terason®

usmart® 3300

User Guide

Volume 1

Terason uSmart3300 Ultrasound System User Guide Volume 1

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Preface Before You Begin

Before you start using the Terason Ultrasound System, you should review this preface.

Prerequisites

Before you use the Terason Ultrasound System, you should be trained in clinical procedures for conducting ultrasound exams. This guide does not provide guidelines for the clinical aspects of performing exams or for interpreting ultrasound images.

You also need to know how to use the system computer. The Terason software runs on the Windows 7 operating system. If you are new to the Windows 7 operating system, Appendix A - Working With Microsoft Windows, on page 144 describes the Windows features used with the Terason software.

Getting Help

If you have a problem using your Terason Ultrasound System, you have options for getting help.

- General instructions for use are in the *Terason Ultrasound System User Guide*. This should be your first action. See Read This Guide Online on page 11 and Volume 2 of the User Guide on page 12.
- More technical information is included in Volume 2 of the User Guide, which is a PDF file in the directory Programs / Terason / Documentation on the computer.
- A Help file is accessible from the Terason Ultrasound program. See Online Help on page 10.
- You can contact Terason Technical Support. See Contacting Terason on page 12.
- Also see Windows Online Help on page 12 if you need help using Windows or computer functions.

Online Help

To access the help, click the **Help icon** . The Help window has three tabs on the left used to view information on the right:

Contents	Click a book ( ) to open it. Click on a topic ( ) to view it.
Index	Enter the subject you want, or scroll to find a topic, then double-click a selection.
Search	Enter the word to search for, press **Enter**, and double-click a topic.

Terason Ultrasound System User Guide

Read This Guide Online

If you are reading a printed copy of this guide, you can also read the *User Guide* online using Adobe Reader.

To read the *User Guide* online, complete these steps:

1. Press **Alt-Tab**.
2. Double-click the **Terason User Guide shortcut** on the Windows desktop.

   The computer opens the *User Guide* in the Adobe Reader software.
3. Click the Bookmarks tab to view a list of topics, or use the Guide's table of contents or index to locate topics.

   For information on using Adobe Acrobat Reader, select **Help** > **Reader Help** from the Reader menu bar.

Warnings, Cautions, and Notes

This Guide uses graphic symbols and special text to alert you to important information.

Warning: Warnings are notices describing actions or conditions that are very likely to cause damage to equipment, injury, or death.

Caution: Cautions are notices describing actions or conditions that may damage equipment or cause injury.

Note: Notes are messages containing useful information that can save time or avoid errors.

Links

If you are viewing this *User Guide* online, you can click any blue text, or any page number in the text, Table of Contents, or Index to go directly to that topic.

Printing the User Guide

Terason delivers the *User Guide* as a Portable Document Format (PDF) file. Please note that color is key for understanding some of the graphics, and these graphics may be difficult to interpret when printed in black and white or grayscale.

To print the *User Guide*, you must connect your ultrasound system to a printer, or to a network that includes a printer. This PDF document is set up for single-sided printing to accommodate the greatest number of users, but can also be printed double-sided.

Caution: A printer installed within the patient environment may result in non-conformance to safety standards. See “Intended Use” in Volume 2 of the *User Guide* for a diagram of the patient environment.
Use of non-medical grade peripherals will result in non-compliance with safety and EMI standards. Non-conformance to these standards can create risks to the patient and operator of this equipment.

To print a paper copy of the guide from Adobe Reader®, complete these steps:

1. Select **File > Print**.
2. Select a **printer** from the Name: menu.
3. Change any **print settings** that you want (optional), including which pages to print (or you can print the entire *User Guide*).
4. Click **OK**.

Windows Online Help

For help with the Windows operating system, press Alt-Tab, then click the **Windows icon** in the lower left of the screen, and click **Help and Support**. The Windows Help system opens.

Volume 2 of the User Guide

Important safety, maintenance, and technical information about the Terason Ultrasound system is included in Volume 2 of the *User Guide*. To access Volume 2 of the *User Guide*, double-click the User Guide Volume 2 icon on the Windows desktop, or navigate through the Windows / Start button to the Terason folder. The user guide files are in the Terason folder.

Contacting Terason

If you have questions about the Terason Ultrasound System, you can contact Terason support:

By Mail

Terason Division of Teratech Corporation
77–79 Terrace Hall Avenue
Burlington, MA 01803 U.S.A.

By Telephone

Voice in the U.S.A.: 1-866-TERASON (1-866-837-2766) Ext. 1048
Voice from outside the U.S.A.: 781-270-4143 Ext. 1048

By FAX

1-781-270-4145

By Email

techsupport@terason.com

On The Web

For more information, you can visit our web site at:

www.terason.com

You can view contact information by selecting **Help > Technical Support**.

