click here to start this tool** to open the tool and click **OK** to the prompt(s).
5. Verify that the **Ghosting Level and Geometric Accuracy** option is not selected.
6. Verify the currently connected RF¹ coil is displayed in the Selected Coil field.
 - If there is more than one coil configuration for the connected coil, select the desired coil configuration from menu.
 - If a coil is not plugged in, the tool will list the Body coil.
7. From Select Scan Plane menu, choose the desired SNR testing plane.
8. Click **Start** to initiate the test.
 - The Abort button stops data acquisition/post-processing before completion. When selected, the system may take up to 30 seconds to complete the abort process.
 - If the connected RF coil is changed after the DAQA tool has started, selecting the Start button displays a "Coil not Valid" message. Click **OK** and the tool refreshes the main user interface with the information of the new connected coil. Confirm the UI settings and click **Start** again to begin data acquisition.
9. Click **Yes** in the "Confirm!" window to acknowledge phantom placement and landmark.
 - A progress bar indicates the status.
 - The system collects one signal image and one noise image and displays the values for signal, noise, SNR, Transmit Gain (TG) in 0.1dB units and the center frequency (CF) in units of Hz in the Test Complete window.
10. Record the results and click **OK** to the prompt.
11. Click **Exit**.

Related topics

[Acquire a DAQA scan](#)

[Execute the DAQA system test](#)

[View DAQA test trends](#)

[System startup and shutdown orientation](#)

¹Radio Frequency

DAQA

System test procedure

The DAQA¹ System test is run using the head TLT² sphere and one of the TDI Head Neck Array coil.



If you do not use the head TLT sphere placed in the appropriate positioner (pad or holder) and centered properly, then the test will fail.

1. [Open the Service Desktop Manager.](#)
2. From the Service Desktop Manager, click **Service Browser**.
3. From the Image Quality tab, select **Daily Automated Quality Assurance**.
4. Click **Click here to start this tool** to open the tool and **OK** to the prompt(s).
5. Select the **Ghosting Level and Geometric Accuracy** option.
 - The Selected Coil and Selected Scan Plane fields are unavailable.
6. Click **Start** to initiate the test.
 - The Abort button stops data acquisition/post-processing before completion. When selected, the system may take up to 30 seconds to complete the abort process.
 - If the connected RF coil is changed after the DAQA tool has started, selecting the Start button displays a "Coil not Valid" message. Click **OK** and the tool refreshes the main user interface with the information of the new connected coil. Confirm the UI settings and click **Start** again to begin data acquisition.
7. Click **Yes** to the "Confirm!" message to acknowledge the correct coil and phantom use.
8. Click **Yes** in the next "Confirm!" message to acknowledge the phantom placement and landmark.
 - A progress bar indicates the status.
 - The system acquires three signal images from all three planes and one axial noise image. The axial signal image is used to calculate center frequency, transmit gain, SNR, ghosting, and geometric accuracy. The noise image is used to calculate SNR. The sagittal and coronal images are used to calculated geometric accuracy. The results display in the Test Complete window.
9. Record the results and click **OK** to the prompt.
10. Click **Exit**.

Related topics

[Acquire a DAQA scan](#)

[Execute the DAQA SNR test](#)

[View DAQA test trends](#)

[System startup and shutdown orientation](#)

¹Daily Automated Quality Assurance

²Top Level Test

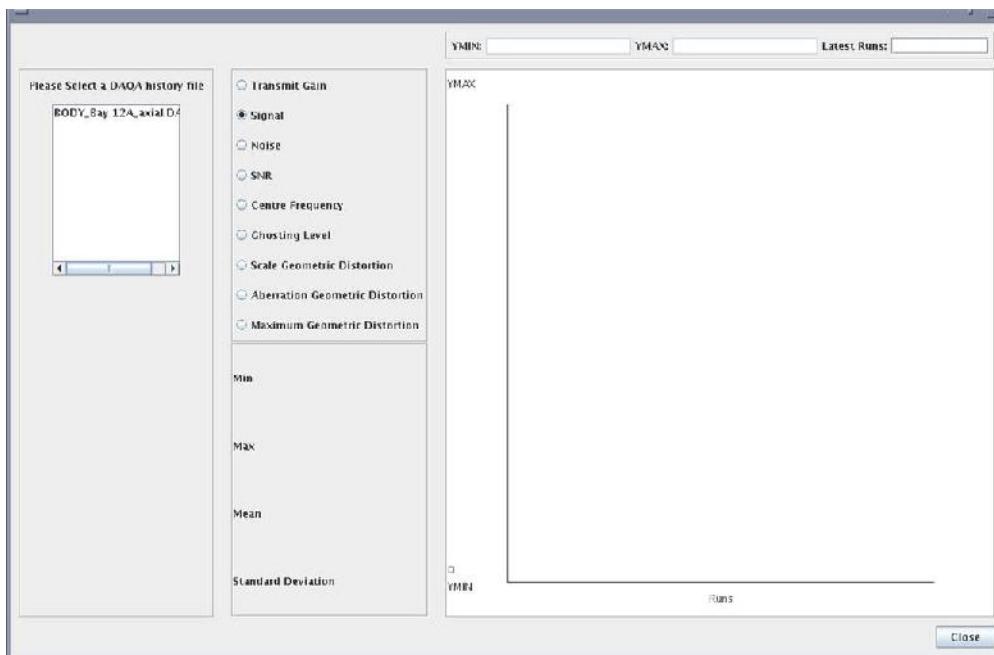
DAQA

DAQA trend setting procedure

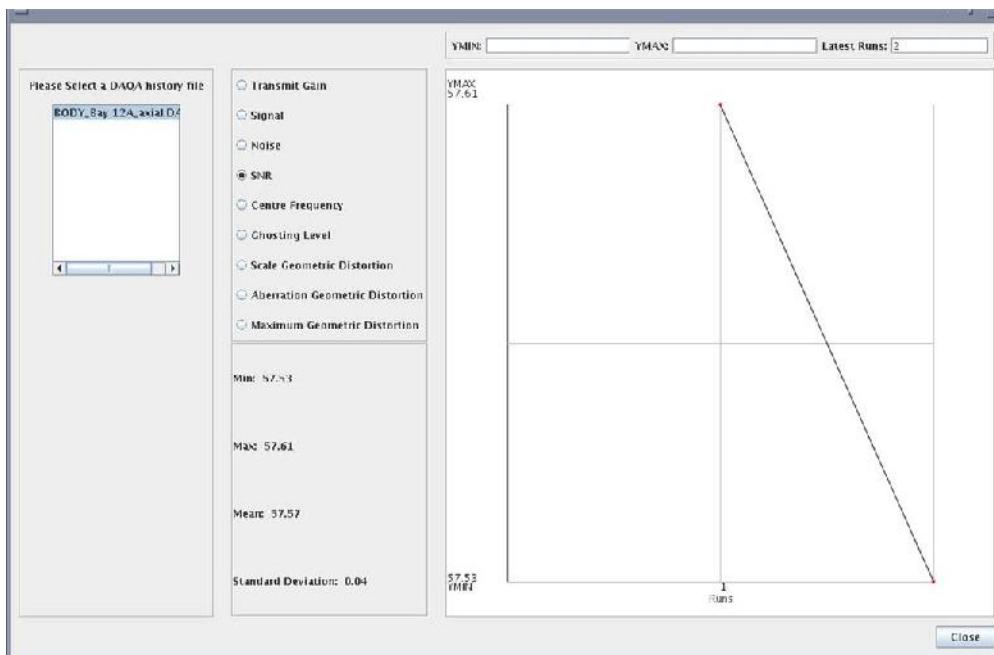
Use these steps to view the trends of your DAQA tests.

1. [Open the Service Desktop Manager](#).
2. On the Image Quality tab, select **Daily Automated Quality Assurance** to view the Daily Automated Quality Assurance.
3. Click **Click here to start this tool** to open the tool and click **OK** to the prompt(s).
4. Click **Trend Data** to view the Trend Viewer screen.

Figure 3-19: Trend Viewer screen



5. Click one of the coils and one of the items in the Result File list to view the trend graph.

Figure 3-20: Trend graph

6. Click any of the available option buttons to view a unique graph, which is representative of the option label.
7. Click **Close** to close the Trend Viewer screen.

Related topics

[Acquire a DAQA scan](#)

[Execute the DAQA SNR test](#)

[Execute the DAQA system test](#)

DAQA

DAQA messages

The following table displays the content of DAQA messages.

#	Message
1.	A different coil is connected! Please re-select the coil and plane before hitting [Start].Coil not valid.
2.	A different coil is connected! This coil is also not supported by Daily QA Tool. Please plug in a valid supported coil before hitting [Start].Coil not valid.
3.	Aberration Geometric Distortion
4.	Abort
5.	ATP execution has hung, please check atp process or the scanner hardware
6.	but was called with incorrect input arguments., ...
7.	Center not within the object. This algorithm works best for convex objects. Very likely that your results are in error
8.	Center Frequency
9.	Close
10.	Coil configuration notice
11.	Daily Automated Quality Assurance
12.	Daily QA Tool aborted on date_time
13.	Do you really want to abort the current scan?','Abort?
14.	ERROR
15.	Error building SVAT file for manual prescan.
16.	Error building SVAT file to load the protocol.
17.	Error editing the protocol for COIL
18.	Error editing the protocol for FOV
19.	Error editing the protocol for GRADMODE
20.	Error editing the protocol for PLANE
21.	Error editing the protocol for SWAPPF
22.	Error executing the SVAT script to load the protocol.
23.	Error executing the SVAT script to run Auto-Prescan.
24.	Error executing the SVAT script to run first image scan.
25.	Error executing the SVAT script to run Manual-Prescan.
26.	Error executing the SVAT script to run second image scan.
27.	Error from get_coilid function.
28.	Error from read_coil_id_list function.
29.	Error with abort_svat function
30.	ERROR with APS_EVENT svat command
31.	ERROR with DOWNLOAD svat command

#	Message
32.	ERROR with DOWNLOAD svat command, scanner busy
33.	ERROR with IPG_ADVANCE_TOSC svat command
34.	ERROR with LOADPROTOCOL svat command
35.	ERROR with MODIFY_CV svat command
36.	ERROR with MPS_SCAN_TR svat command
37.	ERROR with NEW_EXAM svat command
38.	ERROR with PROTOCOL_DIR svat command
39.	ERROR with PROTOCOL_MODE svat command
40.	ERROR with PSC_UPDATE_VAL svat command
41.	ERROR with RECON_STOPPED svat command
42.	ERROR with RESET_SCAN svat command
43.	Error with reset_svat function
44.	ERROR with SCAN_EVENT svat command
45.	ERROR with START_LOOP_EVENT svat command
46.	ERROR with STOP_LOOP_EVENT svat command
47.	Error with table_wait_time function
48.	ERROR with VIEW_EDIT svat command
49.	Error! Cannot find the phantom!
50.	Error! Two test images do not have the same size!
51.	Exit
52.	Ghosting Level
53.	Ghosting Level & Geometric Accuracy
54.	Images: too Few Inputs
55.	Images: too Many Inputs
56.	Incomplete Rx, please check coil and landmark
57.	Max
58.	Maximum Geometric Distortion
59.	Mean
60.	Min
61.	No
62.	No P files found!!!
63.	No valid landmark
64.	Noise
65.	Note: Phantom placement and coil landmarking are critical for repeatable results. Verify coil and phantom are properly placed and landmarked at correct location. Also verify there are no large air bubbles in the phantom. Do you wish to continue?
66.	OK

#	Message
67.	Only system configuration is allowed for ghosting level option. Make sure you landmark on this configuration or unselect ghosting level option. SNR is measured on Axial plane
68.	Please Select a DAQA history file
69.	Please select the coil ! Select Coil
70.	Please select the coil and scan plane! Select Coil & Plane
71.	Please wait at least 15 minutes before scanning to prevent swirling artifacts. Do you wish to continue?
72.	Please wait while the DAQA initializes..
73.	Protocol download failed
74.	Result Files
75.	Scale Geometric Distortion
76.	Select coil
77.	Select Scan Plane
78.	Signal
79.	SNR
80.	Standard Deviation
81.	Start
82.	Success: Center within the object!!!
83.	Sufficient Data is not available for trending. Atleast two runs of the DAQA tool is required.
84.	Table check has hung, please check table_feedback process or the scanner hardware
85.	Test Completed
86.	Test Completed
87.	Test Completed! Results are recorded in output file
88.	Test proceeds without at least 15-minute waiting time. Test result might not be stale' 'Test proceeds without enough waiting time
89.	The current coil is not supported by Daily QA Tool. Please plug in a valid supported coil before hitting [Satrt].Coil not valid.
90.	There is not that many files listed !!!
91.	There might be artifacts on the test images or you are not using homogeneous phantoms!
92.	Transmit Gain
93.	Trend Data
94.	Trend Viewer
95.	Wait for a minute after moving the table
96.	Yes
97.	You chose to include ghosting level and geometry accuracy in addition to SNR in the test. The test will use connected coil configuration and 17 cm sphere phantom with loader if Head Coil is used, otherwise 17 cm sphere phantom without loader. Do you want to continue?
98.	You chose to include ghosting level and geometry accuracy in addition to SNR in the test. The

#	Message
	test will use connected coil configuration and 27 cm sphere phantom with a loader. Do you want to continue?
99.	You chose to use connected coil configuration and Axial plane. Please make sure that you use a 17 cm sphere phantom with loader if Head Coil is used, otherwise 17 cm sphere phantom without loader. Do you want to continue?

Related topics

[DAQA procedure](#)

[DAQA SNR test procedure](#)

[DAQA System test procedure](#)

EQUIPMENT COMPONENTS

Equipment components introduction

This section helps you to become familiar with your MR system, including the system components and hardware.

Concepts

Others

[Computer concept](#)

[Emergency Stop and Abort scan buttons concept](#)

[Equipment cabinet room concept](#)

[Gradient coils concept](#)

[In-room Display concept](#)

[Keyboard concept](#)

[Magnet controls concept](#)

[PAC concept](#)

[Patient alert system concept](#)

[RF coils concept](#)

[Table concept](#)

[Workstation introduction](#)

[System specifications concept](#)

TDI coils

[TDI introduction](#)

[TDI Safety concept](#)

[Coil configurations concept](#)

[PA, Head Neck Array, and AA component patient position procedure](#)

[PA component patient position procedure](#)

[Two AA component patient position procedure](#)

[Whole body patient position procedure](#)

Procedures

Coil

[Coil malfunction considerations](#)

[Coil signal non-uniformity considerations](#)

[Connect coils procedure](#)

[In-room monitor](#)

[In-Room Display concept](#)

[In-Room display coil screen](#)

[In-Room display gating screen](#)

[In-Room display patient setup screen](#)

[In-Room display scan time and table location screen](#)

[Setup In-Room display procedure](#)

[Reset In-Room monitor touch screen procedure](#)

[Set-up patient information from In-Room Display procedure](#)

[Patient comfort](#)

[Patient alert procedure](#)

[Patient comfort procedure](#)

[Others](#)

[Mouse controls concept](#)

[Magnet Rundown Unit test procedure](#)

[Phantom breakage causing spillage considerations](#)

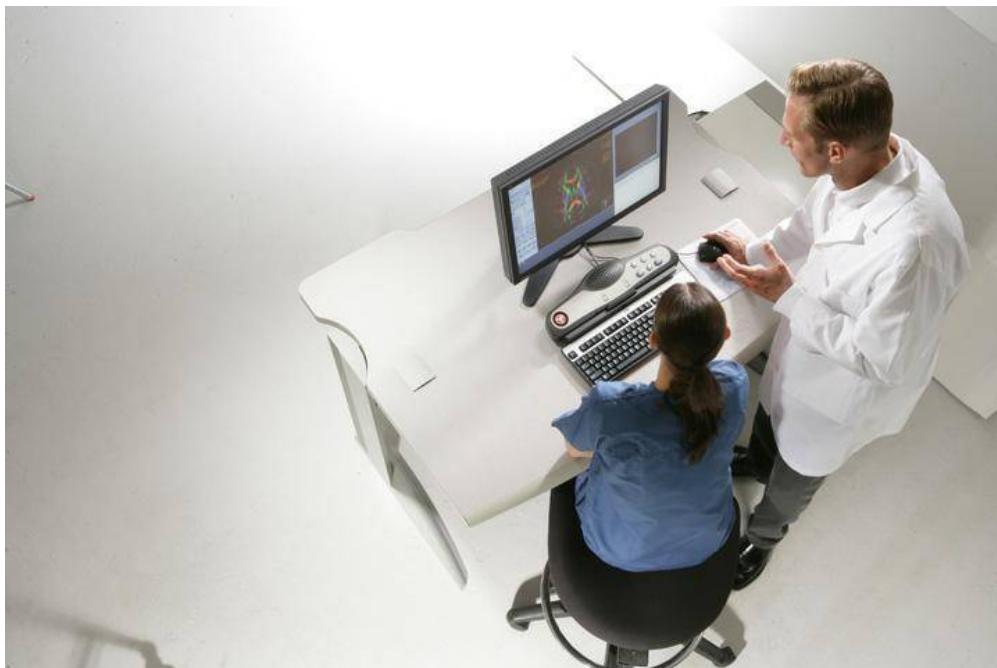
EQUIPMENT COMPONENTS

Workstation introduction

The workstation monitor displays images and scan, display, archive, network, service, and *iLink* programs. It also displays protocol notes and physiological waveforms when they are activated. AutoView is always displayed in the upper right area of the monitor. All routine operations are carried out from this workstation monitor.

The monitor can be raised and lowered, tilted forward or backward, or rotated left to right. Adjust the monitor's height and tilt for a comfortable viewing position.

Figure 3-21: MR Workstation



Concepts

[Computer concept](#)

[Keyboard concept](#)

[Mouse controls concept](#)

Related topics

[Equipment orientation](#)

[In-room monitor](#)

EQUIPMENT COMPONENTS

Computer concept

The computer is located in the cabinet stored below the desk.

Figure 3-22: Dell T5810 System computer



Table 3-5: Image legend

#	Description
1	Insert a pin or ballpoint pen to press the button in the hole to reset the computer when the on/off button doesn't work.
2	USB ports that can be used when exporting images or importing jpgs to add to a Protocol Note .
3	Power on button.
4	The CD/DVD drive that is used by service to install software and the operator manual. The Read/Write CD/DVD drive is used to burn CDs or DVDs when using the CD/DVD for image storage, the Data Export , or the Protocol Exchange options.

Figure 3-23: Dell T5820 System computer

Table 3-6: Image legend

#	Description
1	Power on button.
2	USB ports that can be used when exporting images or importing jpgs to add to a Protocol Note .
3	The CD/DVD drive that is used by service to install software and the operator manual. The Read/Write CD/DVD drive is used to burn CDs or DVDs when using the CD/DVD for image storage, the Data Export , or the Protocol Exchange options.

Procedure

[System startup procedure](#)

[System Power Off/On procedure](#)

[Related topics](#)

[Equipment components](#)

EQUIPMENT COMPONENTS

Keyboard concept

The **keyboard** contains all the keys you would find on any computer keyboard along with a few specialized buttons along the top. Standard keyboard keys and their functions include:

- **Delete** or **Backspace** erases characters
- **Enter** confirms what is typed or selected
- **Tab** moves across the areas on the current screen
- **Up** or **Down** arrow keys move between text boxes or adjust window width or window level

Figure 3-24: Keyboard auxiliary keys

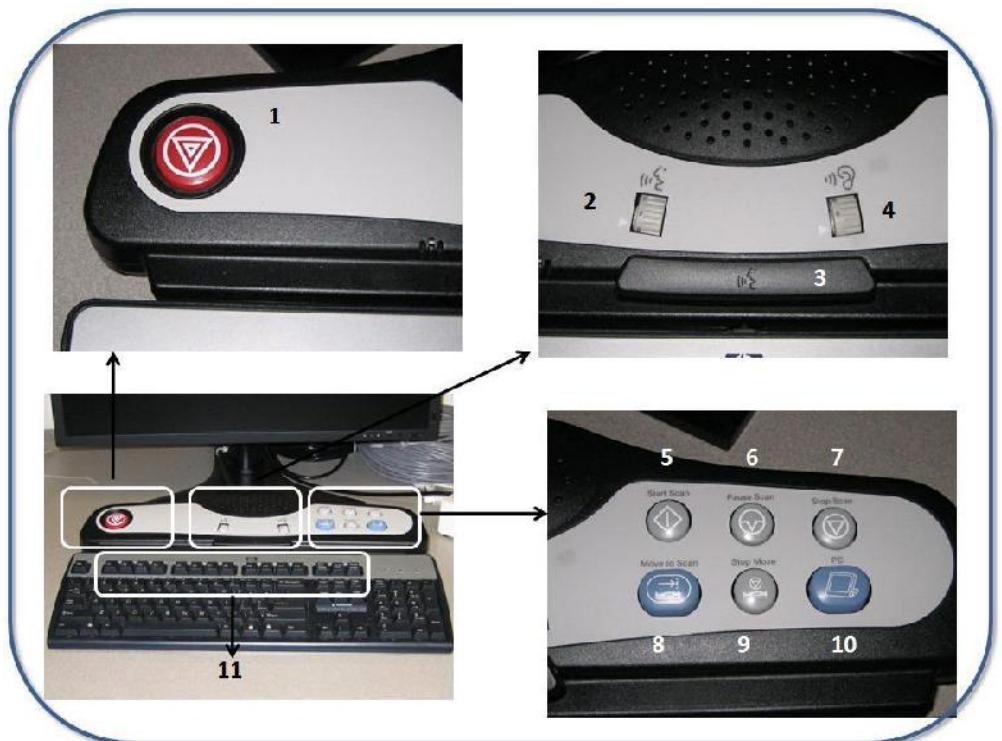


Table 3-7: Keyboard

#	Selection	Description
1	Emergency Stop	Disables all electrical power sources near the patient. It shuts down the RF ¹ , gradient amplifier, table movement, shim power supply, and main MRI magnet power supply cabinets. It will not quench the magnet or turn off the computer.
	eIFU	The eIFU symbol located by the Emergency Stop button (not shown in photo).



Figure 3-25: The new Emergency Stop button appearance

¹Radio Frequency

#	Selection	Description
		indicates that there are electronic instructions for use on your MR system. For details, see online help .
		Figure 3-26: eIFU symbol 
2	Volume Control	Regulates the patient in bore volume for the patient communication system.
3	Talk	Activates the intercom system so you can speak to the patient inside the bore. Press to talk, release to listen.
4	Volume Control	Regulates the MR operator console volume for the patient communication system.
5	Start Scan	Resumes scanning after pause or breath hold techniques.
6	Pause Scan	Stops the scan temporarily.
7	Stop Scan	Aborts a scan or prescan. Scan data is not saved or reconstructed.
8	Move to Scan	Moves the cradle to scan position when pressed.
9	Stop Move	Stops the cradle movement when pressed.
10	PC Icons	Inactive.
11	Function Keys	Activates shortcuts in certain features.

Related topics

[Computer concept](#)

[Equipment orientation](#)

EQUIPMENT COMPONENTS

Mouse controls concept

The mouse is a hand-operated device that you maneuver across the surface of a pad. As you move it, the on-screen cursor mimics the movement of the mouse, allowing you to move among windows and menus. For instance, moving the mouse to the right causes the on-screen cursor to move to the right. The mouse is used to make selections by clicking the left, right, and middle buttons.

Figure 3-27: Mouse



or



Table 3-8: Mouse image legend

#	Description
1	Left button
2	Middle button or scroll wheel
3	Right button

For mouse button actions see [About this manual](#).

Related topics

[Equipment orientation](#)

EQUIPMENT COMPONENTS

Equipment cabinet room concept

The equipment cabinet room houses the *PDU*¹, *RF*², power amplifiers, gradient amplifiers, and system control cabinets. The water chiller, shield cooler compressor, and other equipment is also located here. This room is often referred to as the Computer room because it used to house the computer; however, the computer is now in the [console room](#).

This room is usually kept at very cool temperature in order to keep the equipment from overheating. If you have any questions about the temperature settings, or the equipment kept in this room, please consult your service engineer.

Related topics

[Equipment orientation](#)

[Gradient coils](#)

¹Power Distribution Unit

²Radio Frequency

EQUIPMENT COMPONENTS

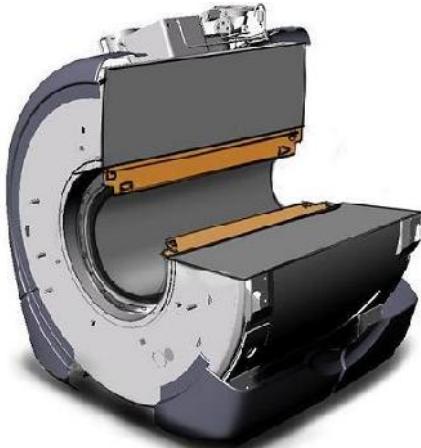
Gradient coils concept

The **gradient coils** are three sets of wire coils wrapped around a fiberglass cylinder located within the magnet housing. Electric current flows through the coils and is turned on and off very rapidly, thereby producing expansion and contraction of the gradient coils. This expansion and contraction creates the tapping sound when scanning. It is commonly measured in gauss per centimeter.

Each coil affects a different plane (the XY, YZ, or XZ plane), as it is turned on and off at different points in a pulse sequence. The scan plane and pulse sequence selected determine which gradient functions as the slice selective, phase encoding, and frequency encoding gradient. The system calculates this automatically.

The gradients are resistive magnets and are water cooled by the gradient chiller located in the [Equipment cabinet room](#).

Figure 3-28: Cut away of gradient coil inside the body coil



Related topics

[Equipment orientation](#)

[RF coils](#)

EQUIPMENT COMPONENTS

RF coils concept

Imaging coils are tuned to match the precessional frequency of nuclei under evaluation. Generally, the length of coil is equal to the *FOV*¹ the coil covers. The depth of penetration is governed by the coil elements. When selecting a coil, keep in mind the FOV, how deep you need to image, and the size of the patient. Phased array and surface coils need to be placed close to the area of interest. The broad category of imaging coils can be classified into two categories:

- transmit and receive coils
- receive only coils



Each coil, other than the body coil, has an operator manual. Refer to the coil operator manual when setting up the patient for an exam.

TDI Head Neck Array

The TDI Head Neck Array is a receive only coil. It provides higher *SNR*² than the **Body** coil due to the smaller size. It is used primarily to image the head, although they can be used for imaging any body part that fits into the coil. It is an example of a volume (uniform depth of signal) coil.

Figure 3-29: Head Neck Array

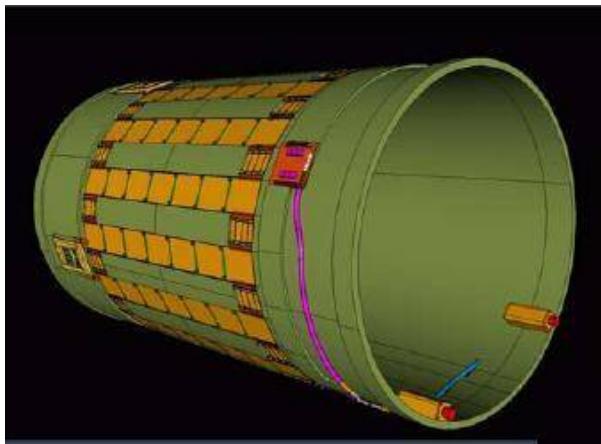


Body coil

The **Body** coil is a transmit/receive volume coil used for large FOV imaging and for uniform depth penetration. The **Body** coil is located within the magnet enclosure and is invisible to you and the patient. The **Body** coil can also act as a transmit only coil when used with receive only coils.