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1 About the Terason Ultrasound System

Overview

The Terason Ultrasound System is an easy-to-use, portable ultrasound system that produces high resolution images.

The microminiaturized ultrasound system runs under the standard Windows interface for easy navigation. You can also connect the system to a printer for image output.

This section of the Terason User's Guide includes the following topics:

Caution: Some actions can expose the Ultrasound System computer to attack by viruses. These actions include: installing non-Terason software, connecting a USB drive, and connecting the system to a network. If you intend to perform any of those actions, or any other action that might expose the computer to a virus, Terason strongly recommends that you install an effective anti-virus software package. Terason has found that Norton AntiVirus v.9 or above and Microsoft Security Essentials are compatible with the Terason Ultrasound System.

Caution: Terason tests the installed version of Windows for safety, stability, and compatibility with the imaging software. The Windows Update function is disabled to prevent changes that might affect that stability and compatibility. Do not enable Windows automatic updates without first contacting Terason.

Indications For Use

The Terason Ultrasound System is a general-purpose imaging system intended for use by qualified physicians for analysis by ultrasound imaging or fluid-flow of the human body. Specific clinical applications and exam types include: Fetal, Abdominal, Intra-Operative (abdominal, organs and vascular), Pediatrics, Small Organ (Thyroid, Breast, Testes); Neonatal and Adult Cephalic; Trans-rectal, Trans-vaginal, Musculoskeletal (Conventional and Superficial); Cardiac (Adult & Pediatric); Peripheral Vascular.

For Diagnostic Ultrasound Indications for Use forms for the probes offered with the Terason ultrasound system, see Volume 2 of the *User Guide*.

Caution: The Terason uSmart3300 is for prescription use only.

Caution: Federal law restricts this device to sale by or on the order of a physician. The Terason system should only be used in a medical facility under the supervision of a trained physician.

Caution: Do not use the Terason Ultrasound System during an MRI exam or when using a defibrillator.

Warning: To avoid injury, make sure the Ocular preset is selected before beginning any scan of the eye. The FDA has established lower acoustic energy limits for ophthalmic use (see Indications For Use on page 15), and if the Ocular preset is selected, the system will not exceed those limits.

About Ultrasound Modes

Ultrasound is primarily an operator-dependent imaging technology. The quality of images and the ability to make a correct diagnosis based on scans depend on precise image adjustments and adequate control settings applied during the exam. The Terason software provides tools to optimize the image quality during a patient scan for all image modes.

The Terason Ultrasound System can be licensed with different levels of features. The following table lists which scan modes come with each version.

Terason Scan Mode Availability

Mode	Basic	Standard	Advanced	Optional
2D Mode	X	X	X	
M-Mode (Motion Mode)	X	X	X	

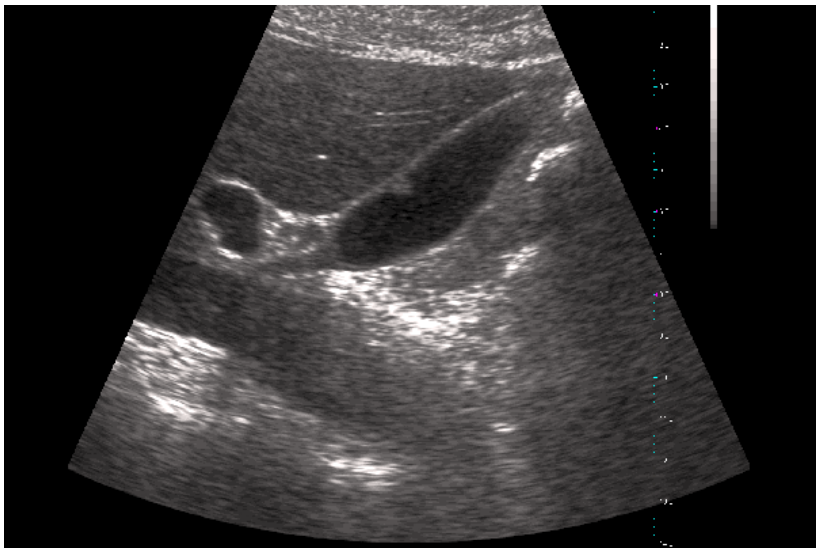
Terason Scan Mode Availability

Mode	Basic	Standard	Advanced	Optional
Triplex		X	X	
Color Doppler			X	
Pulsed-Wave Doppler			X	
Continuous-Wave Doppler		X		X
Omni Beam				X
DICOM Image Transfer				X

2D Mode

The Terason Ultrasound System delivers 2-dimensional digital imaging using 256 digital beam-forming channels. This imaging mode delivers excellent image uniformity, tissue contrast resolution, and steering flexibility in frequencies from 2 MHz to 12 MHz. The high channel count supports true phased array and high-element count imaging probes.

The 2D scan data displays in the 2D Imaging window. The figure below shows a sample 2D obstetrical scan.



Example 2D Scan

To use 2D, see:

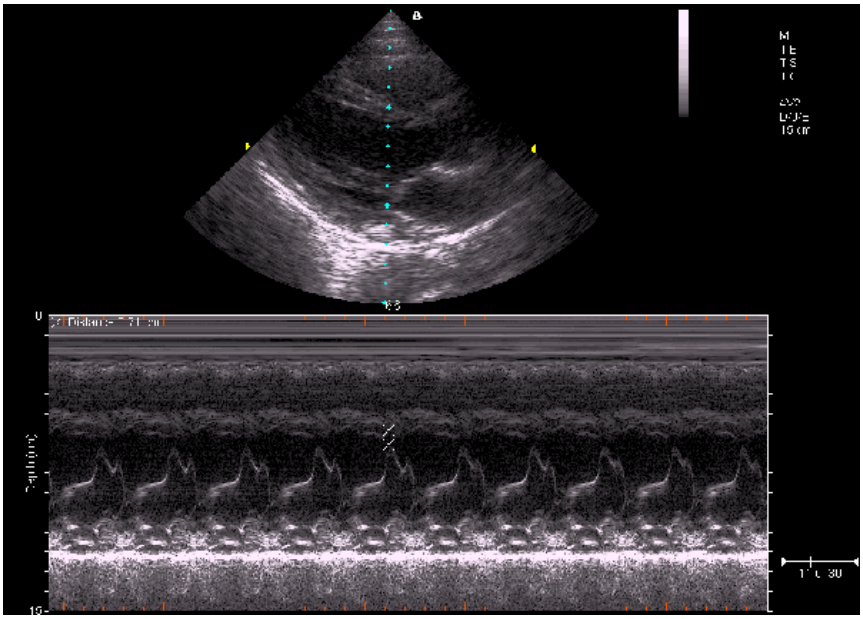
- Acquiring Images on page 43
- Using 2D Image Controls on page 65
- Measuring in the 2D Window on page 89

M-Mode (Motion Mode)

The Terason Ultrasound System provides simultaneous 2-dimensional (2D mode) and M-Mode imaging. This combination is valuable for the efficient assessment of moving structures.

Use M-Mode to determine patterns of motion for objects within the ultrasound beam. Typically, this mode is used for viewing motion patterns of the heart.

M-Mode displays scan data of the anatomy in the 2D Imaging window, and the motion scan in the Time Series window. The following figure shows a sample M-Mode scan.



Example M-Mode Scan

For more information on using M-mode, see:

- Acquiring Images on page 43
- Using M-Mode Image Controls on page 72
- Measuring in the M-Mode Window on page 94

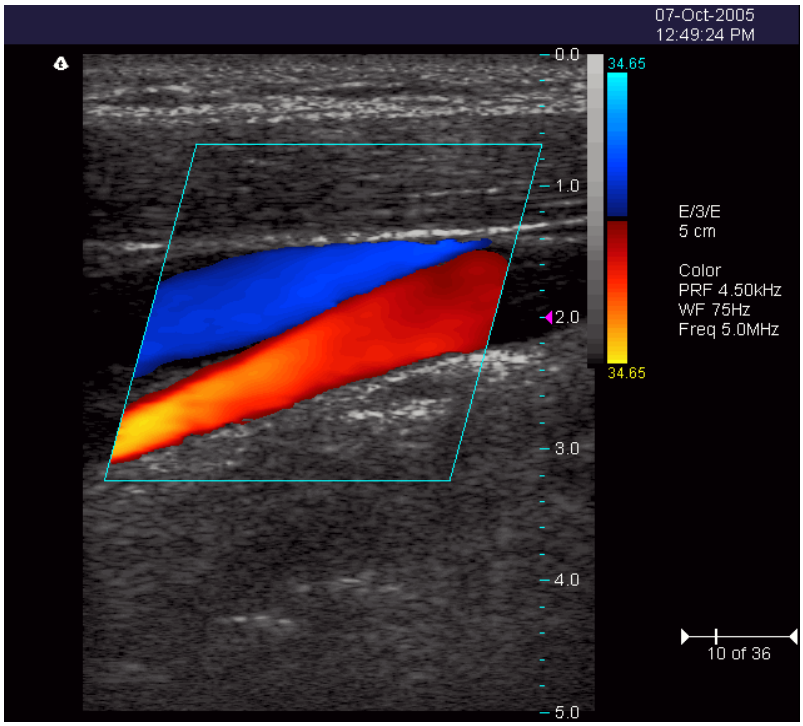
Color Doppler

Color Doppler mode is used to detect the presence, direction, and relative velocity of blood flow by assigning color-coded information to these parameters. The color is depicted in a region of interest (ROI) that is overlaid on the 2D image. Non-inverted flow towards the probe is assigned shades of red, and flow away from the probe displays in shades of blue. The mean Doppler shift is then displayed against a grayscale scan of the structures.