¹Field Of View

²Signal-to-Noise Ratio

Figure 3-30: Body coil

Surface coil

Surface coils are receive only coils that can be either single or multiple channels. Phased array (multi-channel) coils have a number of coil elements combined together to increase SNR, and depending on the coil design, may increase available FOV (either length or depth) without decreasing SNR. Flat surface and phased array coils do not have uniform depth penetration.

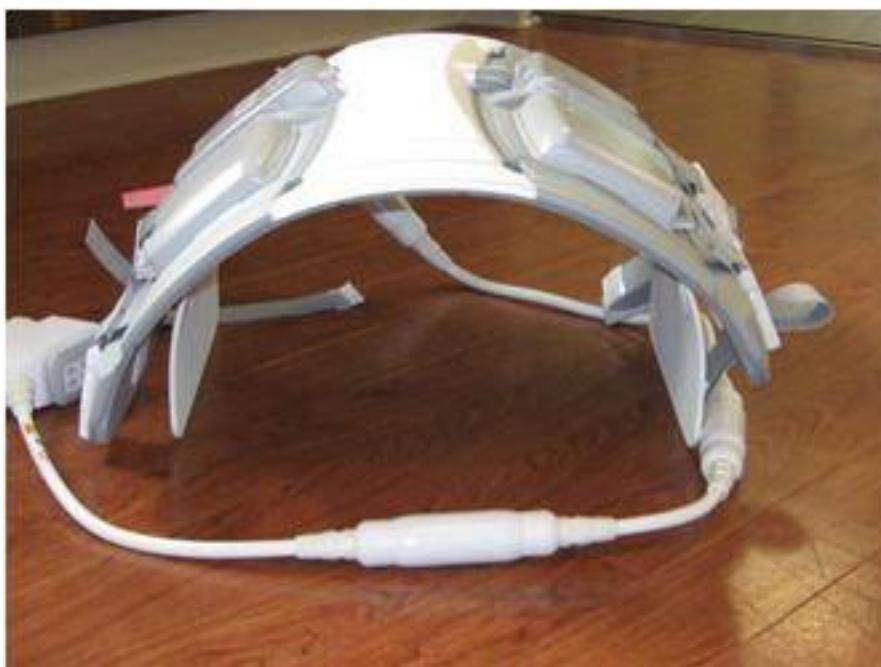
The transmit mode of the coil appears on a label adhered to the coil. A T/R label refers to a transmit/receive coil.



There are some coils commonly referred to as surface coils, such as the Knee coil, that are in fact transmit/receive coils. Therefore, technically, they are not a surface coil.

Multi-channel surface coils can help you improve productivity, a crucial consideration in today's competitive scanning environments. These devices can be optimized for parallel imaging techniques, improved SNR, and can provide better image resolution. Parallel imaging techniques, like **ASSET** or **ARC**, reduce scan times, which can decrease patient exam times. Reduced coil diameter together with multi-channel phased array elements over a given volume increase SNR and thereby resolution.

Figure 3-31: Multi-channel coil



Procedures

[Connect coils procedure](#)

[Patient position procedure](#)

[RF coil connector](#)

Related topics

[Equipment orientation](#)

EQUIPMENT COMPONENTS

Connect coils procedure

Coils can be plugged into coil ports located at either the foot or the head end of the table. All coils have a coil ID. There are two purposes for Coil ID: matching the coil plugged in with the selected coil in the prescription, and checking if the coil is properly seated in the port.

Multi-channel coils

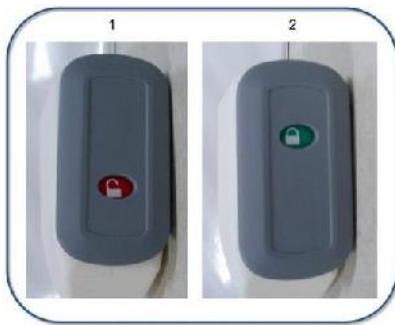
1. Place the lock face in the unlock position.
2. Insert the coil plug into a port located at either the head or the foot end of the table.
 - Transmit/receive coils can only be plugged into Port 2 (labeled P2).

Figure 3-32: Head end of table with two (P1 and P2) coil ports and foot end has one coil port (P4)



3. Lock the connector plug by rotating the spindle handle until the Lock symbol is visible.

Figure 3-33: P connector, 1 = unlock, 2 = lock



Related topics

[Coil Selections screen](#)

[Equipment orientation](#)

[RF coil connector](#)

[RF coils](#)

EQUIPMENT COMPONENTS

Coil malfunction considerations

Coil decoupling mechanisms are circuits activated by diodes to prevent RF^1 currents from flowing in the receive-only coil during transmission from the **Body coil**. This results in local distortion of the transmit field and signal intensity variations within the image.

If you suspect a coil malfunction, consult your service engineer and discontinue use of the coil.

Figure 3-34: Coil malfunction



Related topics

[Equipment orientation](#)

[Annefact](#)

[Coil non-uniformity of signal](#)

[Shading](#)

[Star artifact](#)

¹Radio Frequency

EQUIPMENT COMPONENTS

Coil signal non-uniformity considerations

The **RF¹** receiver detects signals closest to it most efficiently. This characteristic may cause a non-uniformity of signal in the image. The effect is more pronounced with surface coils than with volume coils, appearing as localized bright areas close to the coil. Signal variability may also result in incomplete fat suppression when chemical fat suppression techniques are used.

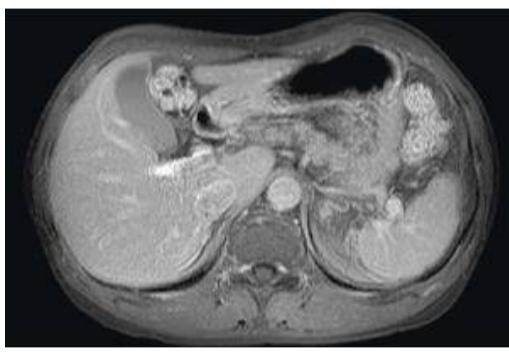
To minimize the chance of non-uniformity of signal in a coil:

- try a different coil or use a **STIR** sequence rather than trying additional fat saturation techniques
- apply a coil intensity correction technique, such as **PURE**.
 - PURE can be used with compatible surface coils
 - PURE can also be used with the 8-channel transmit/receive high resolution **MRI Devices Knee coil**

Figure 3-35: Uncorrected image



Figure 3-36: PURE corrected image



Related topics

[Equipment orientation](#)

[Annefact](#)

[Coil malfunction](#)

[Coil shading artifacts](#)

[Star artifact](#)

[Tips for reducing artifacts when scanning with surface coils](#)

¹Radio Frequency

EQUIPMENT COMPONENTS

In-Room Display concept

The IRD¹ is a shielded touch panel color monitor. The monitor and scan room interface provides immediate feedback on patient information, preparation, coil setup, coil connectivity, and gating information.

Figure 3-37: In-room monitor located on both sides of the magnet front



¹In-Room Display

Figure 3-38: In-room display

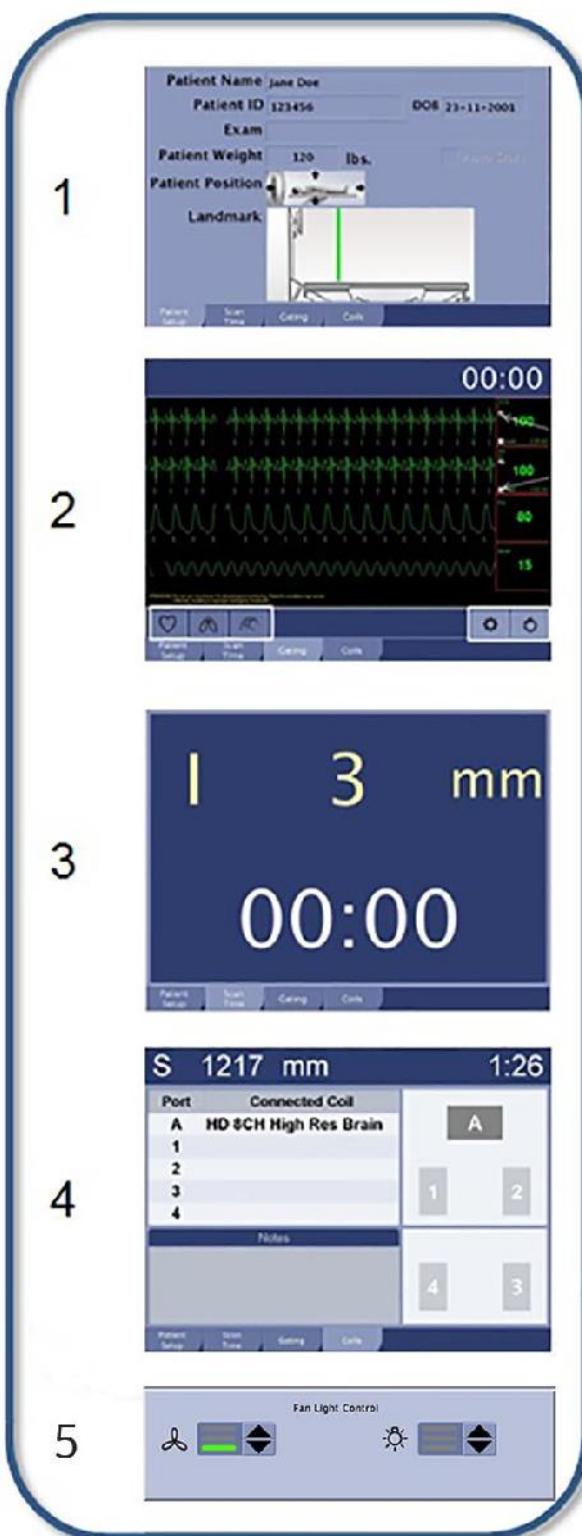


Table 3-9: In-room display monitor description

#	Description
1	Patient information display
2	Waveform display
3	Scan time and scan location information
4	Coil selection information
5	Bore fan and light control

Procedures

[In-room display setup](#)

Related topics

[Equipment orientation](#)

[In-room monitor patient setup screen](#)

EQUIPMENT COMPONENTS

In-Room display coil screen

Figure 3-39: Coil screen with floating coil

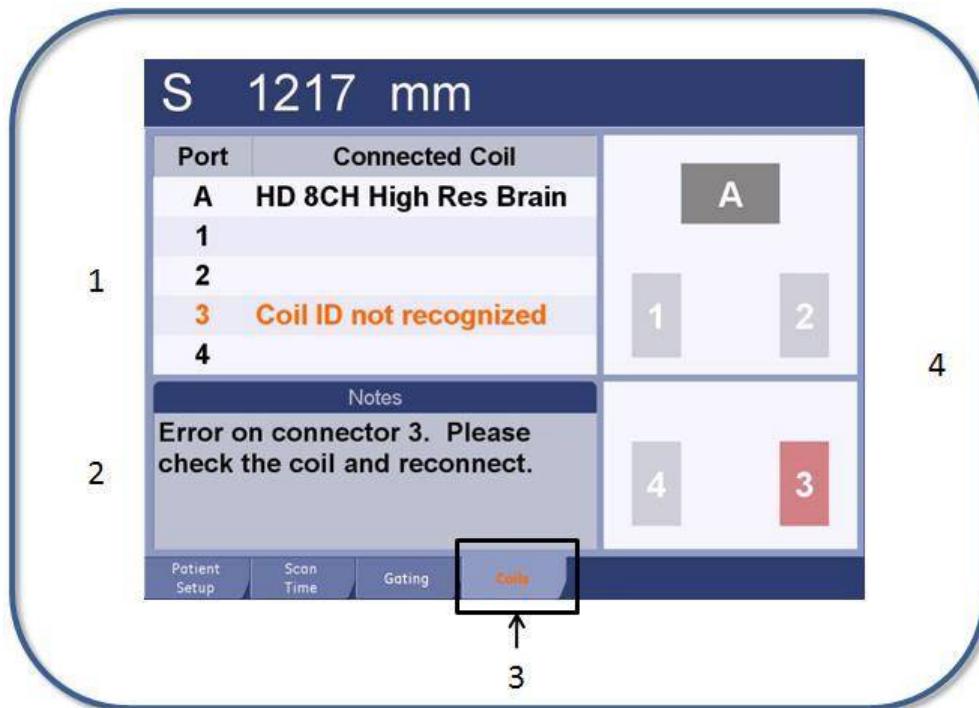


Table 3-10: Coil screen selections

#	Description
1	<p>Port column:</p> <ul style="list-style-type: none"> Indicates the port in which the coil is plugged into. <p>Connected Coil column:</p> <ul style="list-style-type: none"> Black text indicates that the coil is connected. Orange text indicates that there is an operator action required. Red text indicates that there is an error condition.
2	<p>The Notes area displays coil messages or incompatibilities. Orange text indicates an operator action is required.</p> <ul style="list-style-type: none"> You can have multiple coils connected and only one of the coils requires an action, which will be indicated in orange. You can have both coils in black text, and have an error. This scenario occurs when you have two coils plugged in that are incompatible.
3	<p>If Coil tab is orange consider the following:</p> <ul style="list-style-type: none"> There is an operator action required, which is posted in the Notes area. You cannot proceed to scan until "Coil" in the tab is no longer orange.

#	Description
	<p>Figure 3-40: Coil tab is not orange</p> <ul style="list-style-type: none"> The scan time is not displayed in the upper right corner of the display because you cannot proceed to scan when Coil is orange.
4	<p>Figure 3-41: Coil port area is a representation of the coil connectors</p> <p>Color scheme</p> <ul style="list-style-type: none"> Green ports indicate a coil is plugged in or active. Orange blinking or flashing ports indicate that an action must occur before the coil can become active. Red ports indicate an error condition. <p>Notes are displayed at the bottom of the screen to identify the problem.</p> <p>Number system</p> <ul style="list-style-type: none"> P1 represents the left coil port located at the head end of the patient table. See Figure 3-40 to note a green port that indicates it is active.

#	Description
	<ul style="list-style-type: none">● P2 represents the right coil port located at the head end of the patient table. See Figure 3-39 to note an orange port that indicates an error state because the coil has not yet been defined.● P4 represents the left coil port located at the foot end of the patient table.

Related topics

[Equipment orientation](#)

[RF coil connector](#)

[In-room display concept](#)

[In-room display patient setup procedure](#)

EQUIPMENT COMPONENTS

In-Room display gating screen

Figure 3-42: Gating screen

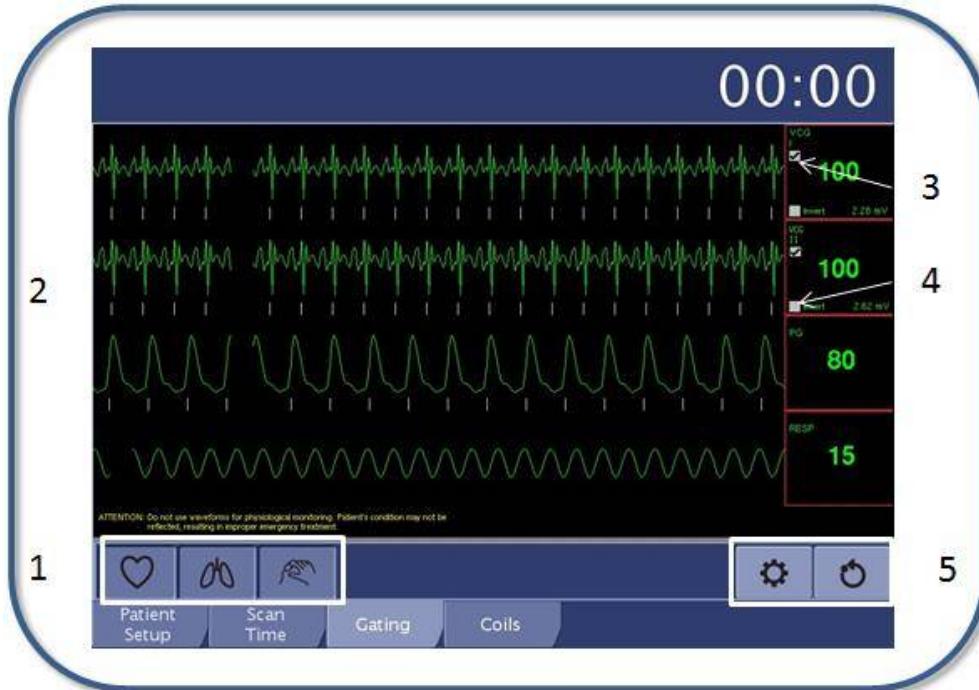


Table 3-11: Gating screen selections

#	Description
1	<p>ECG icon : click to toggle the display between all four waveforms and the cardiac only waveform.</p> <p>Respiratory gated icon : click to toggle the display between all four waveforms and the respiratory only waveform.</p> <p>Peripheral gated icon : click to toggle the display between all four waveforms and the peripheral gated only waveform.</p>
2	Waveform display: ECG gating, peripheral gating, and respiratory.
3	Click to select gating lead: VCG I, VCG II, VCG I + II, PG ¹ , and RESP ² .
4	Click to invert the waveform.
5	Settings icon : click to toggle the Settings control panel on/off.

¹Peripheral Gated

²Respiratory

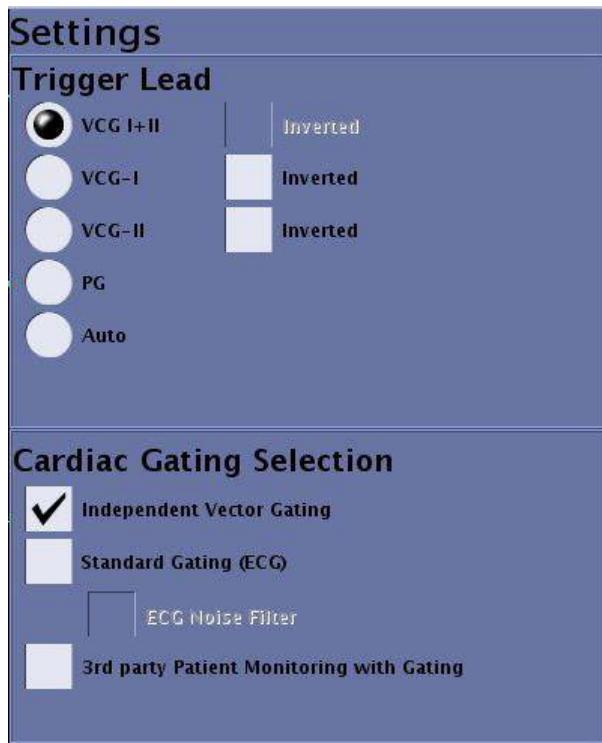
#	Description
	 Reset icon : click to reset the gating system.

Settings control panel

The options on the Settings control panel can also be accessed from the Gating Control screen. The Settings control panel allows you to do the following:

- Select the best trigger lead.
- Invert the ECG waveform
- Select the cardiac gating lead type: VCG, Standard or third party.
- Apply a noise filter for Standard gating leads.

Figure 3-43: Settings control panel



Related topics

- [Equipment orientation](#)
- [In-room monitor concept](#)
- [In-room monitor patient setup procedure](#)
- [Cardiac patient setup: ECG gated exam](#)

EQUIPMENT COMPONENTS

In-Room display patient setup screen

The Patient Information screen displays patient information and allows selection of Patient Weight, Auto Start and Patient Position orientation. The green landmark line changes from dashed to solid when the landmark is established.

Figure 3-44: In-room Patient Setup screen



Figure 3-45: Example of an In-room display header



The far left text indicates the patient table location relative to the landmark (S = superior, I = inferior). If the landmark has not been established, this field is not displayed.

The scan time counts down once scan begins. The field is not displayed until a landmark has been established and there is no error on the coil tab.

Date of Birth

Date of Birth is useful as a table-side secondary patient identification field.

Patient Weight

Tap the Patient Weight text field to display the keypad. Tap the appropriate numbers to enter a weight and tap **OK**.

Figure 3-46: Patient Setup with patient weight



Related topics

[Equipment orientation](#)

[In-room display concept](#)

[In-room display patient setup procedure](#)

EQUIPMENT COMPONENTS

In-Room display scan time and table location screen

The in-room display of the scan time and table location is not interactive. It displays the scan time remaining and the table location.

Figure 3-47: Scan time and table location



Scan Time icons

There are several icons that can display on these tabs: Patient Setup, Gating, Coils and Fan Light. The icons appear in the scenarios described in the table. They must be resolved so that you can proceed to scan.

Figure 3-48: Example of Scan Time iROC display with icon



Table 3-12: Scan Time In-room monitor icons

Scan Time icon	Description
	This icon represents that the table needs to be raised. The animation of the vertical table icon moving up and down stops once the table is all the way up and can connect and move into the bore. The icon then becomes still when the table is at the full up position.

Scan Time icon	Description
 A blue square icon containing an orange house-like shape with a door and windows.	This icon indicates that the table has no home or has lost the home position. The animation of the home icon flashing stops once the table is in the home position.

Related topics

- [In-room monitor coil screen](#)
- [In-room monitor gating screen](#)
- [In-room monitor patient setup screen](#)
- [In-room display patient setup procedure](#)
- [Equipment orientation](#)

EQUIPMENT COMPONENTS

Setup In-Room display procedure

Use these steps to view the various tabs from the In-Room monitor display.

1. From the [In-Room display](#), use the touch screen on the magnet cover to access its functions. There are 5 tabs available:
 - [Patient Setup](#) - displays the patient information and allows selection of weight, Auto Start and patient orientation.
 - [Scan Time](#) - only displays scan time and table location.
 - [Gating](#) - displays waveforms and allows selection of lead and invert. Press the [Gating](#) tab on the In-room monitor to turn it on. If gating is already turned on, the waveforms selected from the operator console are shown. If gating was turned off from the operator console and the In-room displays the gating tab, switch to another tab and return to the gating tab to turn on gating again.
 - [Coils](#) - only displays the currently plugged in coil.
 - [Fan Light](#) - controls the bore fan speed and the light brightness.

In-Room display screen saver

If any of the following events do not occur within 60 minutes, the [screen saver](#) appears on the in-room display:



- new exam or end exam
- change to any patient data displayed on the IRD¹
- change to the table position
- change to the connected coil

Related topics

[Equipment orientation](#)

[Landmark with touch and go strip](#)

[Reset In-room monitor touch screen](#)

[Set-up patient information on in-room monitor](#)

¹In-Room Display

EQUIPMENT COMPONENTS

Reset In-Room monitor touch screen procedure

Use these steps to reset the touch screens on the magnet control panel, if it is not active.



1. From the header area of the screen, click the **Tools icon**.
2. In the System Management work area, click the **Service Desktop Manager** tab.
3. From the Service Desktop Manager screen, click **Service Browser**.
4. From the MR Service Desktop – Insite Browser, click **Diagnostic** tab/icon.
5. In the left screen panel, click **Hardware Location** to open the file tree.
6. Click **Magnet Room** to open the file tree.
7. From the Magnet Room list, click **InRoom Display**.
8. From the right panel, click **Reset IRD Console**. It takes approximately 3 minutes to reset the In Room Display and touch screens.

Related topics

[Set-up patient information on In-Room monitor](#)

[Setup In-Room display](#)

EQUIPMENT COMPONENTS

Set-up patient information from In-Room Display procedure

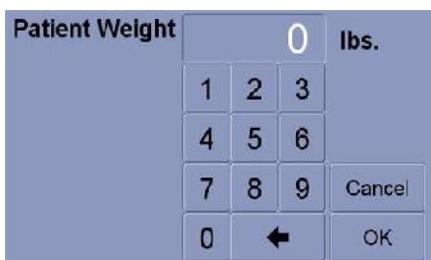
Use these steps to define the patient weight and orientation and activate auto start from the in-room monitor.

Prerequisite

The patient name field must be completed before you change the patient weight, select AutoStart or Patient Position.

1. Setup an exam and click **Start Exam** from the Worklist Manager.
2. From the **in-room display**, use the touch screens to select **Patient Setup** tab.
3. From the **Patient Setup tab**, touch the weight text field to display a numeric keypad.
4. From the numeric keypad, touch the number you want to enter. Repeat this for each number you want to enter.

Figure 3-49: Numeric keypad



- Touch the **arrow** key to backspace.
 - Touch **Cancel** to erase the text in the weight field.
 - Once you acquire the first series, you are unable to access the key pad to change patient weight.
5. When you are satisfied with the number in the text field, touch **OK**.
 - The pop-up key pad closes.
 6. Auto Start is now selectable. To turn on Auto Start, touch the **Auto Start** check box.
 7. To change the patient orientation selection, touch the desired **patient orientation icon arrows**



Related topics

[Setup In-room display](#)

[Reset in-room monitor touch screen](#)

EQUIPMENT COMPONENTS

Magnet controls introduction

This section describes the magnet control concepts and procedures available on multiple MR system platforms.

- [Magnet controls concept](#)
- [Patient comfort procedure](#)
- [Patient alert system concept](#)
- [Patient alert procedure](#)

EQUIPMENT COMPONENTS

Magnet controls concept

Magnet controls provide the method for setting up patient comfort and scanning. The magnet controls are on two panels located on both sides of the magnet cover. The control panels have the same buttons, they are just located in a mirror image of each other. The control panel has a subset of backlit buttons that light up to show what typically is the next step in the workflow. The lights are only typical next steps. You can choose to select another button at any time.

Figure 3-50: Magnet controls



Table 3-13: Image legend

#	Description
1	Left side controls
2	Right side controls

Magnet control buttons

Figure 3-51: Left side magnet controls. Note that the right side panel is a mirror image of the left side

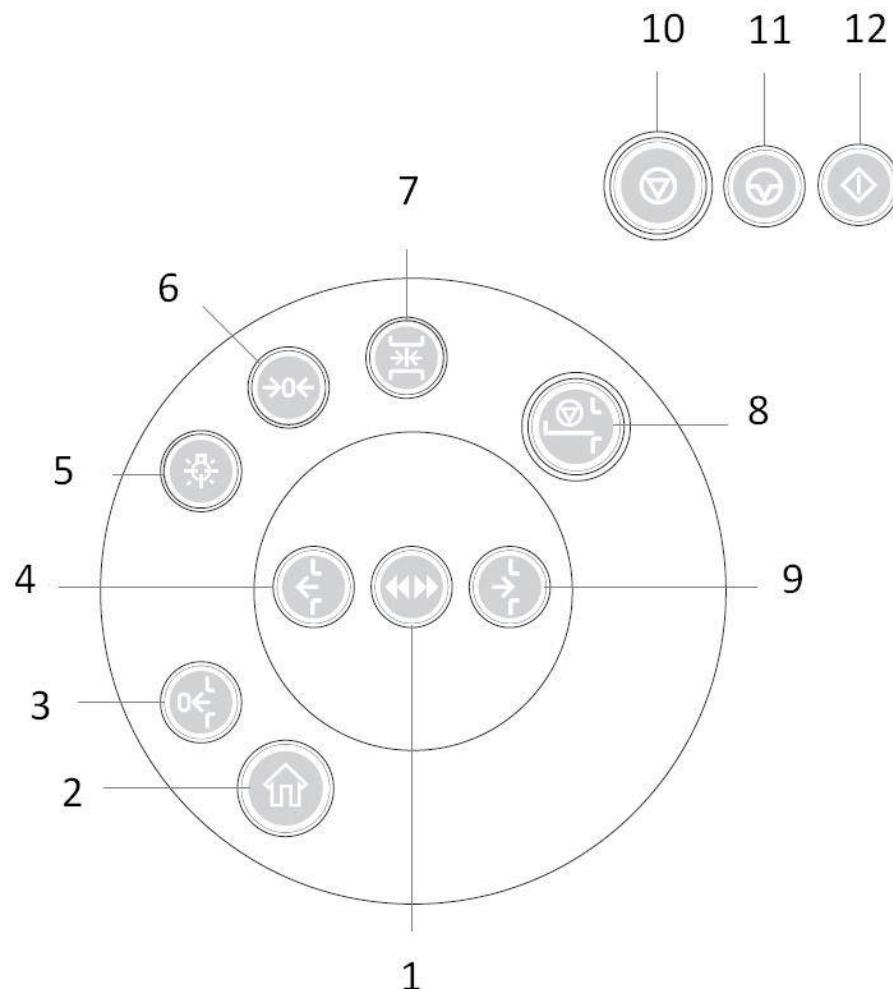


Table 3-14: Imagelegend

#	Button	Description
1		In/Out Fast moves the table in/out of the magnet bore at a faster rate when pressed simultaneously with the In or Out button.
2		Home returns the cradle to the home position, fully retracted on the patient transport.

#	Button	Description
3		Back to Landmark returns the table back to last landmarked position.
4		Out retracts the cradle from the bore. To retract the cradle quickly, press In/Out Fast button and simultaneously press the Out button.
5		Alignment turns alignment lights on or off. When the alignment lights are on, this button is lit and the "landmark on" message is posted on the status panel.
6		Landmark enters the defined landmark.
7		Advance to Scan advances the defined landmark to magnet isocenter.
8		Stop Table halts in-and-out cradle movement. This button overrides all other cradle motion commands.
9		In advances the cradle into the bore. To advance the cradle quickly, press In/Out Fast button and simultaneously press the In button.

#	Button	Description
10		Stop scan stops a scan during either prescan, an active scan, or after Pause Scan is pressed.
11		Pause Scan temporarily halts scanning.
12		Start Scan restarts a study if Pause Scan is pressed, or cradle motion exceeds 2 mm.

Related topics

[Equipment orientation](#)

EQUIPMENT COMPONENTS

Patient comfort procedure

Use the following steps to adjust the light and fan inside the magnet.

Adjust the fan or light controls from the magnet room

Table 3-15: Light and Fan controls. Note that the icon may vary slightly based on your system configuration

Icon	Description
	Light controls the light within the magnet opening. There are three settings.
	Fan controls the circulation of air within the magnet opening. There are three settings.

From the magnet room, press the **light** or **fan** control. Each time you press the control the light/fan moves up to a higher level. The level indicator remains illuminated to indicate the level status.

Turn off the magnet fan or light

Press the button until the display next to the button is not illuminated.

Adjust the fan or light controls from the control room

1. Display the Gating Control screen.



- a. From the footer area of the screen, click the **Gating, Fan Light controls icon**



- b. Alternatively, in the header area, click the **Tools icon** to open the **System Management work area**. Click the **Gating/Fan/Light** tab to open the Gating Control screen.

2. From the Fan Light Control area of the Gating Control screen, click the up/down arrows to adjust the speed of the fan or intensity of the light inside the magnet.

Figure 3-52: Fan Light Control area of Gating Control screen, with fan on low and light off



- The bar illumination status is defined as follows:
 - No bars = fan/light off.
 - One bar = low.
 - Two bars = medium.
 - Three bars = high.

Related topics

[Equipment components introduction](#)

[Patient alert procedure](#)

EQUIPMENT COMPONENTS

Patient alert system concept

The **patient alert system** is comprised of a **squeeze ball** and a **control box**. The **squeeze bulb** is connected to the **PAC unit** and the **control box** is located at the operator console. There are several control box configurations.

Figure 3-53: Patient alert system: squeeze bulb



Figure 3-54: Patient holding alert bulb



Figure 3-55: Patient Alert control box can have multiple configurations





Procedures

[Patient alert procedure](#)

Related topics

[Equipment orientation](#)

[Patient alert procedure](#)

[PAC](#)

EQUIPMENT COMPONENTS

Patient alert procedure

Use the following steps to set the patient up with the alert bulb.

1. Give the patient the **alert bulb**. The bulb is a rubber product and not latex.
2. Instruct the patient to loosely hold the alert bulb and to only squeeze the bulb to bring you into the scan room to consult with the patient and attend to his needs.

Figure 3-56: Patient holding alert bulb



3. If the patient squeezes the rubber ball end of the alert system, a loud sound is heard in the control room. Press **Reset** to stop the alarm and reactivate it. Go into the scan room and attend to the patient's needs.

Figure 3-57: Patient Alert control box. Option 1: Steady/Pulse button on left and Reset button on right. Option 2: Reset button.



Adjust the patient alert sound pattern

The sound pattern can be changed to either pulsed or steady. A toggle switch on the control box selects the sound pattern. The **Patient Alert control box** is typically located on the operator's console or mounted on a wall close to the desk.

Related topics

[Equipment orientation](#)

[PAC](#)

EQUIPMENT COMPONENTS

Table concept

The stationary table includes an embedded high-density, posterior RF array. It can be raised and lowered to simplify moving the patient on and off the table. Although the terms cradle and table are often used synonymously, the cradle is a part of the table that moves the patient into and out of the magnet.

For details related to table specifications, see [Patient Support Information](#).

Figure 3-58: Patient table

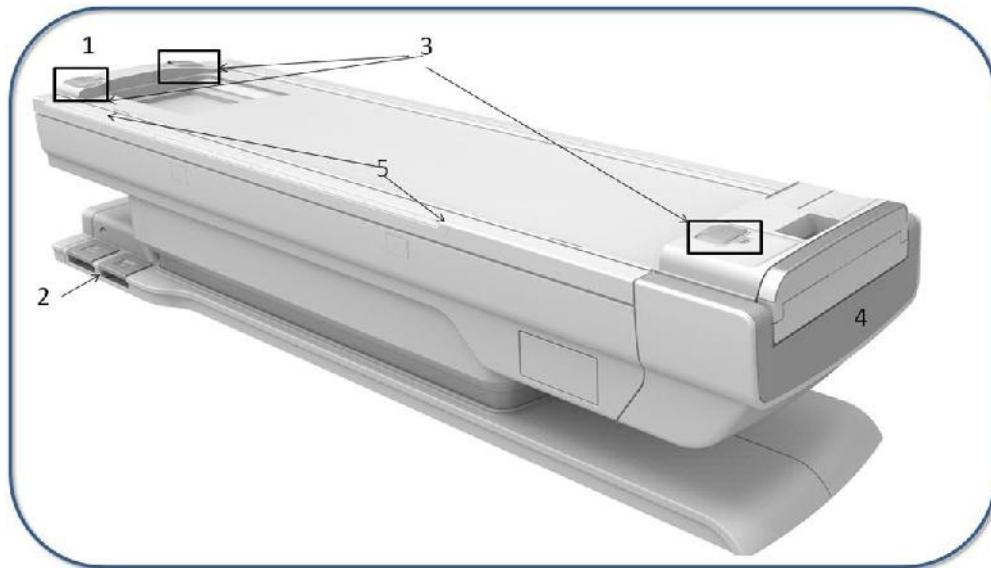
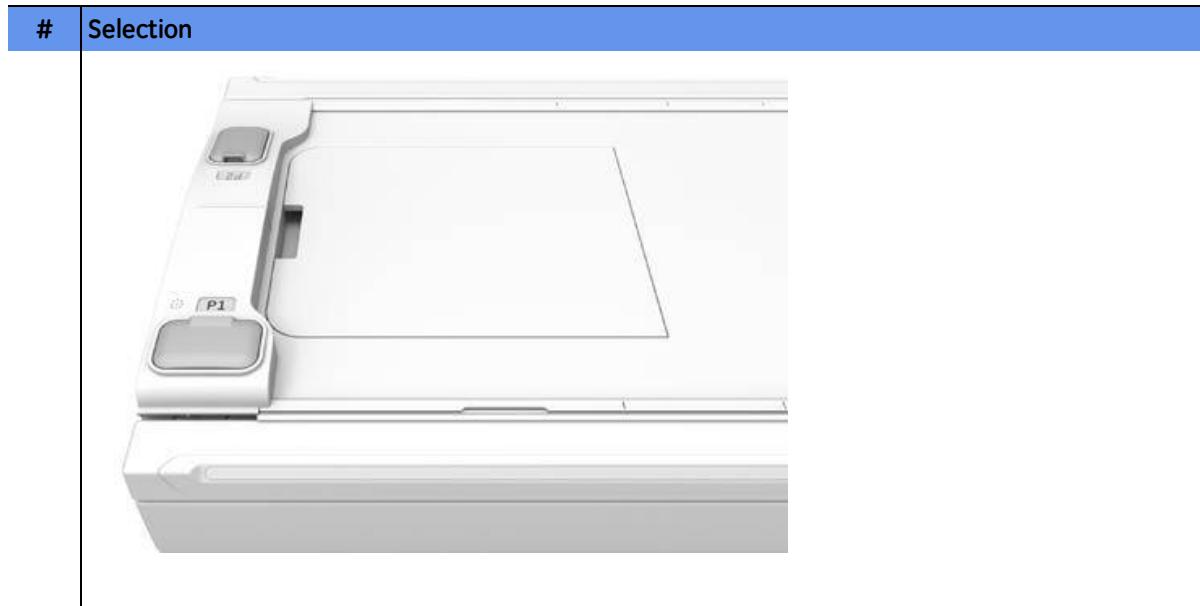


Table 3-16: Table selections

#	Selection
1	Head end The head end of the table has two coil ports and table filler area. Figure 3-59: Head end of table  Figure 3-60: Head end with table filler in place 



2 Table movement pedals

Figure 3-61: Table pedals: 1 = Up motion, 2 = Down motion



Up and down pedals used to raise and lower the table.



IMPORTANT! The patient table of the SIGNA Voyager system is permanently fixed to the magnet system. Always have a non-ferrous gurney placed outside the magnet room for emergency patient transportation.

3 Coil ports

Figure 3-62: Head end of table with two (P1 and P2) coil ports.



Figure 3-63: Foot end of table with one port (P4)

#	Selection
	

4 Foot end

The cradle release and one coil port are at the foot end of the table.

Patient removal using the cradle release handle can be much quicker than the **Out** button on the magnet enclosure. Grasp the handle and squeeze the lever to pull the cradle to the end of the table.

Figure 3-64: Cradle release handle



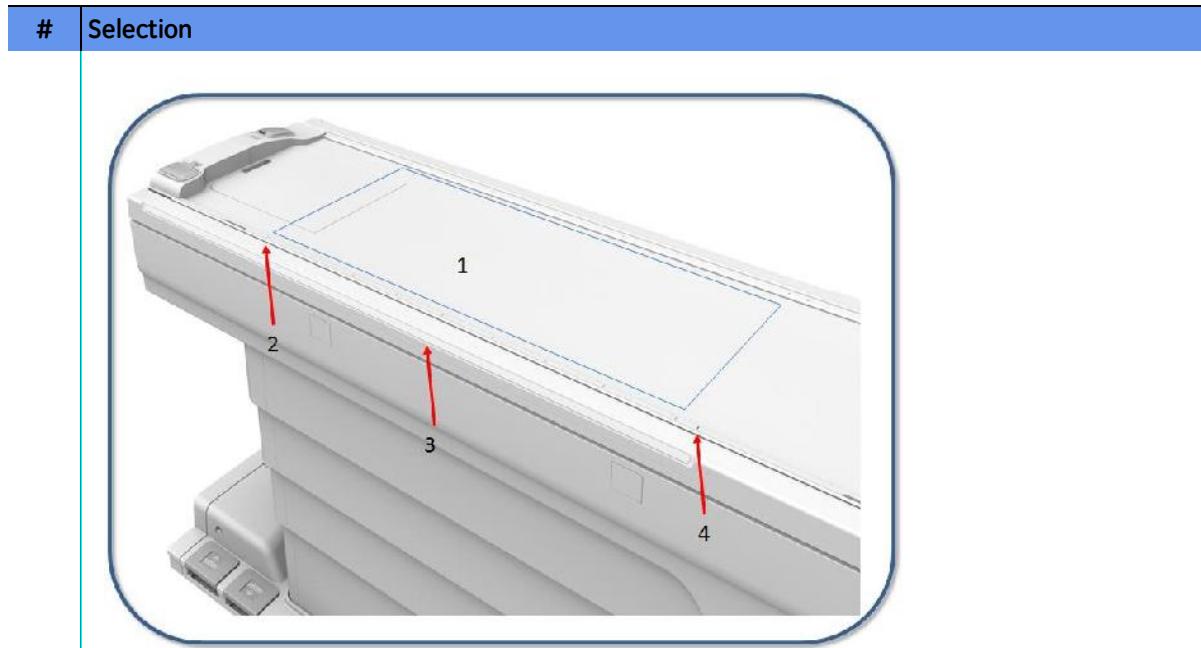
- Use the cradle release handle in the event of power outage to the magnet room or after pressing the **Emergency Stop** button.

5 IntelliTouch landmark strip and TDI Posterior array

The landmark strip is located on either side of the table.

The posterior array is a 32 element phased array coil. It is designed to support parallel imaging in all 3 planes. For coil dimensions, see [Coil Configurations](#).

Figure 3-65: Arrow points to landmark strip and TDI posterior array



1 = TDI Posterior Array.

2 = This line shows the coil area.

3 = Intellitouch Landmark strip

4 = Landmark limit

Patient security straps

The security straps can be slid into both sides of the table from either the head or foot end. Security straps across the arms, abdomen, or legs provides safety for the patient and help control patient motion.

Procedures

[Transfer patient on the table](#)

[Transfer patient off of table](#)

Related topics

[Equipment orientation](#)

EQUIPMENT COMPONENTS

Emergency stop and abort scan buttons concept

Emergency stop

The **Emergency Stop** button disables power to the patient handling and scan related equipment when pressed. It does not shut down the magnetic field.

Figure 3-66: The Emergency Stop button



The Emergency Stop buttons are located on either side of the magnet cover right above the control panels.

Figure 3-67: Location of Emergency stop buttons



Abort scan

The **Abort Scan** buttons are located on either side of the magnet cover on the magnet control panels. They stop an active scan.

Figure 3-68: Abort scan on magnet controls



Related topics

[Equipment orientation](#)

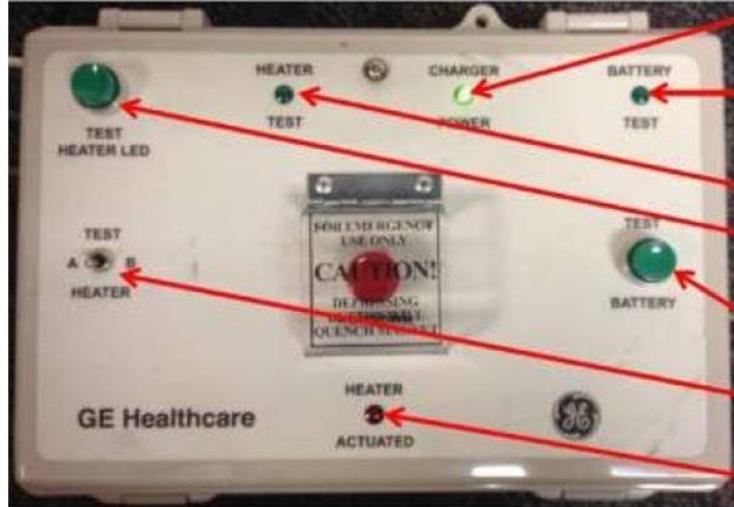
[In-room monitor](#)

SYSTEM MAINTENANCE**Magnet Rundown Unit test procedure**

MRU type I reference number is 5196918 or 5196918-2.

Table 3-17: MRU type 1

#	Description
1	CHARGER POWER LED
2	BATTERY TEST LED
3	HEATER TEST LED
4	TEST HEATER LED switch (for use by GE Service Representative)
5	TEST BATTERY button
6	TEST HEATER switch
7	HEATER ACTUATED LED



The image shows the front panel of a GE Healthcare MRU type I unit. It features several control elements and status indicators. On the left, there is a green 'TEST HEATER LED'. Above it, a small circular button labeled 'TEST' is positioned next to a 'HEATER' indicator light. In the center, a prominent red rectangular label reads 'CAUTION: DEPRESSING THIS BUTTON WILL QUENCH THE MAGNET'. Below this label are two small circular buttons labeled 'A' and 'B', which are part of the 'TEST HEATER' switch assembly. To the right of the central label is a green 'BATTERY' button. Further down on the right, another green 'TEST' button is labeled 'BATTERY'. At the bottom left, the 'GE Healthcare' logo is visible. At the bottom center, a small circular button is labeled 'HEATER' and 'ACTUATED'. Red arrows numbered 1 through 7 point from the left side of the table to these specific components on the panel.

**WARNING**

If the magnet rundown unit test does not perform as described in each step, with the specified LED lighting in each step, GE strongly recommends that you stop using the system and immediately call your GE Service Representative.

Procedure

Use these steps to confirm that the MRU is connected to the magnet and operating properly by performing this test on the MRU every week.

1. Verify that the green CHARGER POWER LED (1) is illuminated.
2. Depress and hold the TEST BATTERY button (5) for 15 seconds.
 - The green BATTERY TEST LED (2) illuminates and remain lit while the TEST BATTERY switch is depressed.
3. Place the TEST HEATER toggle switch (6) in the A position.
 - The green HEATER TEST LED (3) illuminates.



Wait at least 5 seconds before toggling the TEST HEATER switch between position A and B. Not doing so may cause the red HEATER ACTUATED LED (7) to illuminate.

4. Place the TEST HEATER toggle switch (6) in the B position.
 - The green HEATER TEST LED illuminates and it remains lit until the toggle is released.



WARNING

The magnet will not quench if the red HEATER ACTUATED LED illuminates due to toggling the TEST HEATER switch. GE strongly recommends that you stop using the system and immediately call your Qualified Service Representative if this occurs.

Related topics

[Magnet rundown concept](#)

[Secondary ramp down procedure](#)

[Magnet cover removal procedure](#)

[Quench with vent failure procedure](#)

EQUIPMENT COMPONENTS

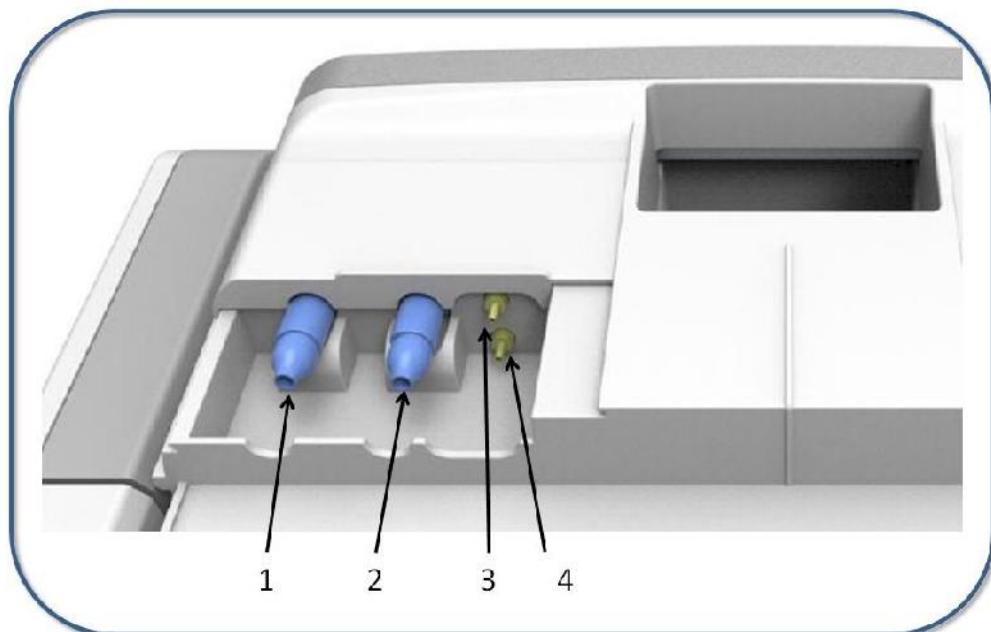
PAC concept

The PAC¹ is located on one side of the patient table and connects the **ECG leads**, peripheral gating device, respiratory bellows, and **patient alert bulb** to the system. Each cable has a unique connector and cannot be accidentally plugged into the wrong port. Disconnected cables can be stored into drawers in the patient table.

Figure 3-69: The drawers are located on either side of the foot end of the table



Figure 3-70: PAC unit located at the foot end of the table



¹Physiological Acquisition Control

Table 3-18: Image legend

#	Description
1	ECG lead
2	Peripheral gating device
3	Respiratory bellows
4	Patient alert bulb

Related topics

[Equipment orientation](#)

EQUIPMENT COMPONENTS

Phantom breakage causing spillage considerations

Information regarding MR phantom content solutions and spill procedure (NiCl₂ (nickel chloride), MSDS 8363917) is shipped with your phantom. In the event of a chemical spill, notify the building security. They will alert the spill team.

In the event of the DAQA phantom breaking and resulting in a nickel chloride spill, keep the following in mind. The information below is an extract from MSDS 8363917:

Health hazard information

Routes of Entry: Inhalation, ingestion, skin or eye contact.

Target Organs: Skin, paranasal sinus, lungs, gastrointestinal system, kidneys and liver.

Symptoms and Effects of Exposure: Metallic taste in the mouth. Exposure can result in irritation of the mucous membranes and the respiratory system. Contact with the skin can result in itchy sensations, redness, erythema, contact dermatitis, eczema, sensitization, or loss of fats and lipids. Contact with the eyes can result in conjunctivitis. Other symptoms include dizziness, giddiness, delirium, confusion, lassitude, loss of strength, asthma, nausea, vomiting, headache, fever or hypothermia, anorexia, loss of sense of smell, diarrhea, anuria, liver damage, jaundice and convulsions.

Animal experiments have resulted in observable birth defects.

Cancers of the lung and nasal sinuses in Nickel workers have been known for more than 50 years to be associated with nickel refining, nickel plating, and nickel polishing.

First Aid:

- If this chemical gets in the eyes, immediately flush the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.
- If this chemical gets on the skin, immediately wash contaminated skin with soap or mild detergent and water. If this chemical soaks clothing, immediately remove clothing and wash contaminated skin with soap or mild detergent and water. Get medical attention promptly.
- When this chemical has been swallowed and person is conscious, immediately give the person large quantities of water or milk. Remove by gastric lavage unless patient is vomiting. Do not make an unconscious person vomit. Get medical attention immediately.

Spill, leak and disposal procedures

Observe all federal, state and/or local regulations when storing or disposing of this substance. Contact local and/or state environmental authorities to insure proper compliance.

This substance does not meet the definition of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) (40CFR260).

EQUIPMENT COMPONENTS

System specifications concept

This section provides system specifications for your MR scanner.

- For details regarding spatial magnetic field compatibility, see [Spatial magnetic field data](#).
- Static magnetic field plots for siting (rule of thumb - assumes no ferromagnetic materials) may be found at:
<http://www.gehealthcare.com/company/docs/siteplanning.html#mr>

1.5T technical specifications

Table 3-19: Magnet information

Component	Specification
Magnet Type	Super-Conducting
Static Field Strength	1.5T
Bore Dimension	163 cm x 70 cm x 70 cm
Cryogen Type	Liquid Helium
Boil Off Rate	Zero under normal operating conditions

Table 3-20: Gradient information

Component	Specification
Gradient type	Non resonant, actively shielded, rapidly switching
Peak Amplitude	36 mT/m
Slew Rate	150 T/m/s
Rise time to Maximum Amplitude	240 microseconds

Table 3-21: RF information

Component	Specification
Transmit RF	
Types of RF transmit coils	Body Coil, Head Coil, and Extremity Coils
Amplifier peak RMS power	16kW for Body, 2kW for local transmit
Amplifier nominal center frequency	63.86MHz
Maximum transmit bandwidth	+/- 0.650 MHz
Receive RF	
Minimum/Maximum reception frequency	63.46MHz/64.26MHz
Nominal RF reception center frequency	63.86MHz
Receive Bandwidth	+/- 250 kHz

Table 3-22: Patient comfort information

Component	Specification
Patient space size	163 cm x 70 cm x 70 cm

Component	Specification
Ventilation	In bore patient ventilation system
Communication	In bore 2 way intercom system
Lighting	Variable intensity LED lighting

Table 3-23: Patient support information

Component	Specification
Height, cradle surface to floor	52 cm. (20.5 inches) to 93 cm. (36.6 inches) continuous
Cradle Length up to coil ports	243.6 cm (scannable range is 182 cm)
Positioning accuracy	+/- 0.5 mm (0.020 inches)
Maximum patient load when attached to scanner or when it is used as a transport	250 kg. (551 lbs.)

Related topics

[Equipment components introduction](#)

Coil List

This section lists all the coil options. The actual coils will depend on the system configuration that you have opted to purchase.

Coil	Part Number
TDI Posterior Array	5015000
Anterior Array	5015100
TDI Head Neck Array	5015300
1.5T HD SHOULDER ARRAY	5344905
HD FLAT GEM TABLE BREAST ARRAY	5015200
1.5T GEM PVA	5372731
8ch Foot Ankle Coil (Receive Only)	5748366-2
GEM Flex Coil 16-L Array, 1.5T Receive Only	5430000-2
GEM Flex Coil 16-M Array, 1.5T Receive Only	5430000-3
GEM Flex Coil 16-S Array, 1.5T Receive Only	5430000-4
16ch T/R knee coil	5718233
16ch T/R Hand Wrist Coil	5768098-2
16Ch Breast Coil	5848000-5
1.5T Endorectal Coil	5772252-2
1.5T Split Head coil	5182594

TDI COIL SUITE

TDI introduction

Medical Device Directive

These products conform with the requirements of council directive 93/42/EEC concerning medical devices, when they bear the following CE Mark of Conformity. The year of CE marking given is 2016.



Manufacturer

GE Healthcare Coils
1515 Danner Drive
Aurora, Ohio 44202-9273
USA

The TDI Coil Suite is a multi-purpose and receive-only coil designed for use with the SIGNA Voyager. The TDI Coil Suite is comprised of multiple components:

- TDI Head Neck Array comprised of
 - Posterior component
 - Anterior component
 - Adaptor block
- TDI Posterior Array
- AA (Anterior Array)
- GEM PVA

For details, see [Coil configurations](#).