All forms of ultrasound-based imaging of red blood cells are derived from the received echo of the transmitted signal. The primary characteristics of this echo signal are its frequency and its amplitude (or power). The frequency shift is determined by the movement of the red blood cells relative to the probe – flow towards the probe produces a higher-frequency signal than flow away from the probe. Amplitude depends on the amount of moving blood within the volume sampled by the ultrasound beam. You can also apply a high frame rate or high resolution to control the quality of the scan.

Higher frequencies generated by rapid flow are displayed in lighter colors, and lower frequencies in darker colors. For example, the proximal carotid artery is normally displayed in bright red and orange, because the flow is toward the probe, and the frequency (velocity) of flow in this artery is relatively high. By comparison, the flow in the jugular vein displays as blue because it flows away from the probe.

The Color Doppler scan data displays in the 2D Imaging window. The following figure shows a sample Color Doppler scan.



Example Color Doppler Scan

For more information on using Color Doppler, see:

- Acquiring Images on page 43
- Using Color Image Controls on page 80

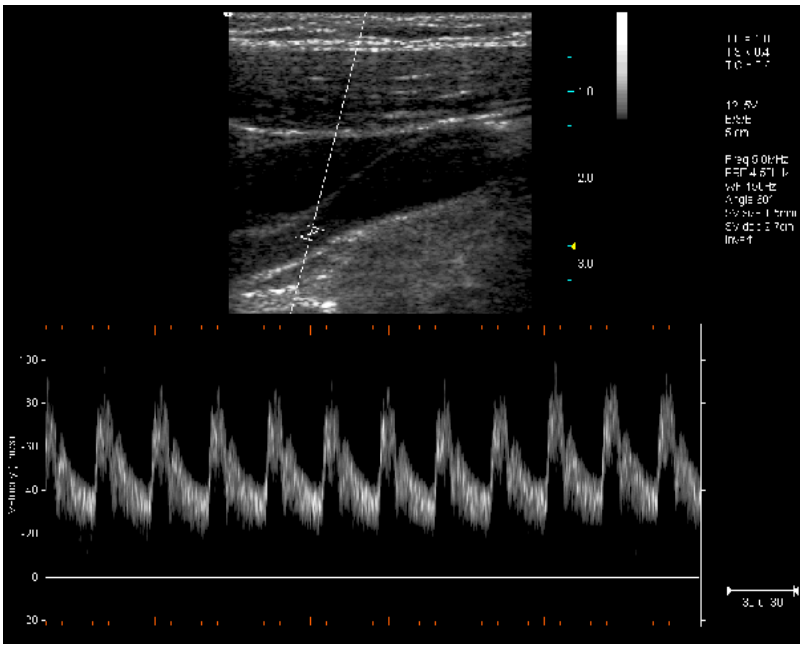
Pulsed-Wave Doppler

A Pulsed-Wave Doppler (PWD) scan produces a series of pulses used to study the motion of blood flow in a small region along a desired scan vector, called the sample volume or sample gate.

The X-axis of the graph represents time, and the Y-axis represents Doppler frequency shift. The shift in frequency between successive ultrasound pulses, caused mainly by moving red blood cells, can be converted into velocity and flow if an appropriate angle between the insonating beam and blood flow is known.

Shades of gray in the spectral display represent the strength of the signal. The thickness of the spectral signal is indicative of laminar or turbulent flow (laminar flow typically shows a narrow band of blood flow information).

In the Terason Ultrasound System, Pulsed-Wave Doppler and 2D are shown together in a mixed-mode display. This combination lets you monitor the exact location of the sample volume on the 2D image in the 2D Imaging window, while acquiring Pulsed-Wave Doppler data in the Time Series window.



Example Pulsed-Wave Doppler Scan

In the 2D scan, the long line lets you adjust the ultrasound cursor position, the two parallel lines (that look like =) let you adjust the sample volume (SV) size and depth, and the line that crosses them lets you adjust the correction angle.

For more information on using Pulsed Wave Spectral Doppler, see:

- Acquiring Images on page 43
- Using Spectral Doppler Image Controls on page 74
- Measuring in Spectral Doppler Modes on page 95

Continuous-Wave Doppler

Continuous-Wave Doppler scans display all velocities present over the entire length of the ultrasound cursor. This is useful for imaging very high velocities such as those resulting from a leaking heart valve.