This rigid coil system incorporates soft, flexible components that conform to a patient's anatomy, accommodating various body contours while minimizing patient discomfort. The Head Neck Array includes the Posterior component, Anterior component, and an adapter block.

The coil suite also contains a Head Filler section. This filler is used to keep the table surface even with the coil surface, which is necessary for patient comfort. The Head Filler is used when the Head Neck Array Posterior is not being used to scan a patient.

The TDI Coil Suite allows multiple scans of patient's head, neck, brachial-plexus, spine, pelvis, hips, prostate, abdominal, cardiac, lower extremities, blood vessels, or long bone imaging without repositioning the patient and changing coils. The TDI coils can support both head first and feet first torso imaging without moving the PA coil.

Indications for use

The TDI Coil Suite is a set of RF surface coils designed for use with a SIGNA Voyager MRI system manufactured by GE. The TDI Coil Suite is indicated for use for: head, neck, brachial-plexus, spine, pelvis, hips, prostate, abdominal, cardiac, lower extremities, blood, vessels, or long bone imaging. The nucleus excited is hydrogen.

TDI COIL SUITE

Safety concept

This section includes all TDI¹ safety cautions and warnings.



This section contains important safety information that you and the physician must understand thoroughly before using the TDI coil system.

Carefully review chapter 2: MR Safety. In particular, review **Tissue heating** and **Contact point heating**.

Patient safety

Patient safety and comfort are the primary concerns during the scanning procedure. Always follow proper safety, operating and maintenance procedures to ensure that the patient is not exposed to electrical or mechanical hazards that may cause injuries. Ensure that the patient is comfortably positioned.

Route cables through the center of the magnet bore. Routing cable near the sides of the bore increases the likelihood of cable heating from induced currents. Place cables under the pads whenever possible.

Keep the length of the cable in the bore to a minimum. When possible, avoid bending the cable 180 degrees. Route cables out of the bore in the most direct way possible, without looping or coiling.

Ensure the patient is comfortably positioned.

Continuously monitor the patient. If the patient reports heating, burning or tingling sensations, stop the scan immediately.

All personnel using this coil must be instructed in its proper use. Personnel must observe all warnings and cautions appearing in this manual.

TDI coil warning messages



WARNING

Patient burn risk. Do not cross or loop coil cables. Do not loop RF receive coil cables and ECG leads.



WARNING

Do not allow the coil cables to touch the patient. Use a thermal resistant material or pad to keep the cable from touching the patient. Failure to comply may cause patient burns.



WARNING

RF can cause localized heating at contact points between adjacent body parts when a loop is formed. Such localized heating can result in discomfort, or burns. This could occur when a patient's hands are touching or when a female patient's breasts are compressed to her chest. Use pads between body parts to avoid creating a loop with adjacent body parts.

¹Total Digital Imaging

**WARNING**

Do not use accessories (e.g. pads or straps) that have not been specifically tested and approved for use in the MR environment (i.e., MR Safe or MR Conditional). Use of MR Unsafe or MR Conditional (used outside of its conditions for use) accessories may result in patient burns or injuries or image degradation. Even auxiliary devices labeled as MR Conditional are capable of causing injury if the manufacturer's conditions are not followed.

**WARNING**

RF can cause localized heating at contact points between the patient/bore and patient/RF coil resulting in discomfort or burns.

**WARNING**

Closed loops formed by clasped hands or crossed arms, legs or feet may cause burns to the patient. Do not allow the patient to cross or loop their hands, arms, legs or feet. Use pads as necessary to separate limbs.

**WARNING**

Always place appropriate non-conductive padding between the surface coil and the patient's skin to prevent burn injuries.

**WARNING**

Prior to patient placement in the coil, assure that any breached or compromised patient skin surfaces that come in contact with the coil have been adequately bandaged or covered.

**Pinch Point CAUTION**

To avoid injuring the patient or damaging the coil, watch carefully for pinch points as the table moves into the bore. Stop advancing the table if the patient or any part of the coil comes into contact with the bore.

**CAUTION**

RF can cause localized anterior coil warming when it is positioned close to the top of the bore. Place non-conductive padding between the coil and the bore in order to keep the coil positioned away from the bore wall.

Equipment safety



WARNING

The use of thresholding for the building of the 3D model excludes all voxel values outside the selected range from the 3D model. Before applying the threshold(s), make sure that the selected threshold settings will not result in removing pathologies or other essential anatomical structures from the 3D model.



WARNING

This coil is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.



WARNING

Patient burns may result from RF coupling of this device with other devices remaining in the magnet. Remove any other unused coil or unused accessory device from the magnet before using this coil.



WARNING

Route cables through the center of the magnet bore. Place cables under the cushion whenever possible to separate the cable from the patient. Routing near the sides of the bore increases the likelihood of cable heating (from induced currents).



CAUTION

Looped cables may cause RF coupling and degrade the scan performance of the coil. Do not cross or loop cables.

Electrical and mechanical safety



WARNING

Electric shock hazard. This coil consists of electrical and mechanical components. Tampering with the coil by untrained personnel can be hazardous to the patient and equipment. Only properly trained and qualified personnel should service the coil.



WARNING

Use only coils, cables and accessories that are in good condition. Before using the coil, visually check each coil component, cable and accessory to ensure that there is no external damage. If any coil component, cable or accessory is suspected of not being in good condition, discontinue its use and contact your GE Service Engineer.

**WARNING**

Electric shock hazard. No user serviceable parts. Refer service to qualified service personnel.

**CAUTION**

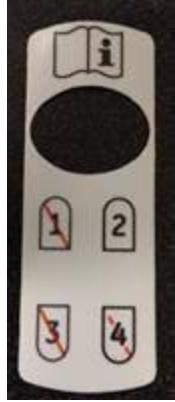
Always base evaluations on all images in the data set and on the clinical history. Information from only a single image should not be used to evaluate a patient.

Label locations on the coil suite components

The serial number labels are located on the covers of the coil components. These labels specify date of manufacturer, part number and revision. These labels also have several symbols that are defined in this manual that will help the user better understand the specifics of the coil suite components.

Table 3-24: Coil labels

Warning/Caution	Description	Label
WARNING	<p>The label shown to the right can be found on the coil cable. It contains three symbols: surface may be hot, do not loop, and consult accompanying documents.</p>	
IMPORTANT: Notice label	<p>Do not pull or carry the coil holding the foam part of the Head Neck Array coil.</p>	

Warning/Caution	Description	Label
 CAUTION	<p>These labels to the right are the symbols located on the P-connector. Plug the P-connector into the system P2 port. All numbers except 2 is crossed out to determine that the connector can only be plugged into P2 port.</p>	
Not applicable	<p>Pull up to unlock / Push down to the lock the Head Neck Array Posterior and Anterior Component/Adaptor Block (engraved label provided on the Latch).</p>	

Related topics

[TDI introduction](#)

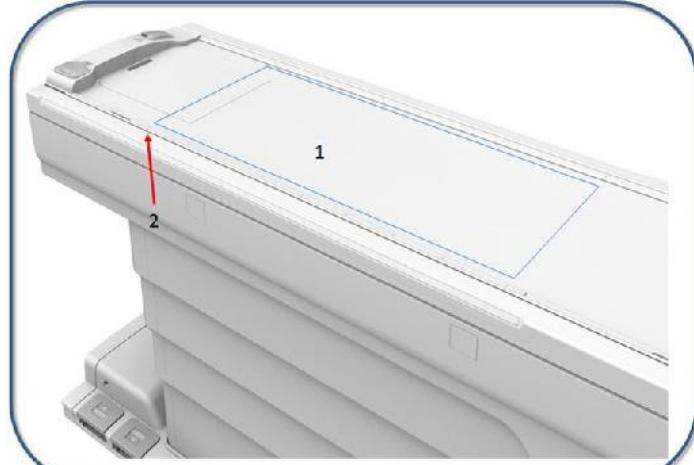
TDI COIL SUITE

Coil configurations concept

The TDI Coil Suite is designed to increase throughput and patient comfort by eliminating multiple coil changes per patient. The coil suite is compatible with a variety of coil mode configurations. The configurations are based on the coil components connected and the required FOV. The system selects the coil mode configuration that best fits the selected region of interest.

Table 3-25: Table legend

Coil Description	Dimensions and Weight	Picture
21 channel TDI Head Neck Array	Length: 55 cm Width: 35 cm Height: 35 cm Weight: 6.5 Kg	
16 channel AA	Length: 55.6 cm Width: 67.4 mm Height: 3.3 cm Weight: 2.8 Kg	
Peripheral Vascular/Lower Extremity Array	Length: 105 cm Width: <ul style="list-style-type: none"> • 2nd station = 64.2 cm • 3rd station = 51.6 cm Height: 24.8 cm Weight: 9.1 kg	

Coil Description	Dimensions and Weight	Picture
32 channel TDI Posterior Array embedded in the patient table	Length: 120.5 cm Width: 48.6 cm Weight: 10.5 Kg	 <p>1 = TDI Posterior Array. 2 = This line shows the coil area.</p>

For details on how to select a coil, see [Select a Coil procedure](#).

Related topics

[Equipment orientation](#)

TDI COIL SUITE

TDI coil workflow

Use this workflow when scanning with coils from the TDI coil suite.

Considerations

- The number of slices per acquisition or for a given TR and the Minimum TR may improve for some PSDs if you only use the PA and Head Neck Array coils alone rather than connecting them to other coils such as the AA or PV coils. Therefore, if you are not acquiring images in the abdomen, heart, or lower leg use the Head Neck Array coil and PA coil.



WARNING

All coil components must be plugged in when they are in the scanner. This includes coil components that should be plugged into the system and coil components that should be plugged into another coil component. Leaving components unplugged can damage the coil, or cause harm to the patient.

TDI coil classification

- It is a Type BF applied part.
- It is suitable for continuous operation.
- The IP Rating for the coil is IPX0. Ordinary equipment. Not rated against water ingress protection.
- It is a non-sterile device.
- The equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.
- The voltage rating of the coil is 10VDC maximum.

All surface areas of the coil, except the bottom surface that sits on the patient table, are considered applied parts and may come into direct contact with the patient. Pads and/or thermal-resistant materials should be used to prevent the coil surfaces from touching the patient.

Pads and/or thermal-resistant material must be used to ensure the patient cannot touch the coil cable and connectors.

1. **Register the patient** and start an exam.
2. Set up the coil components necessary to scan the region of interest and position the patient in the appropriate orientation and with the necessary coil components for the region(s) of interest.
 - **PA, Head Neck Array, and AA component patient position procedure**
 - **PA component patient position procedure**
 - **PA, AA, and PVA component patient position procedure**
 - **Two AA components patient position procedure**
 - **Whole body patient position procedure**



Ensure that all components on the table are plugged in before scanning.

**WARNING**

Do not use accessories (e.g. pads or straps) that have not been specifically tested and approved for use in the MR environment (i.e., MR Safe or MR Conditional). Use of MR Unsafe or MR Conditional (used outside of its conditions for use) accessories may result in patient burns or injuries or image degradation. Even auxiliary devices labeled as MR Conditional are capable of causing injury if the manufacturer's conditions are not followed.

**WARNING**

Prior to patient placement in the coil, assure that any breached or compromised patient skin surfaces that come in contact with the coil have been adequately bandaged or covered.

**WARNING**

Do not allow the coil cables to touch the patient. Use a thermal resistant material or pad to keep the cable from touching the patient. Failure to comply may cause patient burns.

**CAUTION**

Ensure that no hair or fabric is caught between the components. Failure to comply may cause artifacts and decreased image quality.

**CAUTION**

Looped cables may cause RF coupling and degrade the scan performance of the coil. Do not cross or loop cables.

**CAUTION**

RF can cause localized anterior coil warming when it is positioned close to the top of the bore. Place non-conductive padding between the coil and the bore in order to keep the coil positioned away from the bore wall.

3. If you are using the AA coil, press the IntelliTouch strip that aligns with the center point of the coil to complete coil identification.
 - If you make a mistake defining the coil position, you can reset the coil position to zero in one of two methods. Both actions set coil port 1 back to orange status on the In-room monitor coil tab. To redefine the landmark, press the IntelliTouch strip twice in quick succession.



- From the **In-room monitor coil tab**, touch the **humanoid icon** from the magnet control touch screen.
- Unplug and re-plug the coil in the coil port.

- For head-first patient orientation, the AA cable exits at the patient's shoulder. Therefore, place a pad between the cable and the patient.
- Use the system cable guides to prevent the Anterior Array cable from crossing or forming loops with itself or other cable.

Figure 3-71: System cable guide used to avoid loops



- Establish a landmark at the center of the region of interest then press **Advance to Scan**.
- Select the protocol.
 - Use the system recommended protocols for scanning with this coil for optimum results and best performance.
- Select the localizer scan, prescribe the slice locations, and adjust FOV if necessary.
- From the scan desktop, click **Coil** tab to view the Coil selection screen.
 - There are multiple coil configurations available with the TDI Coil Suite. For details see, [TDI coil configurations](#). The correct selection for your study depends on the following:
 - Connected components
 - Type of examination (multiple exams on the same patient)
 - Desired FOV
 - Patient acceptance (when claustrophobia/anxiety prevents using Face component)
 - Image quality (if the desired image quality is not realized, an alternate configuration may be chosen)
 - Precise patient positioning and proper FOV yields optimum results. Improper use of the coil is the major cause of image artifacts.
 - The list of TDI coil configurations updates when the series is in an INRX state. The list is based on the graphic prescription.
 - Coil configurations are dependent upon the coil components that are plugged into the system. If the configuration you want is not listed, it may be necessary to add or remove coil components before your configuration is selectable.
- After performing the localizer, select the next series.
- Prescribe the graphic scan locations and adjust the FOV and coverage.

- For tips on setting the landmark see [Landmark troubleshooting](#).
10. Clean the coil components and comfort pads after each use.
 - Clean with disinfectant wipes that contain 1% of Sodium Hypochlorite (CAS No 7681-52-9) as the only active ingredient. Alternatively, use a cloth that has been dampened in a solution of 10% bleach and 90% tap water, or 30% isopropyl alcohol and 70% tap water.
 - Should the coil need to be returned to GE for service, wipe it down with a 10% bleach solution (as described above) to minimize risk of exposure to potentially infectious agents.
 - Dispose of any materials used to clean the coil and the pads according to all federal, state, and local regulations.
 11. Follow this storage guideline when using the AA coil.

Store the AA component on top of the Anterior Array Coil Positioner storage device that was shipped with the coil. The AA component must be stored on top of the Anterior Array Coil Positioner so that it maintains its curved shape, reliability, and durability.

Figure 3-72: Anterior Array Coil Positioner

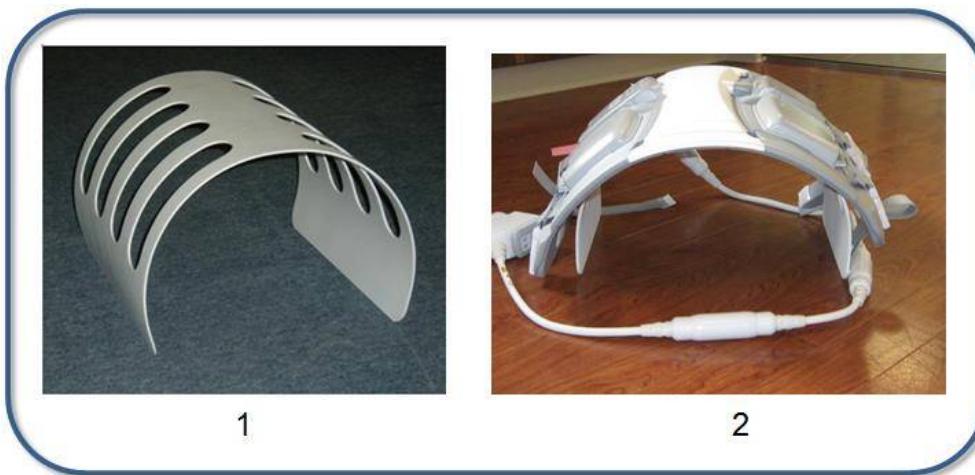


Table 3-26: Image legend

#	Description
1	Anterior Array Coil Positioner.
2	AA coil placed on positioner.



WARNING

Electric shock may occur if the coil is attached to the system during cleaning or when it is still wet. Detach coil connector from the scanner before attempting to clean the coil. Do not touch connectors with bare fingers. Never press sharp objects against connector surface. Do not reattach connector after cleaning until the coil has dried completely.



CAUTION

The coil contains sensitive electronic components that may become damaged. Do not spray or pour cleaning solution directly onto the coil. Do not submerge the coil in any solution. Under no circumstances should the

coil be placed into any type of sterilizer.

Considerations

[Wide bore GRx considerations](#)

Related topics

[TDI introduction](#)

[TDI Safety concept](#)

[TDI Coil configurations concept](#)

TDI COIL SUITE

PA, Head Neck Array, and AA component patient position procedure

Use these steps to position the patient head or feet first with the PA¹, Head Neck Array, and AA² TDI coil components.



CAUTION

Do not carry any of the coil components by the cable. Damage to the coil component may occur. The coil may not work if damaged.

1. Remove the head filler and patient comfort pad based from the head end of the table.

Figure 3-73: Example of table with no head filler



2. Place the Head Neck Array posterior component on the cradle surface.

¹Posterior Array

²Anterior Array

Figure 3-74: Head Neck Array posterior component in place



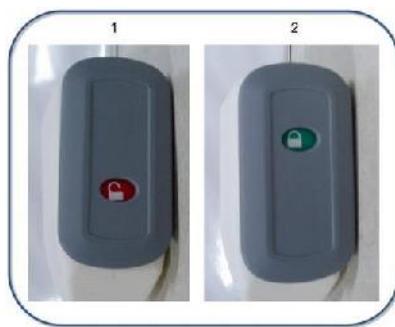
3. Plug the Head Neck Array posterior connector into P2.

Figure 3-75: P2 connector is on the table's right side as you face the magnet cover



4. Lock the connector plug by rotating the spindle handle until the Lock symbol is visible.

Figure 3-76: P connector, all numbers except 2 is crossed out to determine that the connector can only be plugged into P2 port.



5. Place the patient comfort pad in the Head Neck Array posterior component.
6. Position the patient supine in the Head Neck Array posterior component with the shoulders resting against the coil.
7. Depending on the area of interest, position the appropriate Head Neck Array Anterior component onto the Head Neck Array posterior using the locators as a guide.
8. Secure the Head Neck Array anterior component to the Head Neck Array posterior component using the latches that are located on both sides of the Head Neck Array posterior component.



When scanning areas other than the brain, it is not necessary to place the Head Neck Array anterior. Instead, the AB¹ may be used. The AB also is secured to the Head Neck Array posterior using the latches on the posterior component.

¹Adapter Block

Figure 3-77: Adapter Block



CAUTION

Ensure that no hair or fabric is caught between the components. Failure to comply may cause artifacts and decreased image quality.

9. Optional: if you are using the AA coil, position the AA on the patient chest with Head Neck Array overlap as shown in Figure 3-78.

Figure 3-78: 1 = overlap of AA and Head Neck Array



10. Plug the AA component into P1 or P4 port.

- Use the system cable guides to prevent the Anterior Array cable from crossing or forming loops with itself.

Figure 3-79: System cable guide used to avoid loops



11. Press the IntelliTouch strip that aligns with the center point of the AA coil to complete coil identification.
12. Place a pad between any cable and the patient.
13. Place a **landmark** over the region of interest.
 - The Head Neck Array has one raised laser mark on the center of the Head Neck Array Anterior component. The AA has one raised laser mark positioned in the center of the coil. The sections of the PA are indicated on each edge of the table, which identify the element groups.
14. Proceed to scan. From the Coil Configuration screen, select a Head Neck Array Coil configuration.

Related topics

[TDI safety](#)

TDI COIL SUITE

PA component patient position procedure

Use these steps to position the patient on the PA TDI coil component.

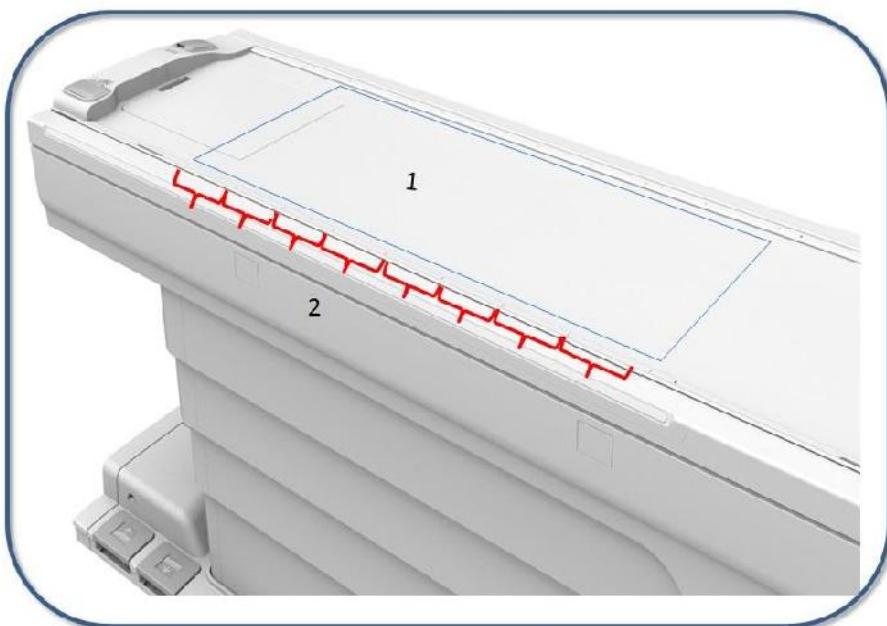
1. Place the head end filler on the patient table.

Figure 3-80: Table with fillers in place



2. Place patient comfort pads on the coil/table surface.
3. Position the patient either head or feet first on the coil/table.
4. Place a **landmark** over the region of interest.
 - The sections of the PA are indicated on each edge of the table, which identify the element groups.

Figure 3-81: PA element group identifiers



#	Description
1	Box indicates the borders of the TDI Posterior Array
2	PA element group identifiers

5. Proceed to scan. From the Coil Configuration screen, select a PA Coil configuration.

Related topics

[TDI safety](#)

TDI COIL SUITE

PA, AA, and PVA component patient position procedure

Use these steps to position the patient feet first with the PA¹, AA², and PVA³ TDI components.



CAUTION

Do not carry any of the coil components by the cable. Damage to the coil component may occur. The coil may not work if damaged.

1. Remove the head-end filler and replace it with the PVA leg filler.
 - The PVA leg filler brings the lower legs into the same horizontal plane as the upper legs or thighs for an optimum runoff position.
2. Position the patient supine and make sure that the patient's heels are located towards the end of the comfort pad.
3. Place the PVA over the lower legs. Ensure that the toes extend through the PVA openings.

Figure 3-82: PVA in place



CAUTION

Ensure that no hair or fabric is caught between the components. Failure to comply may cause artifacts and decreased image quality.

4. Unfold the second station over the upper legs of the patient. Ensure patient comfort by applying pads if necessary.
5. Tuck the right and left foam coil portions under the patient's legs.
6. Secure the top and bottom foam coil portions to the table with the provided straps. The coil should be snug against the anatomy to minimize patient motion.

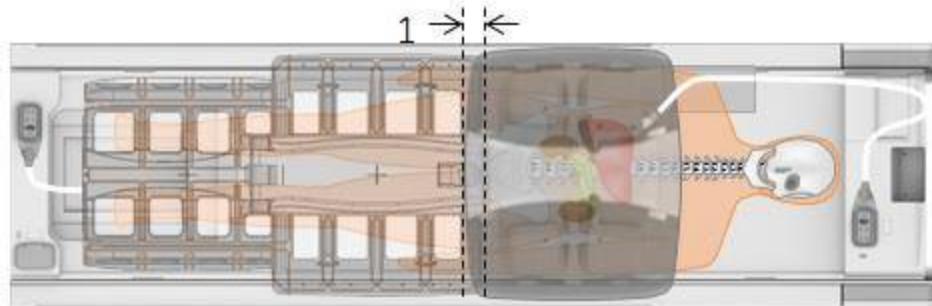
¹Posterior Array

²Anterior Array

³Peripheral Vascular Array

Figure 3-83: Second station in place

7. Plug the PVA into P2 port.
8. Place the AA coil component on the patient There are two options for routing and plugging the AA coil. For details, see Step.10.
 - Plug the cable into the port that is located in the direction the cable exits the coil.
9. Position the AA component on the patient with the PVA overlap as shown in Figure 3-84 to ensure acceptable image quality.

Figure 3-84: 1 = PVA and AA overlap and proper AA cable position

10. Plug the AA coil into P1 port or P4 port. There are two options for routing the AA cable.
 - a. Plug the cable into P4 port (recommended).
 - Place a pad between the cable and the patient.
 - Route the cable down the side of the patient toward P4 port shown in Figure 3-85.
 - Plug the cable into P4 port.

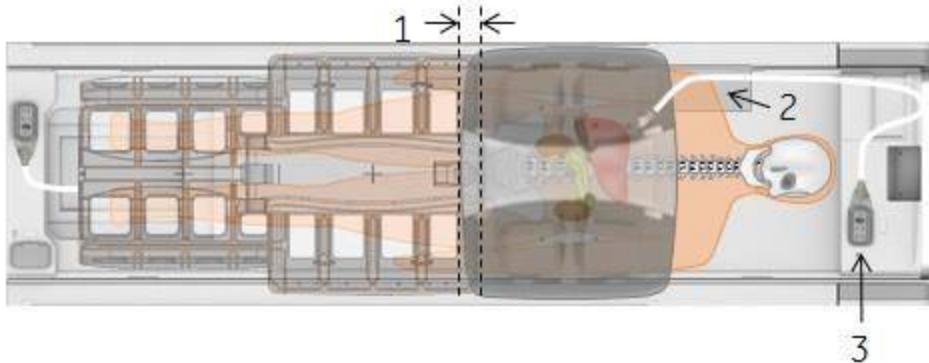
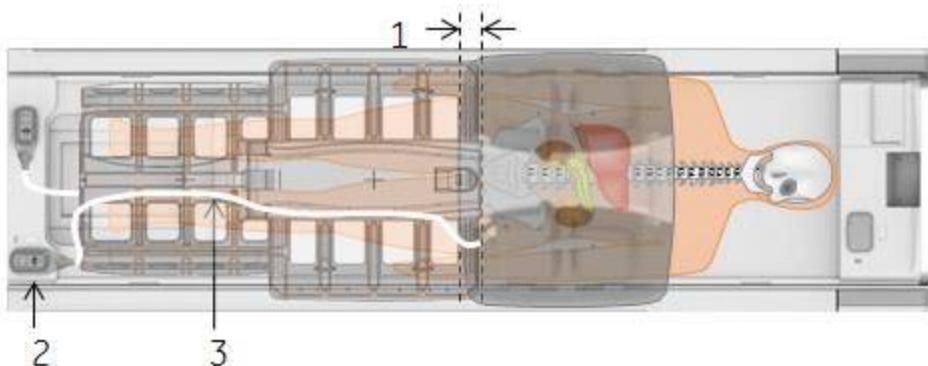
Figure 3-85: Port 4 cable route

Table 3-27: Image legend

#	Description
1	Overlap
2	Pad
3	P4 port

- b. Plug the cable into P1 port.
- Route the cable as close to the center of the bore as possible.
 - Ensure that the AA cable is routed over the center housing of the PVA as shown in Figure 3-86

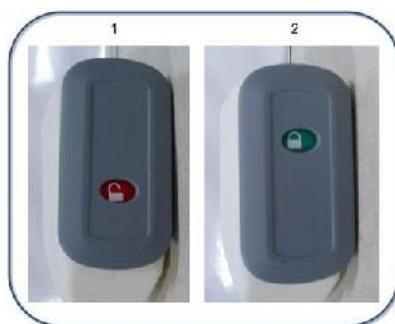
Figure 3-86: Port P1 cable route**Table 3-28:** Image legend

#	Description
1	Overlap
2	P1 Port
3	The cable must be routed over the center housing of the PVA.

**CAUTION**

When using the AA with the PVA in a feet-first orientation, be sure to run the AA cable over the center housing of the PVA, pull it taut, and secure it to the PVA clip to prevent the AA cable from becoming warm.