As with Pulsed-Wave Doppler scans, the X-axis of the graph represents time, and the Y-axis represents Doppler frequency shift.

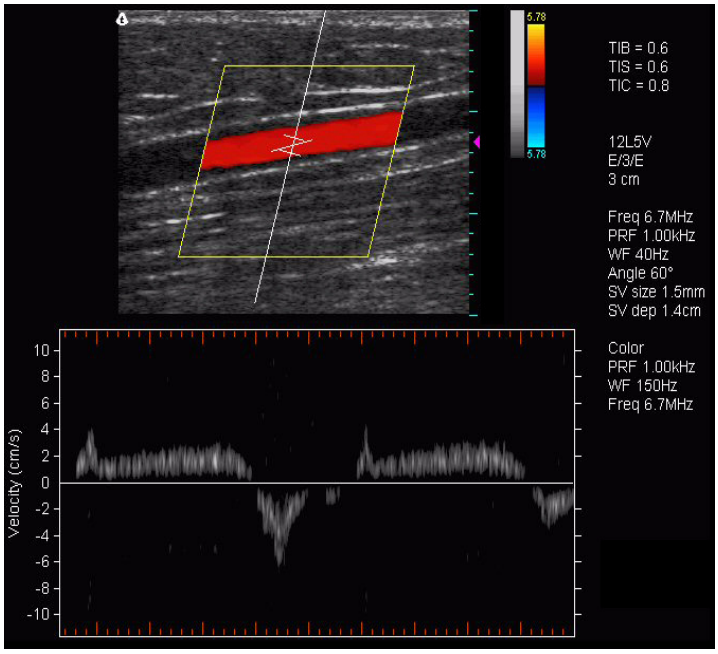
For more information on using Continuous-Wave Spectral Doppler, see:

- Acquiring Images on page 43
- Using Spectral Doppler Image Controls on page 74
- Measuring in Spectral Doppler Modes on page 95

Triplex

Triplex scan mode is available only with the Advanced version of the Terason software. Triplex scan mode combines simultaneous or non-simultaneous Doppler imaging (Color Doppler) with Pulsed-Wave Doppler imaging to view arterial or venous velocity and flow data. Triplex allows you to perform range-gated assessment of flow.

Triplex applications include vascular studies, phlebology, perinatal, and radiology. The following triplex image example shows the greater saphenous vein.



Example Triplex Scan

For more information on using Triplex mode, see:

- Acquiring Images on page 43
- Scanning in Triplex Mode on page 85

TeraVision

TeraVision is an optional image-optimization package that sharpens images produced by the Terason Ultrasound system.

See Enhancing the Image Using TeraVision™ Optimization on page 53

DICOM Image Transfer

To understand using DICOM image transfer, see Using Studies with a DICOM Server on page 142.

Support for Medical Procedures

The Terason Ultrasound System can be configured with needle guides used for tissue biopsy, fluid aspriation, amniocentesis, and catheter placement. The system can also be incorporated into cryoablation (or targeted ablation) and brachytherapy products from other vendors. The Terason Ultrasound System scans the anatomy or vessel for size, location, and patency, and provides guide lines between which the needle will appear.

For biopsy and vascular puncture applications, a needle guide kit directs needles to the proper location for percutaneous vascular punctures and nerve blocks. The needle guide allows you to direct the needle into the center of a vessel or tissue mass, helping to avoid adjacent vital tissue. You can see the anatomy in real time before, during, and after the procedure, and can save images and Cine loops for future reference.

For cryoablation or brachytherapy applications, the system may include an insertion template and a stepper or stabilizer. The procedure for these applications is defined by the company that provides those systems. The Terason software displays the insertion grid and needles on the scan to show the progress of the procedure.

You can use the needle guides in the following modes:

- 2D Mode, see page 16
- Color Doppler, see page 17
- M-Mode (Motion Mode), see page 16

See Performing Medical Procedures on page 131 for information on using the Terason Ultrasound System to perform biopsies.

Terason Probes

The Terason Ultrasound System consists of the probe, electronics envelope, and the Terason software. All of the Terason probes can be used with all scan modes.

For a list and specifications of Terason probes, see “System Specifications” and “Indications For Use” in Volume 2 of the *User Guide.*

Using the Terason Cart

Terason offers a special cart to support the uSmart3300 ultrasound system. To use the cart, the system must be properly mounted to it

Mounting the System On the Cart

To secure the uSmart3300 to the cart:

1. Fold up the **two feet** on the bottom of the system.
2. Place the system on the inclined shelf, with the **two feet resting in the two depressions** in the shelf.
3. Secure the **lock** to the system and the cart.