11. Lock all connector plugs by rotating the spindle handle until the Lock symbol is visible.

Figure 3-87: P connector, all numbers except 2 is crossed out to determine that the connector can only be plugged into P2 port.

12. Press the **IntelliTouch strip** where it aligns with the center of the AA coil to complete coil identification.
13. Place a **landmark** over the region of interest.
 - The AA has one raised laser mark positioned in the center of the coil. The PVA has three laser marks; one in the center of PVA, and one in the center of each section.
14. Proceed to scan. From the Coil Configuration screen, select a PA, AA and PVA Coil configuration. For details see [TDI coil configurations](#).
15. Follow this storage guideline when using the AA coil.

Store the AA component on top of the Anterior Array Coil Positioner storage device that was shipped with the coil. The AA component must be stored on top of the Anterior Array Coil Positioner so that it maintains its curved shape, reliability, and durability.

Figure 3-88: Anterior Array Coil Positioner

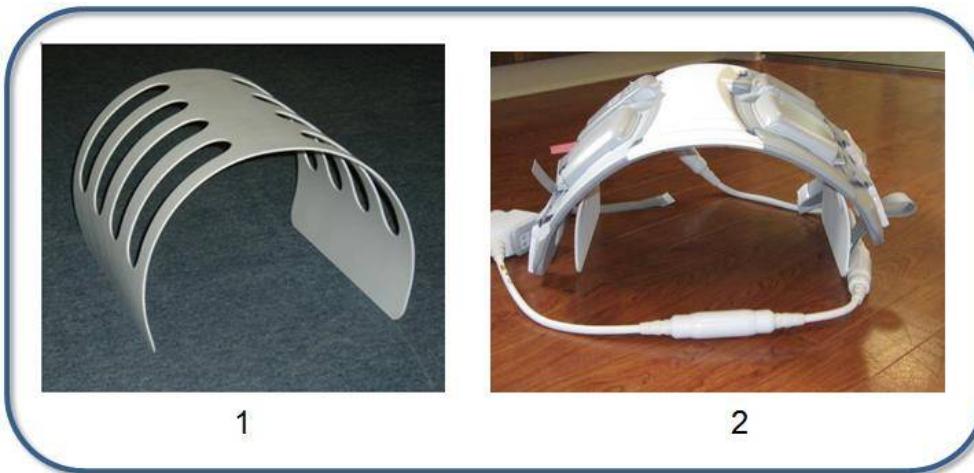


Table 3-29: Image legend

#	Description
1	Anterior Array Coil Positioner.
2	AA coil placed on positioner.

Related topics

[TDI safety](#)

[TDI coil workflow](#)

TDI COIL SUITE

Two AA components patient position procedure

Use these steps to position the patient head or feet first with the PA¹ and AA² TDI coil components.

Considerations



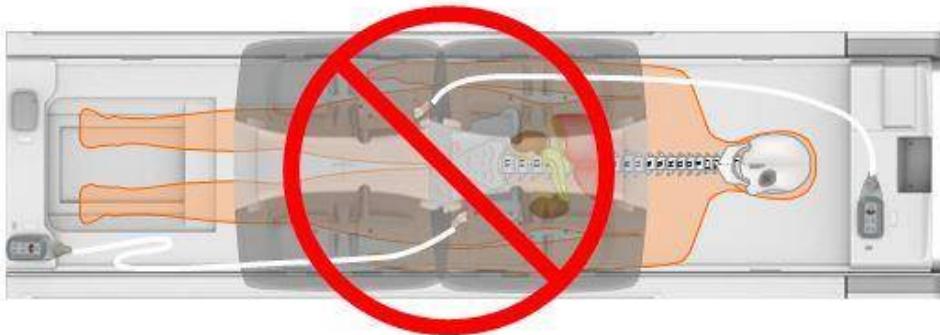
CAUTION

Do not carry any of the coil components by the cable. Damage to the coil component may occur. The coil may not work if damaged.

Rules for setting two AA coils

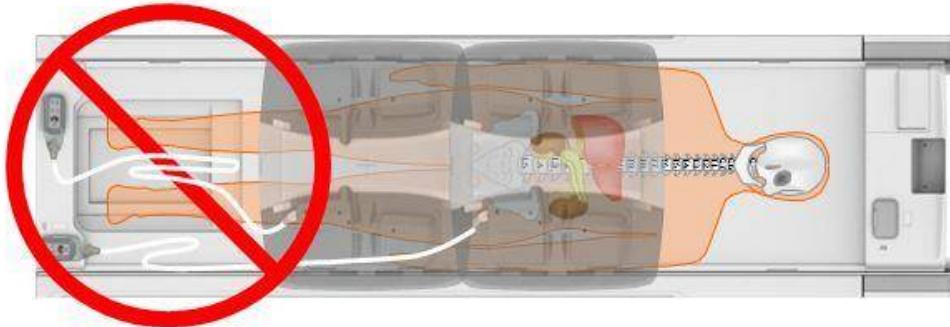
- Incorrect Two AA coil crossover as shown in Figure 3-89.

Figure 3-89: Two AA crossover not allowed



- The cables of the AA coils cannot be plugged into the same side of the coil port as shown in Figure 3-90.

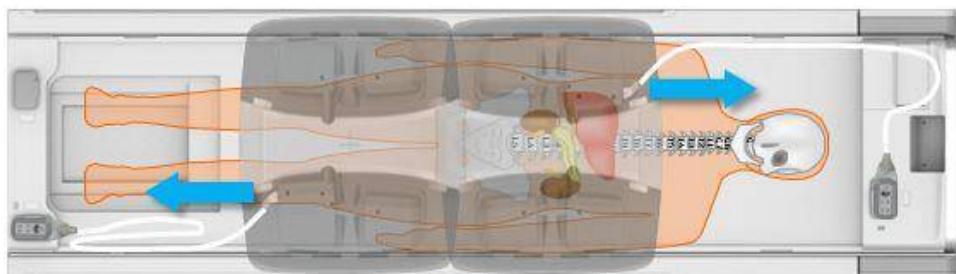
Figure 3-90: Incorrect cables plugged into ports at the same end of the table



- Plug the cable into the port that is located in the direction the cable exits the coil, as shown in Figure 3-91.

¹Posterior Array

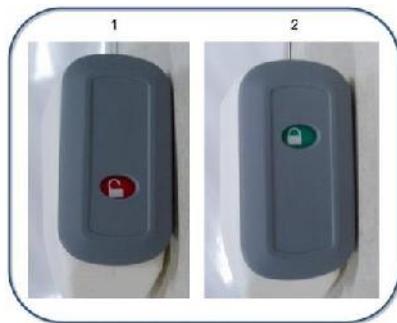
²Anterior Array

Figure 3-91: Cables plugged into correct ports

- Two AA coils can be set with the overlap as shown Figure 3-93. If not, the two AA coils may not work properly.
- The order to align the center of each AA coil must be the same order that the coils are connected into the coil port. The IRD (In-Room-Display) shows which of the AA coils is aligned at the center of the coil.

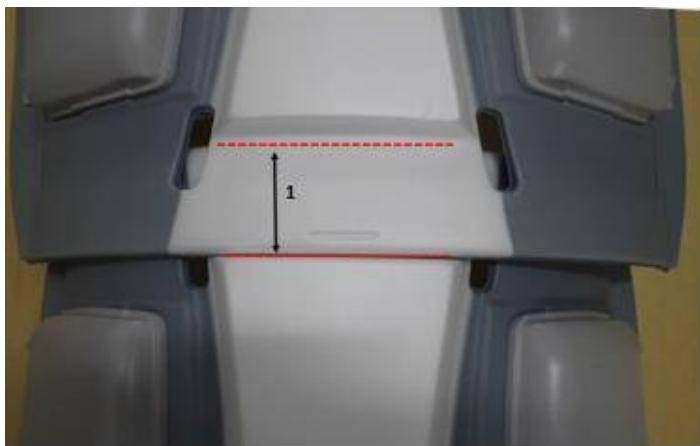
Procedure

1. Place the fillers, pads and patient as described in [PA TDI patient position](#).
2. Position the AA component on the patient.
 - a. Carefully place the AA on top of the patient centered over the area of interest.
 - b. Position the AA so that it is centered on the patient and sits comfortably and securely on the patient.
 - c. Position the arms of the patient to the sides of the body or up over the head. If the arms are placed above the head, do not allow the patient to cross arms or interweave fingers.
 - d. Place a pad between any cable and the patient.
3. Use the straps that are located on both sides of the PA to secure the AA to the table top. The AA should be snug against the patient, but ensure that there is no patient discomfort.
4. **Plug** the cable into the port (P1, P2 or P4) that is located in the direction the cable exits the coil.
 - Note that port 3 cannot be used for the AA coils.
5. **Lock** the connector plug by rotating the spindle handle until the Lock symbol is visible.
 - The AA has one raised laser mark positioned in the center of the coil. The sections of the PA are indicated on each edge of the table, which identify the element groups.

Figure 3-92: P connector, 1 = unlock, 2 = lock

6. Press the **IntelliTouch strip** where it aligns with the center of the coil to complete coil identification.
7. Position another AA component on the patient overlapped as shown in Figure 3-93.

Figure 3-93: Overlap of the two AA coils



8. Repeat the plug in, coil lock and IntelliTouch strip instructions for the second AA coil.



Alternatively, you can plug in and lock both coils and then define the reference point by pressing the IntelliTouch strip in the order in which you plugged in the coils. View the IROC instructions for instructions as you plug in the coils.



CAUTION

The AA coil may not fit in the bore when used on patients with large torsos. To avoid injuring the patient or damaging the coil, watch carefully as the table moves into the bore. Stop advancing the table if the AA coil comes into contact with the top of the bore.



WARNING

All coil components must be plugged in when they are in the scanner. This includes coil components that should be plugged into the system and coil components that should be plugged into another coil component. Leaving components unplugged can damage the coil, or cause harm to the patient.

9. Place a landmark over the region of interest.
10. Proceed to scan. From the Coil Configuration screen, select PA and AA Coil configuration.

Follow this storage guideline when using the AA coil.

Store the AA component on top of the Anterior Array Coil Positioner storage device that was shipped with the coil. The AA component must be stored on top of the Anterior Array Coil Positioner so that it maintains its curved shape, reliability, and durability.

Figure 3-94: Anterior Array Coil Positioner

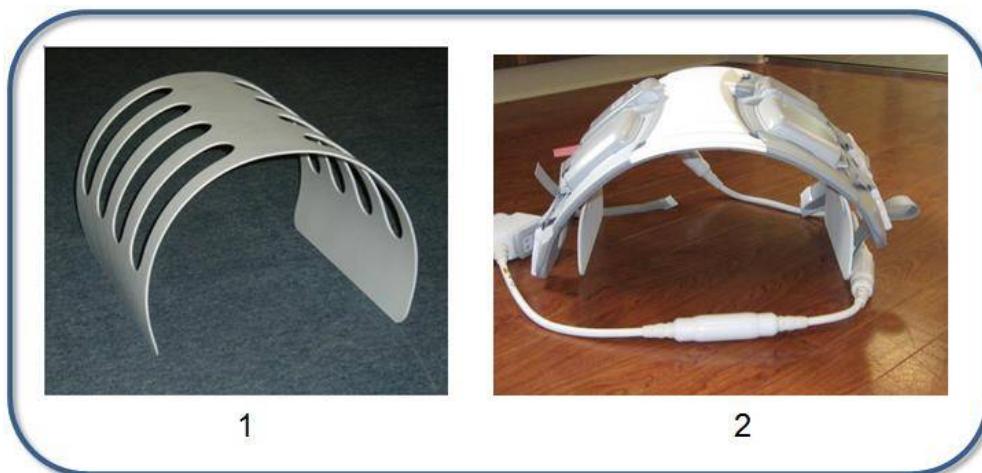


Table 3-30: Image legend

#	Description
1	Anterior Array Coil Positioner.
2	AA coil placed on positioner.

Related topics

[TDI safety](#)

TDI COIL SUITE

Whole body patient position procedure

Use these steps when using the TDI coil for whole body imaging.



WARNING

All coil components must be plugged in when they are in the scanner. This includes coil components that should be plugged into the system and coil components that should be plugged into another coil component. Leaving components unplugged can damage the coil, or cause harm to the patient.



CAUTION

The AA coil may not fit in the bore when used on patients with large torsos. To avoid injuring the patient or damaging the coil, watch carefully as the table moves into the bore. Stop advancing the table if the AA coil comes into contact with the top of the bore.



CAUTION

Do not carry any of the coil components by the cable. Damage to the coil component may occur. The coil may not work if damaged.

1. Remove the head filler and the patient comfort pad.

Figure 3-95: Table with head filler removed



2. Place the Head Neck Array posterior component at the head end of the patient table.

Figure 3-96: Head Neck Array posterior component in place



3. Place the patient comfort pad in the Head Neck Array posterior component, and place the PA comfort pads on the table.
 - Position the patient supine in the Head Neck Array posterior component with the shoulders resting against the coil.
4. Place the Head Neck Array anterior component on the Head Neck Array posterior component.



CAUTION

Do not pick up or carry the Head Component by the mirror attachment. To avoid damaging the coil, pick up and carry the Head Component using two hands on the bottom of the coil.



CAUTION

Ensure that no hair or fabric is caught between the components. Failure to comply may cause artifacts and decreased image quality.

5. Secure the Head Neck Array anterior component to the Head Neck Array posterior component using the latches that are located on both sides of the Head Neck Array posterior.
6. Plug the Head Neck Array posterior connector into P2 port

Figure 3-97: P2 connector is on the table's right side as you face the magnet cover



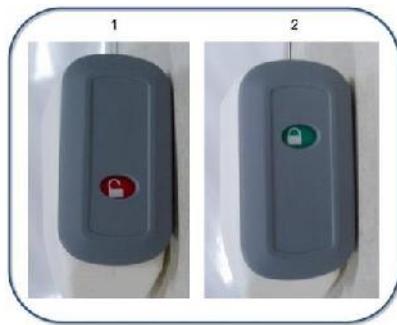
7. Position the AA on the patient chest with Head Neck Array overlap as shown in Figure 3-98.

Figure 3-98: 1 = overlap of AA and Head Neck Array



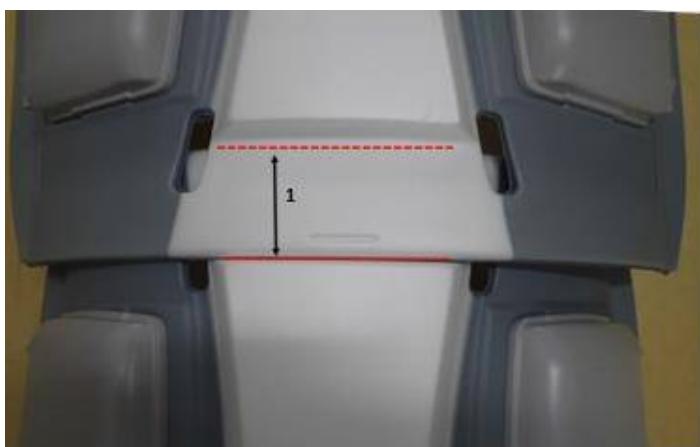
8. Plug the AA components into P1 or P4 ports.
9. Lock the connector plug: rotate the spindle handle until the Lock symbol is visible.

Figure 3-99: P connector, all numbers except 2 is crossed out to determine that the connector can only be plugged into P2 port.



10. Secure the AA to the patient table with straps. Adjust the straps until the coil is snug against the patient.
11. Press IntelliTouch strop where it aligns with the center of the first connected AA coil to complete coil identification.
12. Repeat the plug in, coil lock and IntelliTouch strip (where it aligns with the center of the coil) instructions for the second connected coil. See overlapped coils as shown in Figure 3-100

Figure 3-100: Overlap of the two AA coils





Alternatively, you can plug in and lock both coils and then define the reference point by pressing the IntelliTouch strip in the order in which you plugged in the coils. View the IROC instructions for instructions as you plug in the coils.

13. Place a **landmark** over the region of interest.
 - The Head Neck Array has one raised laser mark on the center of the Head Neck Array Anterior component. The AA has one raised laser mark positioned in the center of the coil. The sections of the PA are indicated on each edge of the table, which identify the element groups.
 - When using the AA, always landmark to the center of the coil.
14. Proceed to scan. From the Coil Configuration screen, select a whole body coil configuration.

Related topics

[TDI safety](#)

[TDI workflow](#)

SYSTEM MANAGEMENT

System Management introduction

The **System Management** work area allows you to access the Service Desktop Manager, Error Log, Gating Control screen, iLINQ, System Preferences, e-Report, and the Protocol Management tab. You can perform planned maintenance and software performance tests, save raw data, change the system date and time, reorganize protocols, or connect to TiP Virtual Assist from these areas.

Procedures

[Open system management work area procedure](#)

[System Management work area](#)

[Open the Service Desktop Manager procedure](#)

[e-report procedure](#)

[Error log view message procedure](#)

[Legacy image converter procedure](#)

[Planned Maintenance procedures](#)

[Raw data save procedure](#)

[Remote software download procedure](#)

[Secure Service Access procedure](#)

[Service Notepad write a message procedure](#)

[TiP Virtual Assist activation procedure](#)

SYSTEM MANAGEMENT

Open System Management work area procedure

Open the **System Management** work area access the Service Desktop Manager, Error Log, Gating Control screen, iLINQ, System Preferences, and the Protocol Management tab. You can perform planned maintenance and software performance tests, save raw data, change the system date and time, reorganize protocols, or connect to TiP Virtual Assist from these areas.



From the **header area** of the screen, click the **Tools icon** to open **System Management work area**.

Related topics

[Session orientation](#)

[System Management orientation](#)

SYSTEM MANAGEMENT

Open the Service Desktop Manager procedure

Use these steps to open a Service Desktop Manager Session to access the Guided Install and Utilities programs.



1. From the header area of the screen, click the *Tools icon*.
2. In the **System Management** work area, click the **Service Desktop Manager** tab to view the Service Desktop Manager screen.

Related topics

[Session orientation](#)

SYSTEM MANAGEMENT

Error log view messages procedure

Use these steps to view error log messages or to view the time an error message occurred.

View system messages



1. In the header area, click the **Tools icon** to open the **System Management work area**.
2. Click the **Error Log** tab on the left side of the screen.
3. On the Error log screen, click **View Log**.
4. Click **Select Viewing level** and choose a viewing level.
5. Click **OK**.
6. Use the buttons at the bottom of the screen to navigate through the error log.

Considerations

Additional messages are displayed at the following locations:

- View the **Message area** to the right of the Patient List.
- From the scan work area, view the Message area on the Scan Parameters screen.

Related topics

[Service Notepad write a message procedure](#)

[System management introduction](#)

SYSTEM MANAGEMENT

e-Report procedure

Use these steps to view, print to pdf, or export a report.



1. From the footer area of the screen, click **e-Report** icon.



- An "i" next to the icon indicates an **unread report**.

2. From the View Service Reports screen, click the desired Unread report option box, and click **View**.
 - The report opens.
 - The report is moved to the Reports list.
 - Click **View Reports** to go back to the View Service Reports list, to view unread and read reports.
3. To print the report to pdf format, click **Print**.
4. To export the report, place a USB device in the computer USB drive or a CD in the CD/DVD drive, from the View Service Reports screen, select the desired report(s) and click **Export**.
5. From the Media pop-up window, select CD, DVD, or USB. Click **OK** to start the export.
6. Click **Close** to exit the application.

Related topics

[System management orientation](#)

SYSTEM MANAGEMENT

Legacy Image Converter procedure

Use these steps to convert images on your MR system so that they can be displayed on a pre-11.0 MR system.

1. In the header area, click the **Tools icon arrow**.
2. Click **Command Window...** to open a command window.
3. Type **LIC** and press **Enter**.
4. From the Legacy Image Converter screen, select the exam and series for processing. The following image types are not supported and cannot be converted:
 - TRICKS, FIESTA-C, VIBRANT, MR-Echo, PROPELLER
 - Raw data images (embedded Pfiles)
 - Legacy format images (these images are already in the correct format)
 - Foreign images (non-GE images)
 - GSPS objects
 - SR objects
5. Click **Start** to begin image processing.
 - While images are being processed, you can click **Cancel** to stop the active conversion.
 - Once processing starts, a new exam with the same exam number is added to the Browser. As images are converted they will appear in the image browser under the newly created exam. (See Identifying Converted Images below for discriminating between the original and the legacy format exams.)
6. Only one exam may be selected at a time and within this exam it will only process the selected series (more than one series can be entered). Therefore, to process more exams, return to step 4.
7. When processing has completed the **Cancel** button will be disabled and the **Start** and **Close** button will become available.
8. Review the message area for errors, then press the **Close** button on the LIC user interface. The LIC user interface screen will disappear.
 - The new exam is created using the same exam, series, and image numbering as the original. Legacy images can be identified by the annotation "Signa 1.5T SYS" rather than your system (for example: "Optima MR450 1.5T") when displayed in the viewer.
 - After networking the images to a pre-11.0 Lx scanner (e.g. 9.x, 10.x), the legacy format images can be identified by type "Advt" rather than "DICO" in the image browser.
9. The converted images can be used with legacy system applications such as CV flow analysis on AW3.1. Once networked to either a Lx scanner (pre-11.0 versions) or an AW 3.1 or 4.0 workstation, the converted images can be further sent to Genesis (5.x) systems. (The unconverted 11.x-format images cannot be sent to a Genesis systems.)

Messages and error conditions

Successful Conversion

The following message is logged in the message box when conversion has completed successfully for each series being processed:

"Series #: Passed: Processed xxx Images"

Unsuccessful Conversion

If processing is attempted on a series containing unsupported image types, one of the following messages is displayed and no images are converted for that series.

"Series #: Failed: Fiesta-c, Tricks, Vibrant etc series not Supported."
"Series #: Failed: fMRI Series Cannot be converted."
"Series #: Failed: Post Processed Images Cannot be converted."
"Series #: Failed: Raw data Images Cannot be converted."
"Series #: Failed: Monarch Images Cannot be converted."
"Series #: Failed: Filtered (non-SCIC) Images Cannot be converted."
"Series #: Failed: Legacy Images Cannot be converted."

Other Error Conditions

If multiple exams are selected from the Patient List and you click **Start**, the following error is displayed:

"Multiple Exams Not Supported"

Select a single exam, then select the series within the selected exam for processing. If multiple exams need to be converted, you must convert one exam at a time.

If you click **Start** a second time without changing the selection in the Patient List, the following message is displayed (no image processing will occur):

"Exam #: Failed: Already Converted/Rejected"

This prevents accidental generation of multiple copies of the same image set. It is possible to close the LIC application and restart it to create a duplicate set of converted images.

Related topics

[System management orientation](#)

SYSTEM MANAGEMENT

Planned Maintenance procedures

Use this information to help you respond to PM Assist messages that display periodically on your system.

PM Date message

The PM Date message, "This system should have Planned Maintenance performed before <date>", where <date> is the last day of the current month, displays when the response has been a Yes to the PM Due message. The prompt is posted to the Operator Attention area at the start of each new patient prescription. The message appears once and is overwritten by any other message being posted in the area. No acknowledgment is required.

Follow these steps for the PM Overdue and PM failure message displays.

1. For the PM Overdue, the message displays if the Planned Maintenance interval has been too long.
 - a. Type your initials in the text box.
 - b. Type the date in the text boxes.



Once a response is made, the system startup is completed with no further waiting.

2. For the PM Failure message displays when there are certain failures that have not been resolved within 21 days of the last PM. The message appears during system startup and in the Operator Attention area at the start of each new patient prescription. The message appears once and is overwritten by any other message being posted in the area.
 - a. Type your initials in the text box.
 - b. Click **OK**.

SYSTEM MANAGEMENT

Raw data save procedure

Use these steps to save Raw data immediately after a scan has completed. Because the raw data resides in the temporary memory of the system, you must save the raw data before starting the next series. Please be patient during the raw data transfer.



1. From the header area of the screen, click the **Tools icon**.
2. From the **System Management work area**, click the **Service Desktop Manager** tab.
3. On the Service Desktop Manager, click **Service Browser**.
4. From the MR Service Desktop screen, click **Utilities** tab.
5. Select **Raw File Manager** from the list of procedures.
6. Click **Click here to start this tool**.
7. Select the data from the TPS area.
8. Click **TPS to Disk**.
 - The raw data is saved on the system hard disk until it is removed.
 - Raw data uses disk space, and, as the disk becomes full, system performance can be degraded.
9. Click **File > Exit**.

Related topics

[System management orientation](#)

SYSTEM MANAGEMENT

Remote service configuration procedure

This feature may not be for sale in all markets due to approval or clearance by in-country regulatory agencies. Remote Service Enables system connectivity to GE Healthcare's back office. A valid GE System ID and an internet connection to the system is needed in order to establish this connectivity.

Use these steps to configure InSite Remote service on your system.



1. In the header area, click the **Tools icon** to open the **System Management work area**.
2. Click the **Service Desktop Manager** tab.
3. Click **Service Browser**.
4. From the Service browser, click the **Configuration** tab.
5. From the left pane, select **Configure Insite**.
6. Click **Click here to start this tool!**.
 - The Agent Configuration screen displays.

Figure 3-101: Agent Configuration screen

The screenshot shows the 'InSite RSvP Agent Configuration' interface. At the top, there is a navigation bar with tabs and a search bar. Below it, the main content area is organized into four panels:

- Agent Configuration:** Displays system details like Agent Version (1.9.2.2), Model Number (MR_RSVP_01), Serial Number, CRM Number, and Enterprise Server (stg-insite.gehealthcare.com:443). It includes a 'Connectivity' section with a green 'ENABLED' button and a caution message about disabling connectivity.
- Proxy Configuration:** Contains fields for Proxy (Enabled), IP Address, Port (88), Username, and Password. Buttons for Reset, Refresh, Restart Agent, and Submit are at the bottom. A success message 'Info: Successfully applied settings.' is displayed.
- Agent Status:** Shows Agent Running (Yes), Registered (No), CRM Verified (No), and Quarantine (No). A note states: 'NOTE: It may take the agent up to 5 minutes to start running with a new configuration. Click the Refresh button under Proxy Configuration to see the latest status for the agent.'
- Feature List:** Lists Prodiags, Sweeps, and Software Download, each with an 'ENABLED' toggle switch. A note at the bottom says: 'Note: Click on the toggle switch to Enable or Disable a feature.'