To mount the power supply on the cart:

1. Place the **power supply** in the open space under the cart shelf.
2. Pass the **DC cable** from the open side of the power supply space to the system, and the **AC cable** from the other open side of the power supply space to the AC power outlet.
3. Push all excess length of the **DC and AC cables** into the space under the shelf.

Warning: To prevent injury and equipment damage, do not overload the cart. No more than 25 Lbs (11.4 Kg) of equipment and other material should be placed on the cart. Do not lean on the cart.

Moving the Cart

Before moving the cart, all parts of the system and any accessories must be securely attached to the cart so that they cannot slide off or drag on the floor.

To prepare the cart for moving:

1. Make sure the **system and power supply** are properly secured, as described in Mounting the System On the Cart on page 21.
2. Disconnect the **AC cable** from the power mains, and coil the cable on the hook at the rear of the cart so that it cannot drag on the ground.
3. Firmly seat **probes** in the holders at the rear of the cart. Coil their cables on the hooks at the sides of the cart so that they cannot drag on the ground.
4. Firmly seat **gel bottles** in the holders at the sides of the cart shelf.
5. Remove all **loose items** from the shelf and place them in the bin below it.
6. Grasp the handle at the front of the cart and release the **wheel brakes**.

Warning: To prevent injury and equipment damage, always grasp the ultrasound cart firmly when moving it. Do not park the cart on an incline, and when you do park it, set the wheel brakes.

When transporting the cart, the cart top must be in its lowest position. When transporting the cart over irregular surfaces, such as thresholds, the cart should be grasped firmly by the handle and pulled over these irregular surfaces.

Always secure the system, power supply, probes, and any accessories to the cart before moving the cart.

Using the Probe Multiplex Option

If you purchased the cart with the probe multiplex option, you can have up to three probes connected at the same time.

To connect the multiplex unit to the system:

1. Make sure the system is **shut down**.
2. Connect the **multiplex jumper cord** to the system probe port, just as you would a probe cord.
3. Power up the **system**.
4. Connect a probe or probes to the multiplex unit **probe ports**.

   You do not have to power down the system when connecting or disconnecting probes to the multiplex unit.

   The system automatically detects probes connected to the multiplex unit. When more than one probe is connected, a Probe button appears on the scanning window.
5. Tap the **Probe** button on the screen to cycle between connected probes.

   The selected probe name displays at the top right of the scanning window.

Imaging, Patient, Report, and Review Windows

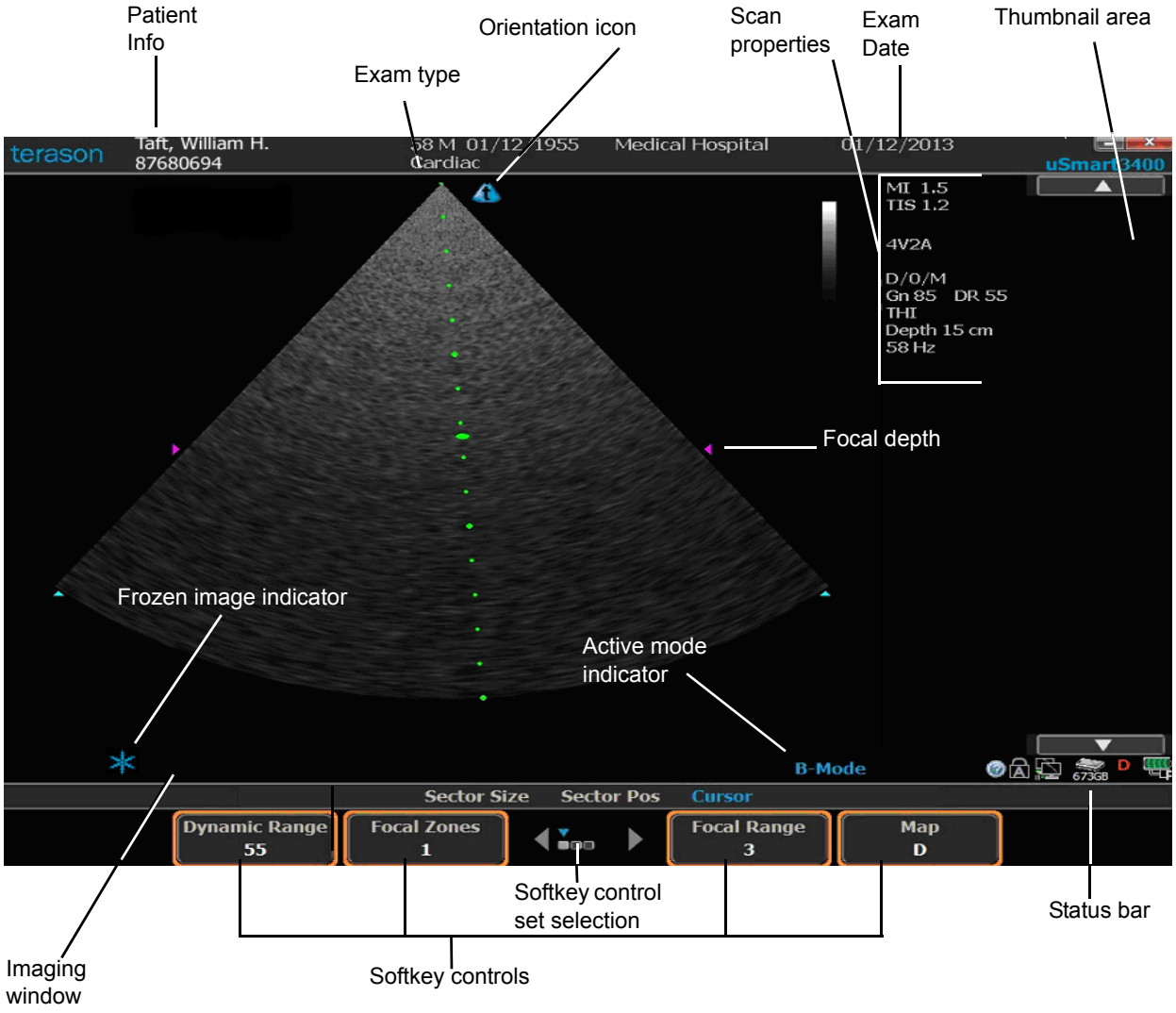
These windows use the same space on the computer screen. Press the appropriate key to open that window.