At the bottom of the page, there is a copyright notice: '© 2019 General Electric Company.'

- a. Read the caution displayed under Agent Configuration.

**CAUTION**

Disabling connectivity disconnects the system from the GE Healthcare Back Office. This will make the system unreachable for remote service or AutoSC sweeps.

If connectivity is disabled, it can be enabled again by clicking the **Enable Connectivity** Button.

- b. Ensure that the CRM number displayed is exactly the same as the System ID that belongs to your system. If this is not configured correctly, then update the correct system ID in the Service ID & System ID fields under the System Configure tab in Guided Install.
 - Guided Install modifications in relation to System ID and Networking information updates are only allowed in the root login environment
7. If internet connectivity to the system is established via proxy, then enable Proxy setting and provide Proxy credentials.
8. If internet connectivity to the system is established via DNS, then configure the DNS Option in Guided Install under the Networking tab.
 - Guided Install modifications in relation to System ID and Networking information updates are only allowed in the root login environment
9. Click **Submit** once all the information has been entered. It could take up to 5 minutes for connectivity to be established. The refresh button can be used to check the correct status.
10. Observe the following, which indicates connectivity is successfully established:
 - Agent Running is **Yes**.
 - Registered is **Yes**.
 - CRM Verified is **Yes**.
11. If entitled, GE Remote Service involves analysis of system performance data and downloading software updates. This data can be sent back and forth from the system through one of the following methods. Note that data collected through these methods are used only to enhance product/service quality.
 - Proactive Diagnostics (ProDiags): Automatic push of system hardware parametric data at regular intervals
 - Sweeps: Automated scripts that login from the GE back office to pull only system configuration and performance data
 - Software Download: Used to download software updates in the form of service packs to the system
12. Click an item in the Feature List window to enable or disable the remote features.
13. Contact GE service if you have a problem configuring InSite.
14. Click **Disable Connectivity** if you want to stop remote service connection.
15. Click **X** to exit the Configure InSite screen.

Related topics

[System management introduction](#)

SYSTEM MANAGEMENT

Remote software download procedure

Remote software update may not be for sale in all markets due to approval or clearance by in-country regulatory agencies.

There are three modes in which the remote software can be installed. These modes are configured by an authorized user in root login.

- EA3 by an authorized user
- Auto
- Any User

Procedure

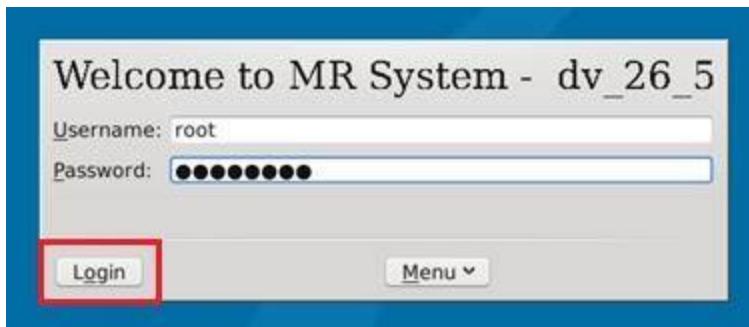
Use these steps to accept and install software service packs.

1. To perform a remote software download follow these steps.
 - a. From the logon screen, click **root login** to logon as a Unix Root User.

Figure 3-102: Logon screen



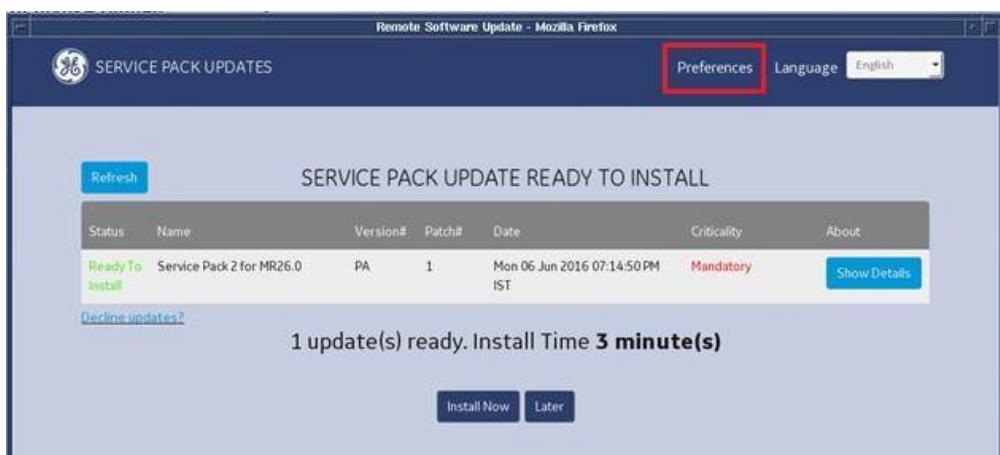
- b. Enter your password and click **Login**.
 - The default password is **operator** until you updated your local users roles.
 - The remote software update automatically launches after logon.

Figure 3-103: Password screen

- c. If the remote software does not automatically launch, place the cursor in the screen background and right-click to view the Root menu.

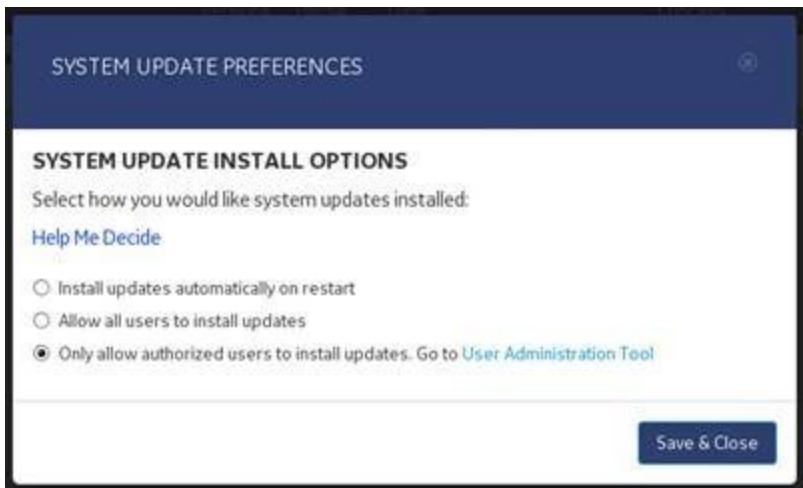
Figure 3-104: Root menu

- d. From the Root menu, click **Remote Software Update** to display the Remote Software Update screen.
- e. From the Remote Software Update screen, click **Preferences**.

Figure 3-105: Remote Software Update screen

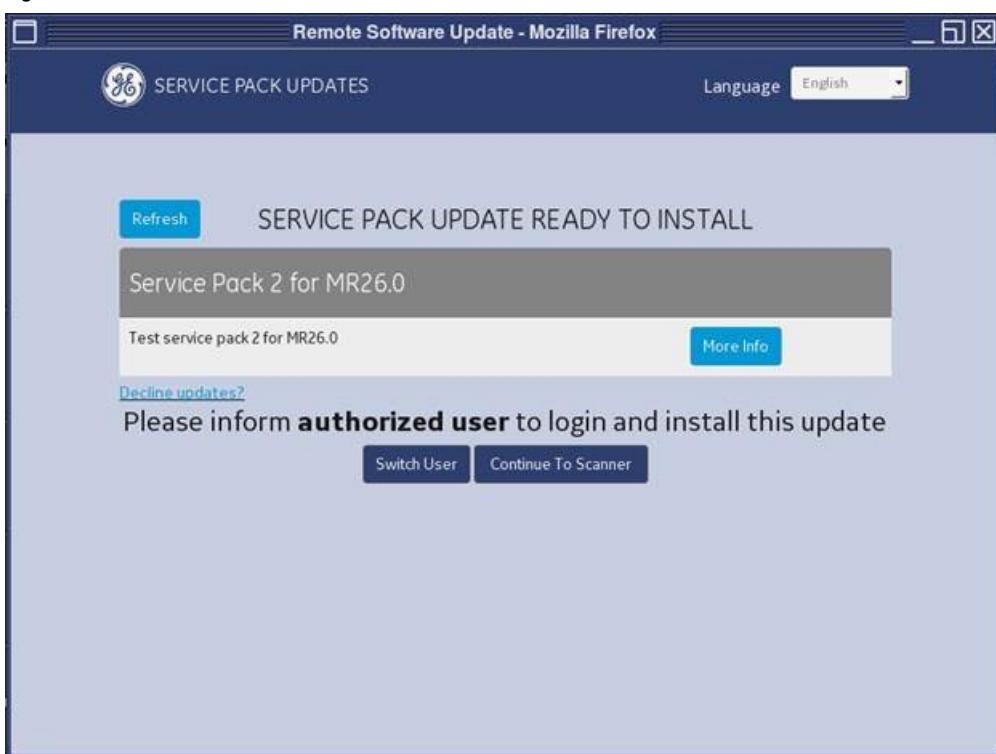
- f. Select an option from the Preferences menu and click **Save & Close**.
 - Install updates automatically on restart.
 - Allow all users to install updates
 - Only allow authorized users to install updates (controlled through EA3 access).

Figure 3-106: Preferences screen



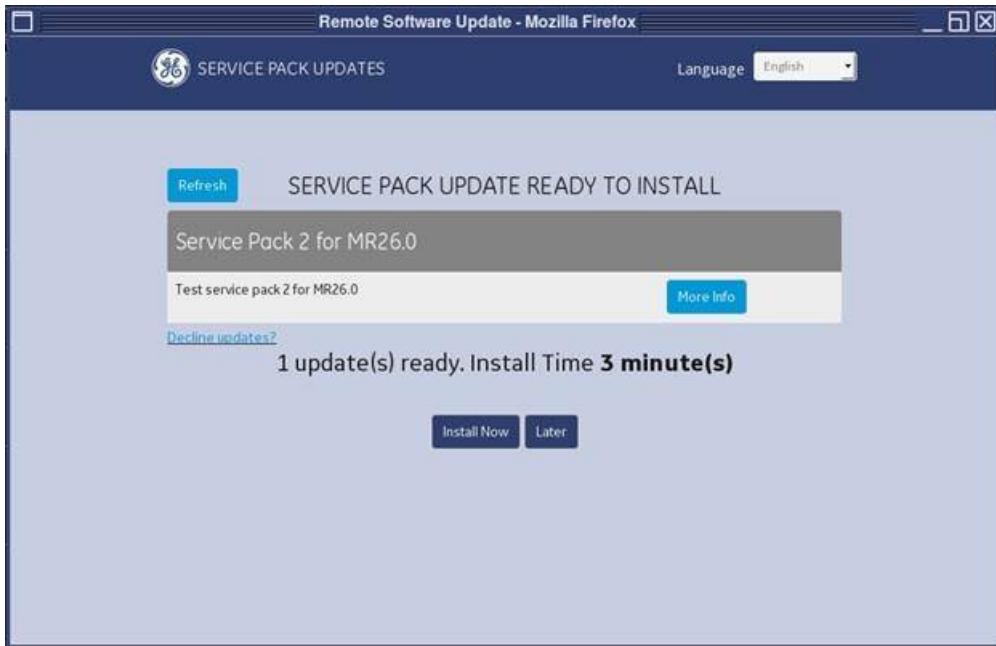
2. If you are a EA3 user, follow these steps.
 - A software download can only be installed or declined by an authorized user.
 - a. If you are an unauthorized user, the following screen appears at logon to inform you that a download is available.

Figure 3-107: Unauthorized EA3 user install screen

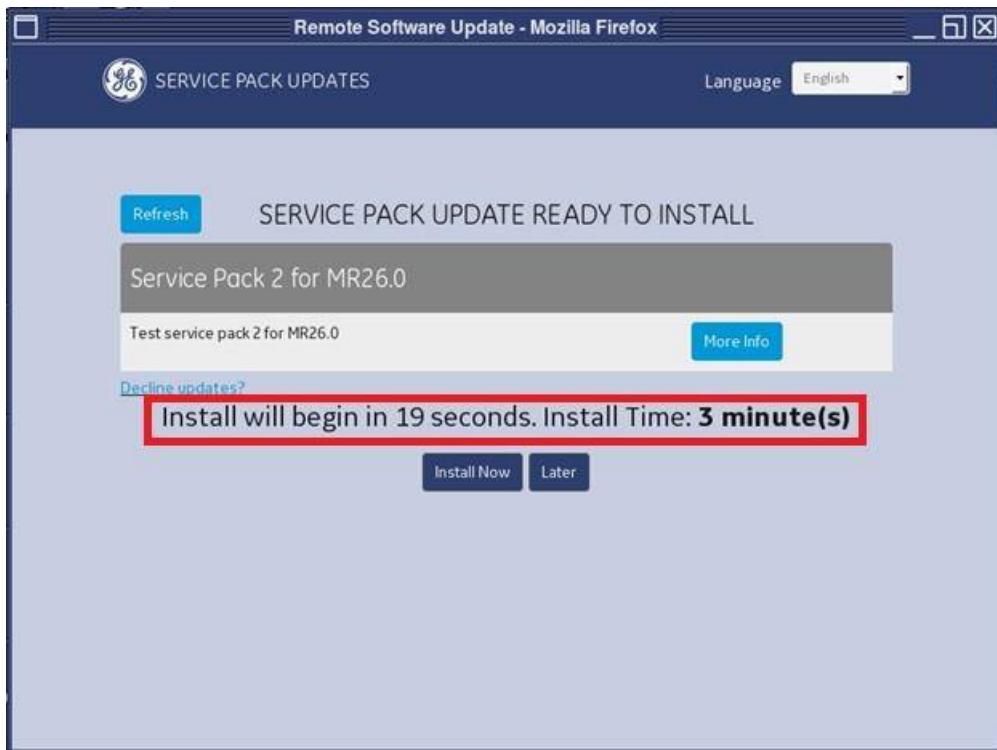


- You can click **Switch User** and the HIPAA screen appears.
 - You can click **Continue to Scanner** and the Logon screen appears.
- b. If you are an authorized user, the following screen appears.

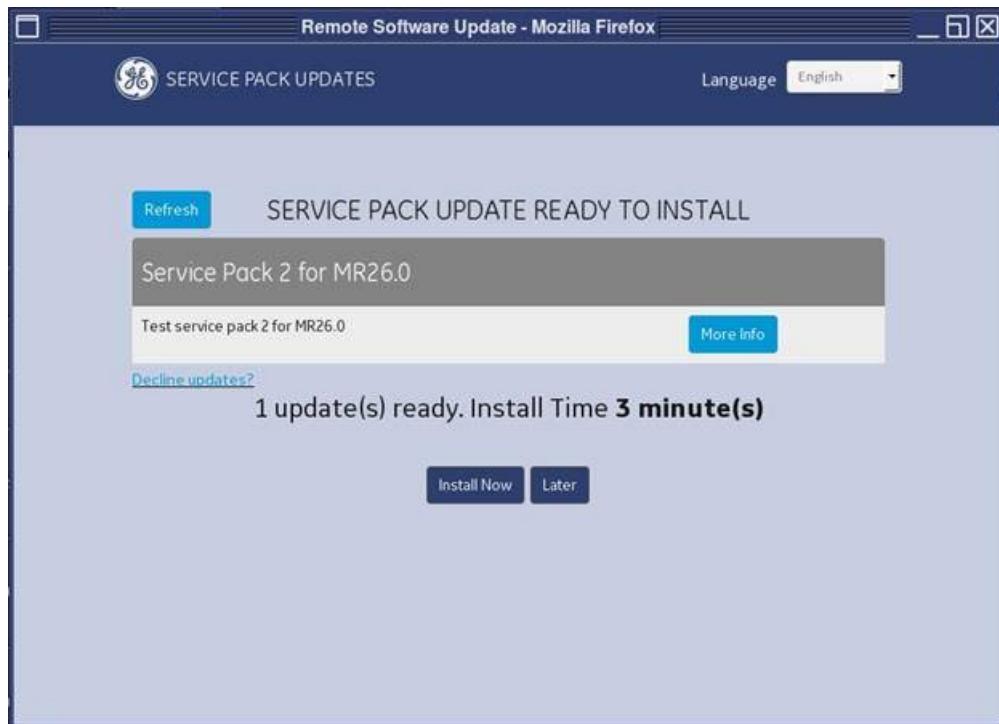
Figure 3-108: Authorized EA3 user install screen



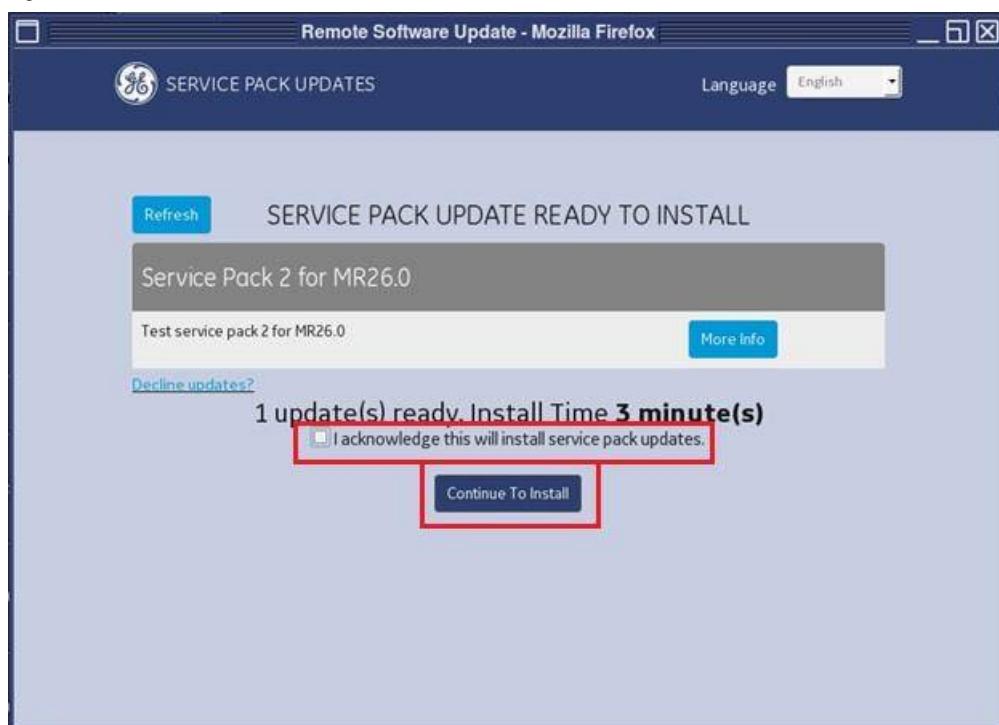
- You can click **Install Now** to start the software download.
 - You can click **Later** to install the software at a later date and then proceed to logon.
3. If your site has Auto Install, the following screen appears.

Figure 3-109: Auto Install screen

- The counter will count down to 30 seconds and then automatically install the service pack.
 - The system does not check for any authorization.
 - a. If you do not want the installation to occur, click **Later**.
4. If your system is configured for all users to authorized a software download, the following screen appears.

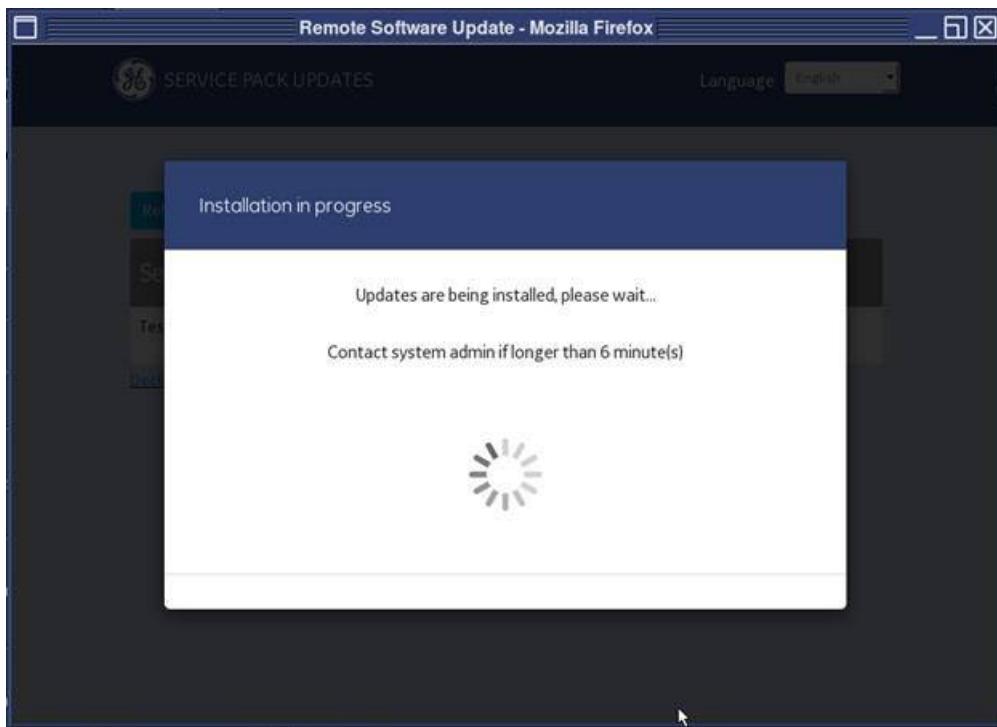
Figure 3-110: All users install screen

- The system does not check for any authorization.
- 5. Once you have accepted an Install Now, the following screen appears.

Figure 3-111: Continue to install screen

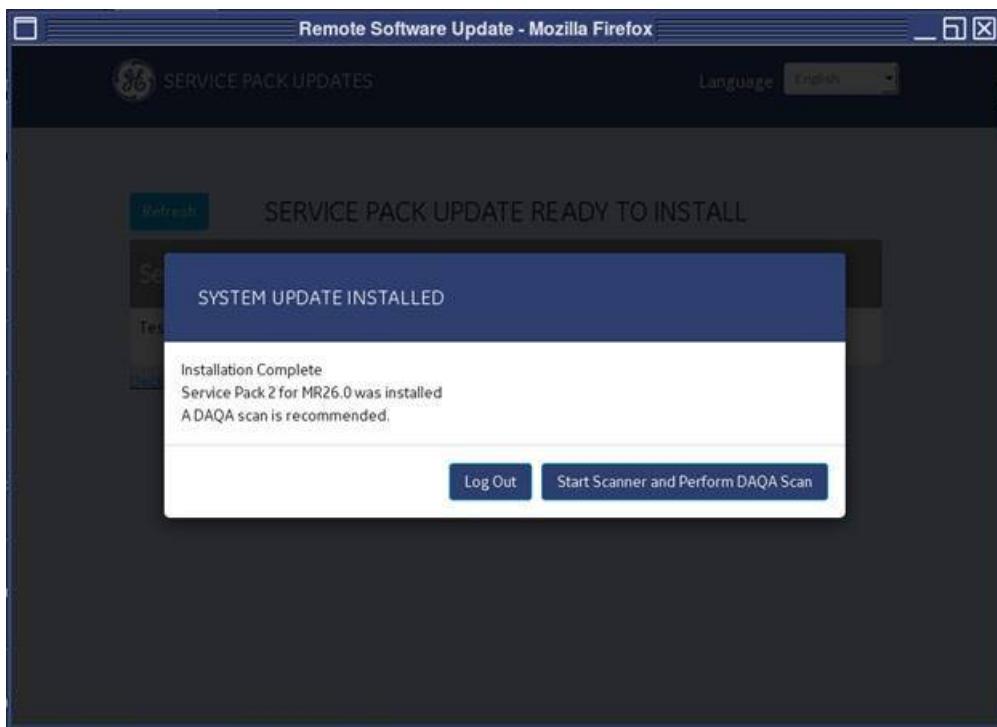
- a. Click the **Acknowledge** box.
- b. Click **Continue to Install**.
 - The following screen appears while the installation occurs.

Figure 3-112: Installation screen



6. When the installation is completed, the following screen appears. Make one of the following selections.

Figure 3-113: Installation complete screen



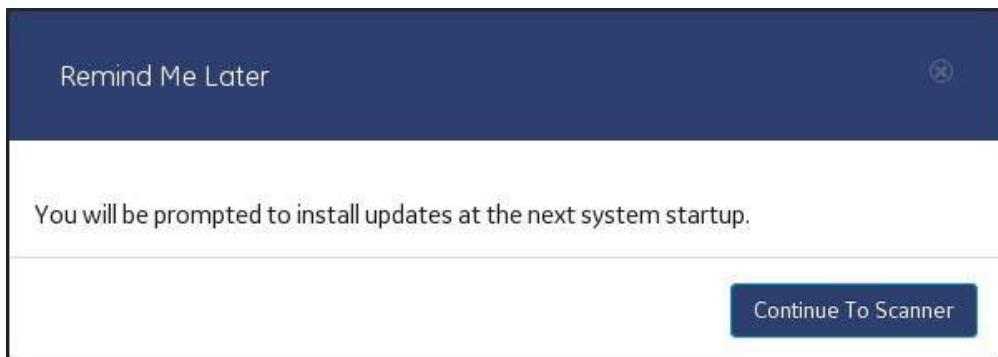
- a. Click **Log Out** to log out the currently logged in data privacy user and continue to boot the system.
- b. Click **Start Scanner and Perform DAQA Scan** to proceed to scan once a DAQA scan is completed.

Considerations

Later

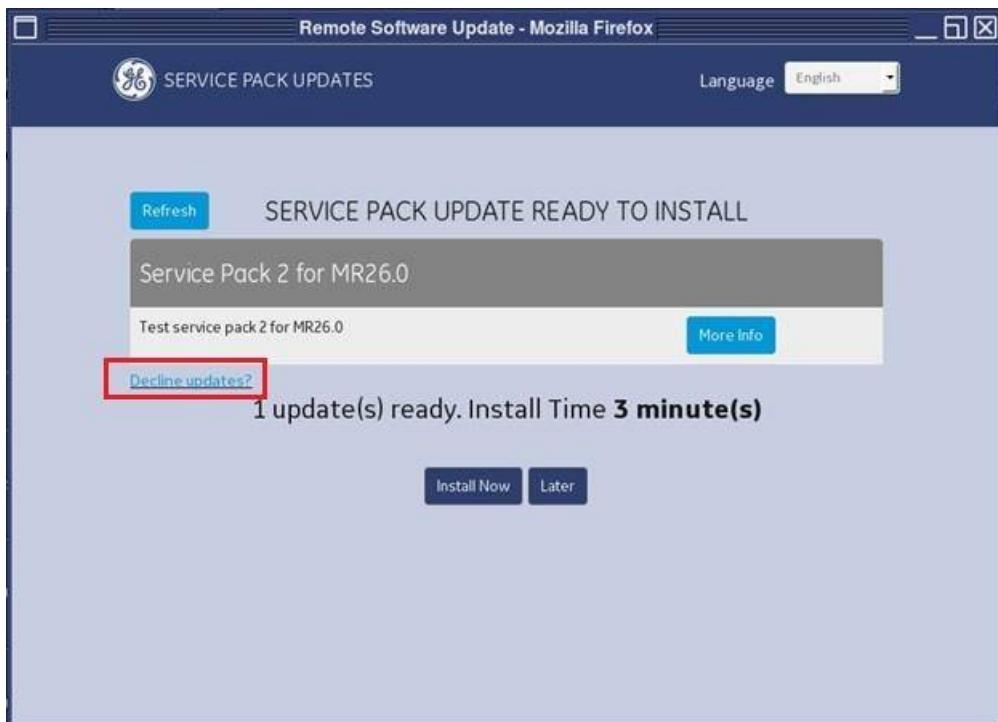
In all modes, if you click **Later**, a prompt for install during next startup of MR scanner, appears. Click **Continue to Scanner** to proceed to logon.

Figure 3-114: Later screen prompt



Decline Updates

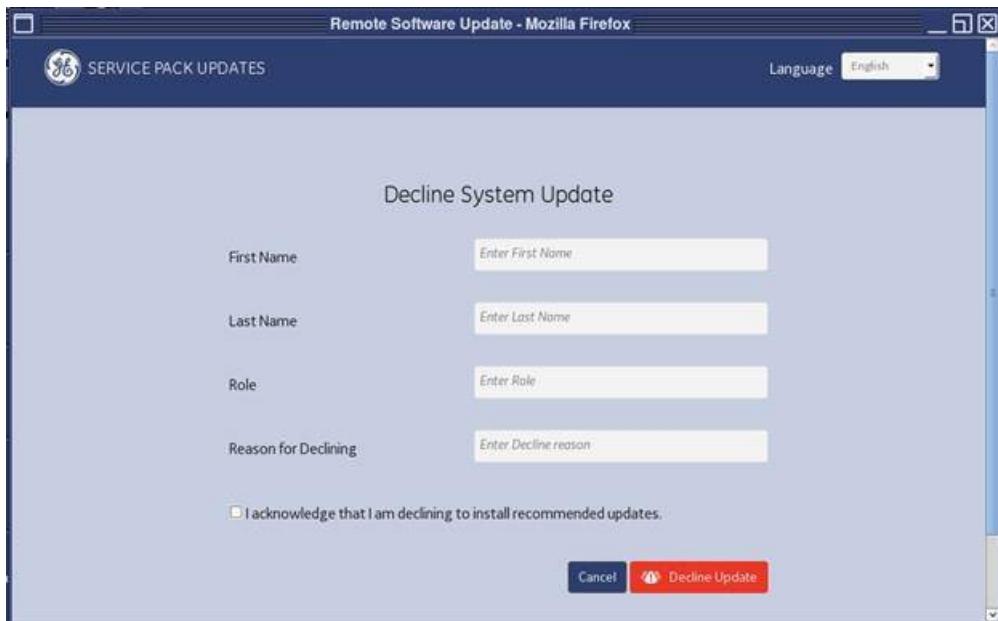
Figure 3-115: Decline Updates selection



In all modes, if you select **Decline updates**, the following screen appears, from which you must enter text in all fields and click the Acknowledgment box:

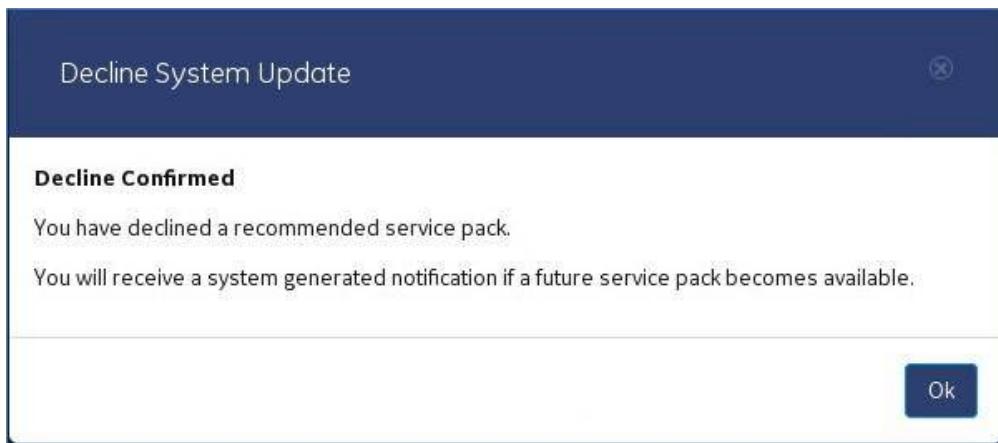
- First Name
- Last Name
- Role
- Reason for declining
- Acknowledgment box

Figure 3-116: Decline updates screen



Once the text fields are completed, click **Decline Update** and the following prompt appears.

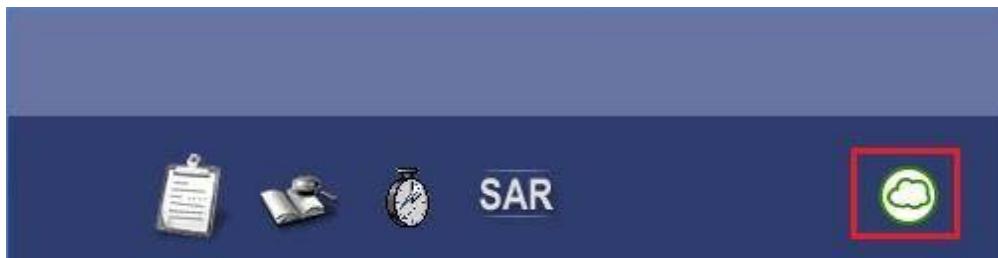
Figure 3-117: Decline updates confirmation prompt screen



Click **Ok** to proceed to logon.

Service Pack icons

Once the MR system is up and operational, if a software download is available, an icon appears in the footer area of the screen.

Figure 3-118: Software download available icon

The icon changes based on conditions described in the table below.

Table 3-31: Service Pack icons

Icon	Description
This icon displays when a new service pack is available and the MR system is up and operational. Click the icon to see an information screen about the service pack. Click Close to close the information screen.	
This icon displays when a service pack has been successfully installed. The icon automatically turns off 20 seconds after it is displayed.	
This icon displays when a service pack has failed to install. The icon automatically turns off 20 seconds after it is displayed.	
This icon displays when the MR system is connected to Backoffice. The frequency at which the system checks Backoffice for software updates is every 5 days.	

Related topics

[System management introduction](#)

SYSTEM MANAGEMENT

Secure Service Access procedure

Secure Service Access is a soft service license key that enables various levels of service software tools packages. If you have a SSA¹ license, you are required to renew the soft service license yearly.

Considerations

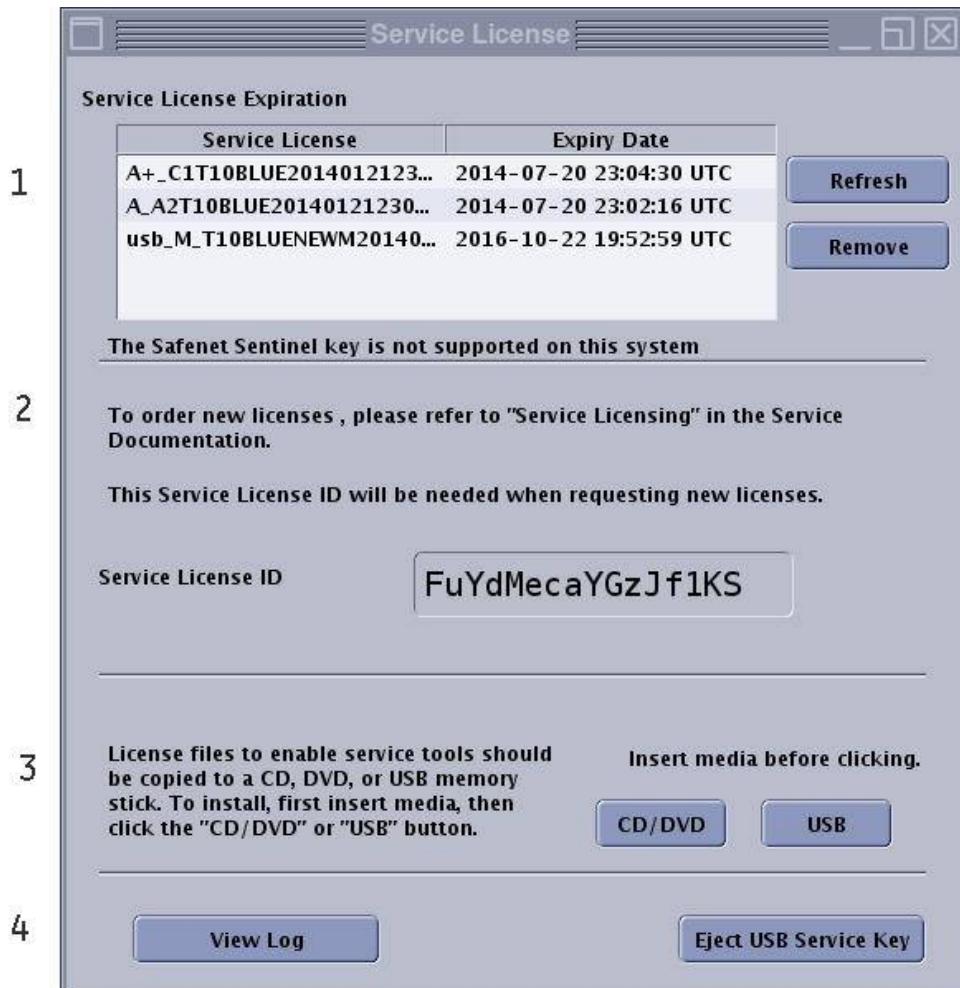
- Depending on your Soft service license contract, your key may expire in 1 year from first date used. Please refer to service license page for expiration dates.
- For additional information on your SSA license, contact your local sales/service representative.
- To find how to order a new license and more details regarding the new Secure Service Access customer website link, please refer to your "Service Licensing" section in the Service Documentation.

Use these steps to access the SSA screen.



1. From the header area of the screen, click the **Tools icon**.
2. From the Tools menu, click **Install Service Licenses**.
 - Alternatively, from the Service Desktop Manager screen, click **Service Browser**. From the MR Service Desktop Insite Browser, click **Insite Service License**.
3. The Service License screen displays.

¹Secure Service Access

Figure 3-119: Example of a Service License screen. Your screen will vary based on the licenses on your system.**Table 3-32:** Image legend

#	Description
	Service License Expiration area displays the Service License name and its expiration date.
1	<ul style="list-style-type: none"> Click Refresh to update the list. Click a license from the list and click Remove to remove a service license.
2	Your service license ID that is required to order new licenses.
3	Use a CD, DVD or USB drive to install a new Service License file (used by service representative).
4	<ul style="list-style-type: none"> Click View Log to view the date, License name and its status. Click Eject USB Key (used by service representative) to remove the USB service key.

- Click the **X** in the upper right corner to close the screen.



For more information about your licenses, contact your GE sales/service representative.

Related topics

[System Management introduction](#)

SYSTEM MANAGEMENT

Service Notepad write a message procedure

Use these steps to write a message that will be posted on the Error Log.



1. In the header area, click the *Tools icon* to open the **System Management work area**.
2. Click the **Error Log** tab.
3. Click **View Current Messages**.
4. On the Scan Error Log screen, click **Notepad**.
5. Verify that the Number Lock keypad is **off**.
6. In the Service Notepad text box, type a message.
7. Click **Save** to save the message to the error log and close the window.
 - Clear erases the message and allows you to write a new message.
 - Exit closes the Service Notepad screen without posting your message on the Scan Error Log.

Related topics

- [Error log message procedure](#)
- [System management orientation](#)

SYSTEM MANAGEMENT

TiP Virtual Assist activation procedure

Use these steps to activate TVA for receiving live-on-demand support to troubleshoot system performance.



1. In the header area, click the *Tools icon* to open the **System Management work area**.
2. Click the *iLinq* tab.



- Alternatively, click *iLinq* icon located in the footer area of the screen.
3. Click **TiP Virtual Assist**.
 4. Click **Accept** to view the Remote training screen and connect the console to TVA.
 - The buttons displayed depend on the current status of the training session.
 - Click **Close** to close the screen without connecting to TVA.

Related topics

[System management orientation](#)

GUIDED INSTALL

Guided Install introduction

This section describes the guided install topics available on MR system platforms.

Guided install procedures

[Map a protocol to HIS/RIS code procedure](#)

[Configure MR with the HIS/RIS system procedure](#)

[SPR Snap procedure](#)

[Set default protocol library procedure](#)

[Protocol lockout procedure](#)

[Patient anonymize settings procedure](#)

[Admin password procedure](#)

[System date and time procedures](#)

GUIDED INSTALL

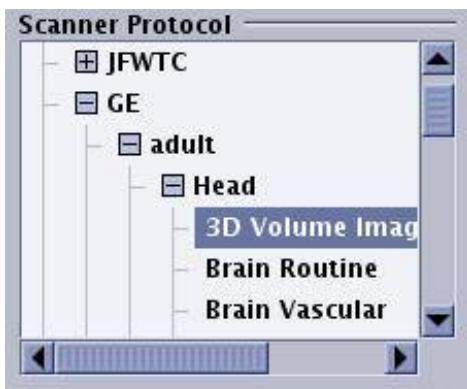
Map a protocol to HIS/RIS code procedure

Use these steps to map a protocol to a particular HIS/RIS code.



1. In the header area, click the *Tools icon* to open the **System Management** work area.
2. Click the **Service Desktop Manager** tab.
3. From the Service Desktop Manager, click **Guided Install**.
4. From the list of applications, click **Protocol Manager**.
5. Click **Start**.
6. From the left panel, click **Auto Mapping Configure**.
7. From the Scanner Protocol area, navigate to the protocol location in which you want the auto map associated.

Figure 3-120: Scanner Protocol area



8. From the Scanner Protocol - RIS Protocol code Mapping area, enter the Action Code and Coding Scheme Designator for the selected scanner protocol.

Figure 3-121: RIS Protocol code Mapping area

Scanner Protocol - RIS Protocol code Mapping			
Scanner Protocol	Action Code	Action Description	Coding Scheme Designator
3D Volume Imag...	3DVI		GEHC

9. Click **Configure**.
 - Each time a worklist item comes in with the same Action Code and Coding Scheme Designator, the exam is launched with the protocol selected from the Auto Mapping Configure screen.

Figure 3-122: RIS Protocol Code area

10. From the Guided Install menu bar, click *File > Quit*.
11. Click **Yes**.

Related topics

[Protocol orientation](#)

[Set default protocol library](#)

[Protocol lockout procedure](#)

GUIDED INSTALL

Configure MR with the HIS/RIS system procedure

The ConnectPro MR application allows you to download a modality worklist to your MR system. The MR system must be configured to obtain data from the *HIS/RIS* system and to map protocols to action items. The actual configuration must be done by a service engineer with the assistance of the facility's Information Technology department. Through the *HIS/RIS* and *SCP* tabs on the Guided Install panel, the server and port setup and the *SCP* (charge codes used by the scanning facility when billing insurance) can be established.

1. [Navigate to the Service Desktop Manager](#).
2. On the Service Desktop Manager, click **Guided Install**.
3. From the list of applications, click **HIS/RIS DICOM**.
4. Click **Start**.
5. Select **SCPConfigure** or **PPS Configure** from the left side of the Guided Install window to check if the system is configured with *HIS/RIS*.
 - If it is not configured, notify your service engineer or work with your site IT team to configure your MR system with your *HIS/RIS* system.
6. Select any of the other options from the left side of the Guided Install window and make adjustments as needed.
7. When all work is completed on the Guided Install screen, click **Configure** and respond to any prompts.
8. To exit Guided Install, from the Guided Install menu bar, click **File > Quit**.
9. Click **Yes**.
10. Reboot the system to activate your changes.

Related topics

[Worklist Manager orientation](#)

GUIDED INSTALL

SPR snap procedure

Use these steps to acquire an SPR¹ snap for the following scenarios:

- Anytime there is a system hang, lock or crash. A crash can be defined as anytime the system as a whole or any part of the system quits functioning completely. When in doubt, run an SPR Snap regardless. It takes only minutes and you don't have to stop any other function to do so.
- Anytime a problem forces you to reset the TPS or re-boot the computer.
- Run the SPR Snap, if possible, before resetting or re-booting the system. If this is not possible (for example, if the screen/mouse freezes), run the SPR Snap immediately after the re-boot.

An SPR Snap is a script that is run on the scanner that captures a file with the following:

- all of the most recent error messages
- the most recent protocol run
- log files that may indicate where a problem occurred
- your description of what went wrong

This file can then be viewed for analysis by the engineering group.



1. In the header area, click the **Tools icon** to open the **System Management work area**.
2. Click **Service Desktop Manager** tab.
3. On the Service Desktop Manager, click **Guided Install** if it is not already selected.
4. From the list of applications in the Service Desktop Manager, click **Spr Snap**.
5. Click **Start**.
6. From the SPR snap screen, complete the following fields.
 - a. From the left panel, click **sprsnap**.
 - b. Select **Yes** or **No** to the question "Store SPR Information onto DVD?".
 - If you respond with a Yes, insert a DVD into the DVD drive.
 - c. Select **Yes** or **No** to the question "Remove SPR directory when done?". This option is only available if you selected Yes to the "Store SPR Information onto DVD?" question.
 - Typically select No so that, if needed, your service engineer can view the SPR directory.
 - d. Select how far back you want to retrieve the system log files.
 - Number of retrieve days are: 2, 7, 15 and 30.
 - An SPR snap can sometimes take as long as 15-20 minutes. Generating traces for the core files is one of the most time consuming parts of an SPR snap. Selecting a shorter retrieval day value can significantly reduce the SPR snap time, particularly if it has been a long time since a software load from cold was performed.
 - e. Type and enter a brief description of the problem in the problem text field.

¹Software Problem Report

7. Click **SPR SNAP**.
 - A busy cursor appears while the snap is in progress.
8. Click **OK** to the message prompt. Record the SPR snap location, if desired.
9. From the left panel, click **Log file** and scroll to the bottom of the list to view the SPR snap, if desired.
10. From the Guided Install menu bar, click **File > Quit**.
11. Click **Yes**.

Related topics

[Guided Install introduction](#)

GUIDED INSTALL

Set default protocol library procedure

Use these steps to set the default protocol library, humanoid and to automatically have a set of filters applied by anatomical area.



1. In the header area, click the **Tools icon** to open the **System Management work area**.
2. Click the **Service Desktop Manager** tab.
3. From the Service Desktop Manager, click **Guided Install**.
4. From the list of applications, click **Protocol Manager**.
5. Click **Start**.
6. From the left panel, click **Default Configuration**.
7. From the Default Configuration screen and from the Library menu, typically select your site library.
8. Click one of the options for Humanoid: **Adult** or **Pediatric**.
9. If desired, select an Anatomy area from the menu and then click the desired filters that you want to automatically be applied to that anatomical area. Repeat this action for each anatomical area.
10. Click **Configure**.
11. From the Guided Install menu bar, click **File > Quit**.
12. Click **Yes**.

Related topics

[Protocol orientation](#)

[Protocol lockout procedure](#)

[Map a protocol to HIS/RIS code](#)

GUIDED INSTALL

Protocol Lockout procedure

Use these steps to enable Protocol Lockout to protect protocols from being changed by unauthorized users.



1. In the header area, click the **Tools icon** to open the **System Management** work area.
2. Click **Service Desktop Manager** tab.
3. From the Service Desktop Manager, click **Guided Install**.
4. From the list of applications, click **Protocol Manager**.
5. Click **Start**.
6. Click **Password Configure** to open the Password Configure screen.
7. In the Lock Required menu, select **Yes**.
8. Enter a password that is between 4 and 8 characters.
9. Confirm the password.
10. Click **Configure**.
11. Click **OK** to the confirmation prompt.
12. From the Lock Protocol menu bar, select **File > Quit**.
13. Click **Yes** to the confirmation prompt.



To turn off **Protocol Lock**, complete steps 1 to 6, and then in the Required menu, select **No**.

Reset the password

Use these steps if you want to reset the password to the default (adw2.02.0) or enter a new password.

1. From the the Password Configure screen click **Reset Password**.
2. Click **OK** to the message prompt.
3. If desired, enter a new password.
4. Confirm the password.
5. Click **Configure**.
6. Click **OK** to the confirmation prompt.
7. From the Lock Protocol menu bar, select **File > Quit**.
8. Click **Yes** to the confirmation prompt.

Related topics

[Protocol orientation](#)

GUIDED INSTALL

Reset the password procedure

Use these steps if you want to reset the password to the default (adw2.02.0) or enter a new password.

1. From the the Password Configure screen click **Reset Password**.
2. Click **OK** to the message prompt.
3. If desired, enter a new password.
4. Confirm the password.
5. Click **Configure**.
6. Click **OK** to the confirmation prompt.
7. From the Lock Protocol menu bar, select **File > Quit**.
8. Click **Yes** to the confirmation prompt.

Related topics

[Protocol introduction](#)

[Guided Install introduction](#)

GUIDED INSTALL

Patient anonymize settings procedure

Use these steps to change the level of anonymizing patient information.

1. [Open the Service Desktop Manager.](#)
2. Click **Guided Install**.
3. From the Guided Install list, click **Anonymization Settings**.
4. Click **Start**.
5. In the left portion of the Guided Install screen, click **Patient Anonymization Settings**.
6. Select **Partial** or **Full** from the menu.
7. Click **Configure**.
 - The Configure button only becomes available when you change the Anonymize setting from the selection that is displayed when you first entered the window.
 - The anonymization setting displayed in the menu is activated once you click Configure.
8. Click **OK**.
 - You do not have to reboot to activate the new anonymization mode.
9. From the Guided Install screen menu bar, click **File > Quit**.
10. Click **Yes**.

Related topics

[Patient de-identification procedure](#)

[Tools orientation](#)

GUIDED INSTALL

Admin password procedure

Use these steps to change or reset the Administrator password for system preferences.



1. Click **Tools icon** to display the **System Management work area**.
2. Click the **Service Desktop Manager** tab.
3. From the Service Desktop Manager, click **Guided Install**.
4. From the list of applications, click **System Preferences**.
5. Click **Start**.
6. On the System Preferences Password screen, click **System Preferences**.
7. In the System Preferences Selection area, select Enable password protection **Yes**.
8. In the System Preferences Selection area, type a password in the New system Preferences Password text field.
9. Retype the password in the confirmation text field.
10. Click **Save the new password** and respond to the confirmation prompt.
 - If no password is defined, adw2.02.0 is the administrative password.
 - If you answered **No** in step 7, click **Configure** to disable the password protection.
11. From the Guided Install menu bar, click **File > Quit**.
12. Click **Yes**.
13. Reboot the system to activate your changes.

Related topics

[Preferences orientation](#)

GUIDED INSTALL

System date and time procedure

Use these steps to change the date or time that is displayed in the footer area of your MR system.

Considerations

- If the scanner time drifts out of synchronization with the actual time, it is probable that the Network Time Protocol server was not configured to synchronize time with the MR scanner. Please consult with your service engineer to properly configure the Network Time Protocol server.
- If your MR system is configured with Network Time Protocol server, any date or time setting done in Guided Install will be overridden with the time supplied by the Network Time Protocol server.

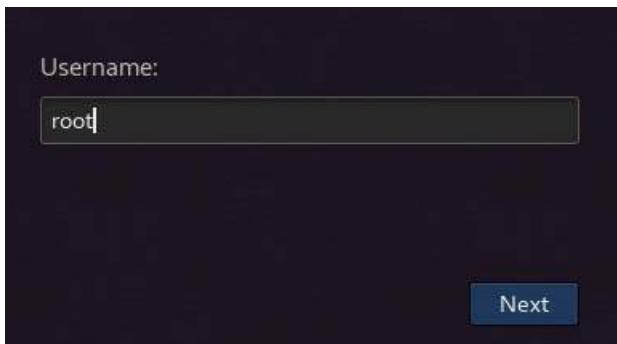
Procedure

1. Restart your MR system.
2. From the Logon screen, click **root login**.
 - This action logs you on as a Root User.

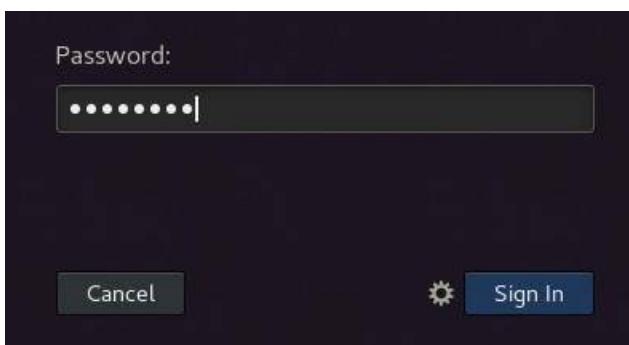
Figure 3-123: Logon screen



3. Enter the following information.

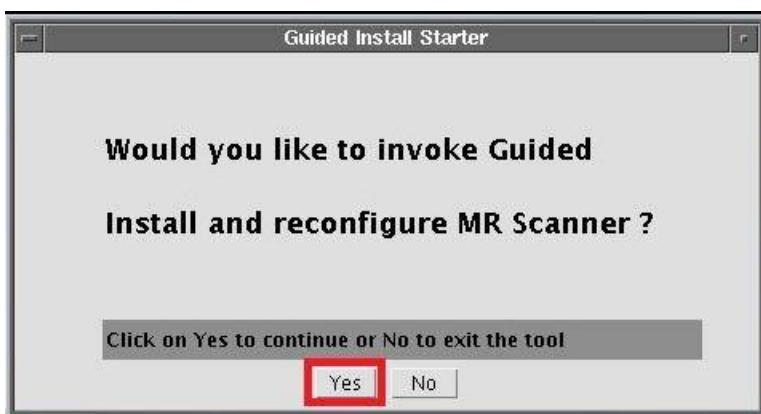
Figure 3-124: Root Username screen

- a. In the Username field, type **root**.
- b. Click **Next**.