To use these windows, see:

- Imaging Window on page 23
- Status Bar on page 24
- Working With Scan Modes on page 64
- Setting Up Patient Information on page 32
- Reviewing Patient Studies on page 119

Imaging Window

When you start the Terason software, the Imaging window displays.



Terason Imaging Window

The Imaging window consists of the 2D window above the Time Series window (if the selected scan mode generates a Time Series window). The 2D window displays in all scan modes; the Time Series window displays only when scanning in M-Mode, PWD mode, CWD mode, or Triplex mode.

If a control, button, key, or menu shows in gray, it usually means that the function is not available for the current circumstances.

For details of the imaging information display, see Status Bar on page 24 and Scan Properties Display on page 25.

Status Bar

The Imaging screen includes a status bar at the lower right corner.

Status Bar

The status bar displays the following indicators, from left to right:

Help button - click this to open the Help file.

Caps lock - shows if the Caps key is depressed. If the Caps key is not depressed, this space is empty.

Network connection - shows if the computer is connected to a network. If there is no connection, a red X shows on the indicator.

Disk free space - shows how much free space is left on the computer hard drive.

DICOM status - shows whether the connection to a DICOM server is active, and whether sending of any studies to the DICOM server has failed. See DICOM Status Indicator on page 143 for a full explanation of this indicator.

System power - shows the remaining charge of the system battery, and whether the AC power supply is connected. In the illustration, the battery is fully charged, and the system is connected to an AC power source. As the battery discharges, the green bands disappear, from right to left. When the battery is almost fully discharged, a single red band shows at the left end of the indicator. When the battery is partly discharged and the AC power supply is connected, a yellow lightning bolt shows on the battery icon. When the battery is full charged and the AC power supply is connected, a power plug icon displays below the battery icon.

Minimize and Exit Buttons

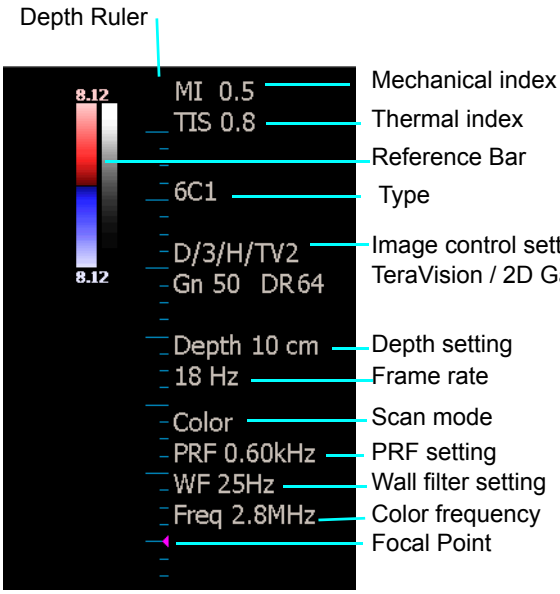
Two buttons at the top right corner of the screen let you hide or close the Terason ultrasound window.