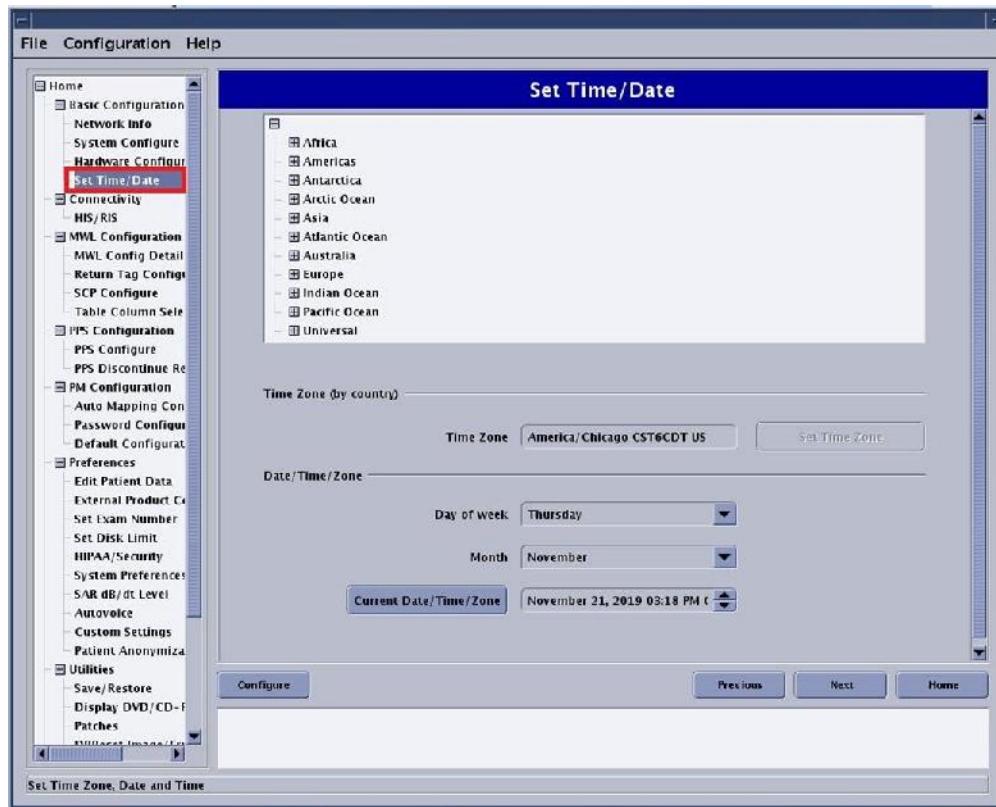
Figure 3-125: Password screen

- c. In the Password field, type **operator**.
 - If the password was changed, consult with your system administrator for the correct password.
- d. Click **Sign In**.

4. From the Guided Install Starter screen, click **Yes** to launch Guided Install.

Figure 3-126: Guided Install Starter screen

5. From the Basic Configuration section on the Guided Install screen, click **Set Time Date**.

Figure 3-127: Guided Install screen

6. From the Set Time/Date screen complete these steps.
 - a. Select the desired geographic area and/or time zone and click ***Set Time Zone***.
 - b. From the Date/Time/Zone area, select an option from the menus or click ***Current Date/Time/Zone***.
 - Use the arrow buttons to change the values.
 - c. Respond to any confirmation prompts.
 - d. Click ***Configure***.
7. From the Guided Install menu bar, click ***File > Quit***.
8. Restart your MR system.

Related topics

[System management orientation](#)

Chapter 4: Patient handling

Patient preparation depends on a range of factors including the type of study, the RF coil being used, and the patient's condition. Regardless of the type of examination, patient comfort and safety are of primary importance.

Procedures

[Cardiac patient setup](#)

[Setup the coil procedure](#)

[ECG gated exam procedure](#)

[Peripheral gated exam procedure](#)

[Patient padding](#)

[Padding introduction](#)

[Surface coil padding considerations](#)

[Whole body padding considerations](#)

[Other procedures](#)

[Screen patients and personnel procedure](#)

[Patient transfer procedure](#)

[Patient position procedure](#)

[Protect patient's eyes and ears procedure](#)

[Protect the patient from RF burns procedure](#)

[Patient landmark procedure](#)

[Patient return to landmark procedure](#)

[Transfer patient off the table procedure](#)

[Patient emergencies procedures](#)

PROCEDURES

Screen patients and personnel

For your safety and the safety of the patient, an MR safety-trained health care worker at your facility should carefully screen for hazards before patients and personnel enter the Exclusion Zone. All personnel must be aware of and comply with your facility's screening procedure.



WARNING

Patient screening is required for patients who are going to be imaged on an MR scanner.

1. Use a Patient Screening form routinely before bringing patients or other personnel into the Exclusion Zone.
 - Thoroughly review all safety information and considerations before starting a scan with patients that have an MR Conditional implant. In general, patients with conductive (e.g. metallic) implants are contraindicated for MR scans. For patients with implants that are labeled as MR Safe or MR Conditional consult the implant device manufacturer's documentation.
 - Every patient, individual, and employee must be carefully screened prior to admission to the magnetic field. Refer to the [Screening form](#) topic.
2. Review the completed screening form and evaluate the individual prior to entry.
 - Identify circumstances that contraindicate admission to the Exclusion Zone or items that need to be removed before entering the Security Zone.
 - In addition to safety issues, metal objects or materials containing metal may distort the magnetic field and detract from the image quality.
3. Discuss the items on the screening form with the patient or other individual.
 - Verbally interview the patient to verify the information on the form and ensure the patient understands each question he/she is answering.
 - Allow discussion of any question or concern that the patient may have.
4. Examine all patients with diapers or incontinence products, including adults, should have dry diapers on prior to the start of the scan.
5. Examine or X-Ray patients who are at risk for metal eye slivers.
 - Serious injury may occur as a result of movement or heating of the metallic foreign body as it is attracted by the magnetic field of the MR system.
 - Follow your departmental clinical screening policy.
6. Require that patients change clothes.
 - Provide clothes without metallic fasteners and pockets.
 - Patients should not wear shoes into the magnet room as they may have collected metal on the soles.
7. Instruct the patient to wash off non-permanent make-up.
 - Follow the precautions for patients with permanent make-up such as permanent eyeliner, which can cause tissue heating.
8. Keep metal out of the bore.*

- A metal-free bore prevents burns and image artifacts.

*In general, patients with conductive (e.g. metallic) implants are contraindicated for MR scans. Some implantable devices have been labeled as MR Conditional under certain operating conditions. Only use quadrature transmit for MR Conditional devices. MR Safe implants will have the MR Safe symbol in their implant documentation.

When evaluating whether to proceed with MR scanning on patients with such implants, consult the implantable device's labeling.

Related topics

[Contraindications for use](#)

[High risk patient](#)

[Clinical screening](#)

[Patient emergencies](#)

PROCEDURE

Patient transfer procedure

The table is designed to accommodate the transfer of ambulatory, wheelchair, and gurney patients. For table weight specification details, see [Table](#).



Note that the MR magnet is always on even when the system is not acquiring scan data. The only exception to this is if service has ramped down the magnet or it has been quenched.

1. Make sure the patient has completed the screening sheet and has removed all metal items.
2. Bring the patient to the table either in a non-ferrous wheelchair or non-ferrous gurney, or escort the ambulatory patient into the scan room.



WARNING

Do not bring conventional life-support equipment into the magnet room, because it may contain metal parts and may malfunction or cause patient injury or equipment damage.

3. If the patient is using a wheelchair or gurney, lock the wheels.
4. If using a coil, place it on the table. For details see the [Connecting Coils procedure](#).
5. Press the **Up** and **Down** foot pedals at the magnet end of the table to adjust the table height.
6. Transfer the patient onto the table.
7. Help the patient with any medical accessories he or she may have.
8. Raise the table to scanning height.
9. Remove any wheelchairs or gurneys from the scan room.

Related topics

[Patient position procedure](#)

[Patient preparation orientation](#)

PROCEDURE

Patient position procedure

Thoroughly review all **patient preparation** and **screening** information in the **MR Safety Guide**, 2381696, prior to scanning a patient or allowing anyone into the MR scan room.

1. Position the patient on the table, either head or feet first.
 - Typically, use head or feet first for body scans and head first for head and neck.
 - For table weight specification details, see the following **System specifications**.
 - All MR healthcare providers that work with the patient must be trained to reduce the risk of patient musculoskeletal injury such as fracture, dislocation or subluxation during the transfer of the patient on/off the table, positioning the patient on the table, positioning coils on the patient, etc.
2. Position the patient either supine, prone, left decubitus, or right decubitus.
 - From the Scan control panel, match the patient's position and orientation with the selection made on the **Patient Orientation** button. Click the arrows to change the patient orientation icon.
 - Ensure that the patient forms no closed body loops. For details, see step 4.

**WARNING**

Ensure that the Patient Position selection matches the actual patient orientation. Making a selection that does not match the patient's actual position results in incorrectly annotated and/or rotated images, possibly resulting in improper medical treatment.

Table 4-1: Patient Orientation menu

Selection	Description
 Head First, Supine	Head first, supine orientation.
 Head First, Right Decub	Head first, right decubitus orientation.
 Head First, Left Decub	Head first, left decubitus orientation.
 Head First, Prone	Head first, prone orientation.

Selection	Description
 Feet First, Supine	Feet first, supine orientation.
 Feet First, Right Decub	Feet first, right decubitus orientation.
 Feet First, Left Decub	Feet first, left decubitus orientation.
 Feet First, Prone	Feet first, prone orientation.

3. Position the imaging coil, if needed.

- Each coil, other than the body coil, has an operator manual. Refer to the coil operator manual when setting up the patient for an exam.
- Use the supplied coil pads with the coil at all times. The coil should never come into contact with the patient.
- Never let the coil's RF¹ cables come into contact with the patient. Position cables under a cushion whenever possible.
- Use only approved, undamaged RF coils.
- Inspect coils for damage and wear. Do not use a coil that is not functioning properly, e.g., tuning problems or intermittent poor quality images.
- When using the Head Neck Array coil, it is recommended to first place the base of the coil on the table then position the coil on the patient. Storing the coil on the table or the bore entry is not advised.
- Consider using a [multi-coil configuration](#).



WARNING

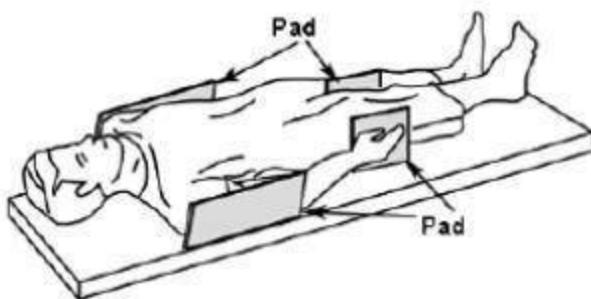
All coil components must be plugged in when they are in the scanner. This includes coil components that should be plugged into the system and coil components that should be plugged into another coil component. Leaving components unplugged can damage the coil, or cause harm to the patient.

¹Radio Frequency

4. Position the patient with padding.

- Review the **Contact Point Heating** section of the MR Safety Guide (#2381696) for patient positioning information.
- For more patient padding details, see **Patient padding**.
- Position the patient so that there is no direct contact between the patient's skin and the bore of the magnet or an RF coil.
- Hand-to-hand, calf-to-calf, and elbow to side contact should be avoided. To help prevent a patient burn from closed loops formed by clasped hands, hands touching the body, from thighs touching, or from the patient's breasts contacting the chest wall over a small area, insert nonconducting pads at least 0.25 inches thick between touching parts.

Figure 4-1: Patient positioned with non-conducting pads



WARNING

RF can cause localized heating at contact points between adjacent body parts when a loop is formed. Such localized heating can result in discomfort, or burns. This could occur when a patient's hands are touching or when a female patient's breasts are compressed to her chest. Use pads between body parts to avoid creating a loop with adjacent body parts.

5. Position the patient with straps. Insert the straps into the mounting track on the table and wrap the straps around the patient. Straps are to stabilize, not restrain the patient.

Figure 4-2: Strap inserted in table mounting track



- If you find it difficult to insert the strap into the track or move it in the track, then slightly bend the strap base on a hard surface.

Figure 4-3: Bend the strap base



Figure 4-4: Bent strap that more easily slides in the mounting track



6. Provide blankets, pillows, etc. for **patient comfort**.
7. Add dielectric pads if required.
 - **Dielectric pads abdomen procedure**
 - **Dielectric pads neck procedure**
8. If necessary, attach cardiac leads and the respiratory bellows.
 - **Standard gating setup**
 - **Peripheral gating setup**
 - **Vector gating setup**
 - **Respiratory bellows procedure**



WARNING

Do not use waveforms for physiological monitoring. Patient condition may not be reflected, resulting in improper treatment.

9. Remove any accessory devices from the bore of the magnet that are not required for the procedure.
10. Keep electrically conductive material that must remain in the magnet bore from directly contacting the patient by placing insulation between the conductive material and the patient.
11. Place a clean cotton sheet over the coil and comfort pad so the patient's skin does not come in contact with the coil or the comfort pad.
12. Position RF cables down the center and directly out of the bore (i.e., not along side of the MR system or close to the body coil or other transmit RF coil), without looping or crossing the cables.
 - Route the cables so there are no loops (conductive loops can be circular, u-shaped, or s-shaped) in any cables in the magnet.
 - Use the appropriate gating cable for surface coil imaging.
 - Use only **MR system recommended** monitoring equipment, ECG leads, wires, electrodes, and other components and accessories.
 - Follow all instructions for the proper operation of physiologic monitoring or other equipment provided by the manufacturer of the device.
13. Provide the patient with the **patient alert bulb** so that the patient may signal you if needed.
 - If your patient tells you he or she is experiencing a burning sensation, stop the scan.
14. Explain breathing instructions, table movement, length of exam, gradient noise, adjustment of mirror on head coil, etc.
 - Instruct the patient not to clasp his or her hands or cross his or her feet in the magnet bore.
15. Provide the patient with hearing protection.
 - Review the **Acoustic Noise section** of the MR Safety Guide.



Closely monitor the patient (especially those who are unconscious) during the procedure. If the patient reports sensations of heating or other unusual sensation, discontinue the procedure immediately and perform a thorough assessment of the situation.

Related topics

- [Transfer patient on the table](#)
- [Transfer patient off of table](#)
- [Patient landmark procedure](#)
- [Patient preparation orientation](#)

PATIENT PADDING

Padding introduction

Preventing patient warming is one of the most important safety measures you must take into consideration as you prepare a patient for an MR exam. Appropriate RF padding and proper patient positioning are the most effective means of preventing injury related to RF heating. The following are a few “golden rules” to remember as you position and pad your patients:

- Only use GE approved RF padding.
- Approved padding must be a minimum of 0.25 inches (0.635 cm) thick.
- Appropriate padding must be used EVERY time without exception.
- Sheets and gowns are not a substitute for approved RF padding.
- Never allow your patient’s skin to come in direct contact with the scanner bore or any surface coil or cable.
- If a patient does not fit in the MR scanner bore with the required padding, another modality should be used to image the patient.

While some of these rules may seem a little tough to follow at times, remember that RF injury, which can in extreme cases include burns such as the one you see below, can happen very quickly and your patient may not have time to warn you in time to prevent an injury.

Figure 4-5: Elbow RF Burn



The following are a series of short vignettes that will assist you in properly positioning and applying RF padding to your patients. Should you need more information on prevention of patient warming than what is provided here, refer to your surface coil and MR Safety Manuals. If you need help beyond the documentation please do not hesitate to reach out to your local Applications Specialists.

Considerations

Whole body padding

Surface coil padding

Cardiac coil padding

Procedures

Protect the patient from RF burns

PATIENT PADDING

Cardiac coil padding tips for cardiac scan considerations

RF padding with the cardiac coil is another example where you'll need to follow your basic padding recommendations to prevent contact with the scanner bore and prevent conductive anatomical loops, but there are a couple of additional steps you'll need to take to ensure patient safety.

- The coil for cardiac scans does not require additional RF padding to be placed between the patient and the anterior coil component, but you should use the manufacturers pad on the posterior component of the coil for patient RF protection. You should also cover the patient with their gown before placing the anterior component of the coil and make certain both the anterior and posterior elements are in alignment.
- Secure the coil snugly, but comfortably with the straps.
- As is the case of all surface coils ensure that the cables do not come in contact with the patient and that they are not looped and that they are routed down the center of the bore. As you can see, there is cabling that we need to isolate from the patient, so be sure to use as much padding as needed.
- If you are using the coil for cardiac scans, it's likely you are also using the ECG leads and cable. The rules for the ECG cable are the same as the coil cable. Route the ECG cable down the center of the bore, do not loop the ECG cable and do not allow it to come in contact with the coil cable.

Related topics

[Patient padding procedure](#)

[Surface coil padding](#)

[Whole body padding](#)

[Protect the patient from RF burns](#)

PATIENT PADDING

Surface coil padding considerations

Surface coils present different challenges from a patient RF padding perspective.

- First rule of thumb is to remember to use all manufacturer provided padding to prevent motion and the patient's skin from coming in contact with the coil, and to also use additional padding if appropriate to secure an opposing extremity to prevent contact with the coil which could also lead to burns or motion artifacts.
- Just as with the whole body RF padding demonstration, you'll need to make certain that the patient's skin does not come into contact with the scanner bore and that padding is placed between the hands and thighs to prevent conductive loops.
- A final safety consideration for surface coils is to ensure that the patient does not come into contact with the coil cable, therefore you may need to use additional RF padding to protect the patient.
- Care should also be taken to ensure the cable is not looped in the bore and that it is routed down the center of the scanner bore.

Related topics

[Patient padding procedure](#)

[Whole body padding](#)

[Cardiac coil padding](#)

[Protect the patient from RF burns](#)

PATIENT PADDING

Whole body padding considerations

In this first example, some general guidelines are reviewed for positioning the RF padding.

- Notice that padding is positioned not only at the patient's sides to prevent their arms from touching the bore, but that padding is also placed between the hands and thighs and between knees and ankles to prevent forming conductive loops.
- An important consideration when padding your patients is that you will need to double check the position of the pads once the patient is in the bore. Table movement may dislodge padding and expose skin to the scanner bore.

Related topics

[Patient padding procedure](#)

[Surface coil padding](#)

[Cardiac coil padding](#)

[Protect the patient from RF burns](#)

PROCEDURES

Landmark with the alignment light procedure

Axial, sagittal, and coronal alignment lights help position the area of interest at isocenter.

1. Press the Alignment light button on the Magnet control panel.



CAUTION

Exposing eyes to laser alignment lights may result in eye injury.

- Do not stare directly into the laser beam.
- Instruct patients to close their eyes to avoid eye exposure to the alignment light.
- Closely monitor all patients and prevent them from accidentally staring into the beam. Do not leave the laser beam on after you position the patient.

2. Press the **table movement** buttons to advance the cradle until the axial alignment light rests at the desired landmark. Confirm centering with the sagittal and coronal alignment lights.
3. Press **Landmark** button from the Magnet control panel. The cradle position reads zero.
4. Make sure all health lines are long enough to accommodate movement and then press **Advance to Scan** to move the cradle to magnet isocenter.
 - The alignment lights automatically turn off.
5. Adjust the in-bore light and fan.
 - For details see the [Patient comfort procedure](#).
6. Leave the scan room and enter the console room to begin scan prescription.
 - Close the scan room door during the acquisition to prevent RF leaks.
 - An open door prevents scanning.

Related topics

[Patient return to landmark procedure](#)

[Patient handling](#)

[Table concept](#)

PROCEDURES

Protect the patient's eyes and ears procedure

During scanning gradients produce noise that can exceed 99 dBA in the bore. Hearing protection is required to prevent hearing impairment. Patients must close his or her eyes when the alignment light is on during positioning. Follow these guidelines to ensure proper eye and ear protection for your patient.

1. Provide the patient with hearing protection.
 - Earplugs or a headphone system with stereo music. For details, see [Acoustic Noise](#).
 - Earplugs reduce the intensity of the sound, while allowing your patient to hear normal conversations.
 - Headphone systems soften acoustic noise, but may impede verbal communication with patients while the system is operating.

Table 4-2: Disposable ear protection

Description	dB
E8801BA EAR Disposable Foam Earplugs	29
E8801BB EAR Taperfit2 Foam Earplugs	32
E8801BC Max-Lite Foam Earplugs	30



WARNING

Hearing protection is required for all people in the magnet room during a scan to prevent hearing impairment. Acoustic levels may exceed 99 dB(A)

2. Make sure that the hearing protection device is worn properly.
 - Earplugs should be comfortable for the patient and inserted fully. Pliable earplugs compress when they are rolled between the fingers and conform to the ear after they are inserted.
 - The headphone system should be audible and comfortable for the patient.
3. Instruct the patient to close his or her eyes when the alignment light is on.
 - The Laser Alignment Lights for patient positioning can cause eye injury.



CAUTION

Turn off the laser light after positioning the patient.

PROCEDURES

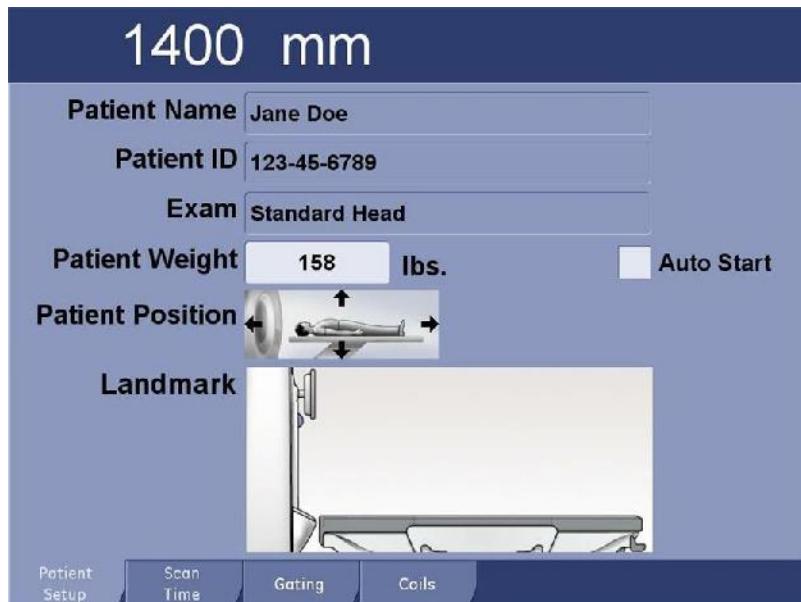
Patient landmark procedure

Use these steps to define a landmark. A scan cannot begin until a landmark has been established.

Landmark with IntelliTouch (Touch-n-Go) strip

If no landmark has been established, the in-room monitor does not display a green landmark line nor scan time.

Figure 4-6: In-room display with no green line and no scan time



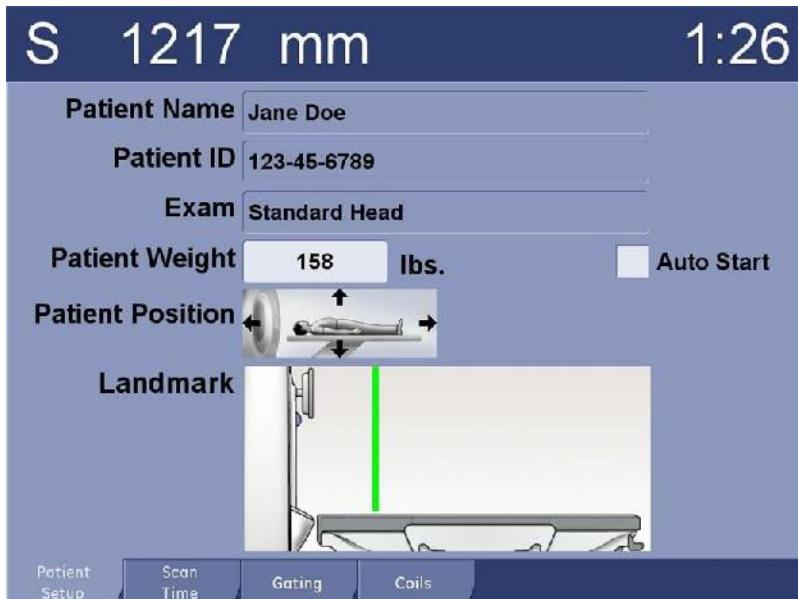
1. Press the **IntelliTouch landmark strip** on either side of the table at the location where you want to establish a landmark. The landmark location appears as a dotted green line on the in-room display.

Figure 4-7: Landmark location is dotted green line



2. Press **Advance to Scan** from the magnet controls panel within 5 seconds of pressing the **Touch and Go** strip. The cradle position reads zero and the landmark changes from a dotted to solid green line on in the in-room display.
 - If more than 5 seconds elapse between touching the **Touch and Go** strip and pressing **Landmark** or **Advance to Scan**, the green landmark line is removed from the in-room display and the previous landmark is used if one has been established for the current patient.
 - To display the dotted green landmark line, press the **Touch and Go** strip again, and then press **Landmark** or **Advance to Scan** to establish the landmark.

Figure 4-8: Landmark is a solid green line



3. Press and hold **Advance to Scan** until the Stop Cradle button turns red.
 - The cradle advances to the landmark location.
 - Make sure all health lines are long enough to accommodate movement before you press and hold **Advance to Scan** to move the cradle to magnet isocenter.
4. Adjust the in-bore light and fan.
 - For details see the [Patient comfort procedure](#).
5. Leave the scan room and enter the console room to begin scan prescription.
 - Close the scan room door during the acquisition to prevent RF leaks.
 - An open door prevents scanning.

Related topics

[Patient return to landmark procedure](#)

[Patient handling](#)

[Table concept](#)

PROCEDURE

Patient return to landmark procedure

Once you have started scanning, you can remove the patient from the magnet bore and then return the patient to the scan position without losing the landmark. This may be done to prep the patient for another phase of the exam, give the anxious or claustrophobic patient a break between acquisitions, etc.

1. When the system is in between scans, press the **Out** button (fast or slow) to bring the patient out of the magnet bore.
 - For table movement details, see [Magnet controls](#).
2. When the patient is ready to be placed back into the magnet, press the **Back to Landmark** button.

Related topics

[Patient landmark procedure](#)

[Patient preparation orientation](#)

PROCEDURE

Transfer the patient off the table procedure

Use these steps when the exam is finished to move the patient from the MR table to another mode of transportation.

1. Bring the patient out of the magnet using the table movement buttons while paying careful attention to all health lines.
 - For table movement details, see [Magnet controls](#).
2. Adjust the table height to safely transport the patient back to a gurney, wheel chair, or to exit the table and walk out of the scan room.
3. Assist the patient out of the scan room.



CAUTION

Following the exam, your patient may need assistance when getting off the table. After lying in a prone position for a length of time, your patient may experience lightheadedness upon sitting up.

PROCEDURES

Patient emergencies procedure

Dealing with patient emergencies requires special planning in the MR environment because of the magnetic field. Certain equipment used for resuscitation does not function in a magnetic field, and ferrous items can become projectiles. If a patient needs emergency medical attention during the scanning session, follow these guidelines:

1. Press ***Emergency Stop*** on the operator's console or magnet enclosure.
 - The scan aborts.
 - The power disables the patient-handling and scan-related equipment.
2. Notify emergency personnel, if necessary.
 - Since ferromagnetic life support and related equipment cannot be brought into the magnet room, it must await the patient outside the magnet room.
3. Quickly bring the patient out of the magnet bore. Refer to your specific product operator manual for details on cradle emergency release.
4. Transfer the patient onto a non-ferrous gurney or transport and remove the patient from the magnet room as quickly as possible.
 - It is important to have an assigned emergency area outside of the magnet room where you can take a patient so that the emergency team can use the necessary equipment.
5. Follow your facility's emergency protocol.



WARNING

The Emergency Stop button does not remove the magnetic field, turn off the computer cabinets, operator's console, or camera.