Minimize button - click this to hide the Terason Ultrasound screen and view the Windows desktop. To return to the Terason Ultrasound screen, press alt-tab on the computer keyboard.

Exit button - click this to exit the Terason Ultrasound program. To restart the Terason Ultrasound program, double-click the ultrasound icon on the Windows desktop.

Scan Properties Display

The Imaging window includes a text display that shows information about the current scan. The image control settings displayed vary, depending on the scan mode and other factors.



Scan Properties Display (*Example*)

* The 2D gain display is initially 50. This is not an absolute value; the actual gain changes with different presets, but always displays as 50 initially. When you change the gain using the Gain knob, the displayed value goes up or down.

When the Cardiac exam type is selected, the depth ruler and focal depth indicator are on the ultrasound cursor, as shown in the figure Terason Imaging Window on page 24.

See Chapter 4, Working With Scan Modes, on page 64 for explanations of how to change settings.

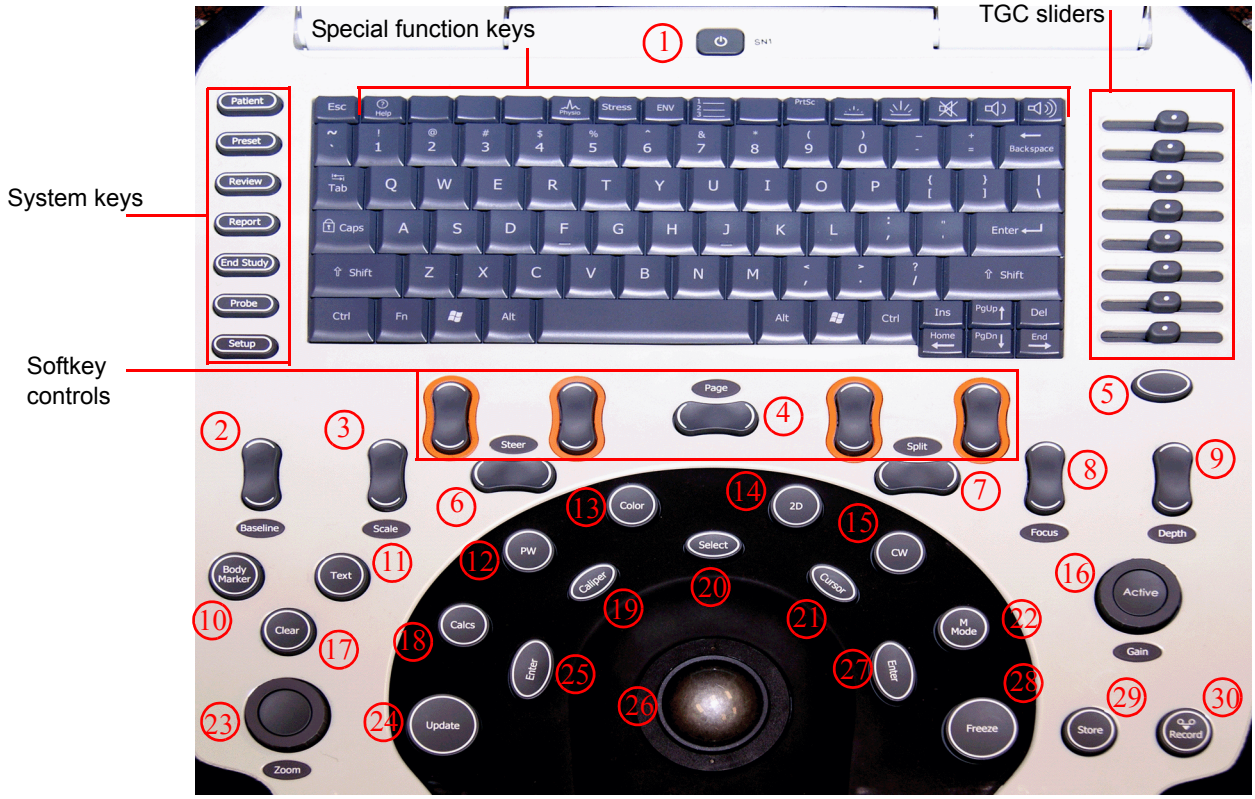
Review Window

You can view a saved study in the Review window. While reviewing a saved study, you can add annotations and measurements in the same way as on the Imaging window. See Working with Annotations on page 54 and Working With Measurements on page 88.

Note: The text home position set in the Imaging window does not apply to the Review window. The text home position set in the Review window does not apply to the Imaging window.

The uSmart3300 Console

A console houses controls that configure and operate the Terason Ultrasound system.



1: Power button
2: Baseline key
3: Scale key
4: Page key
5: Unassigned
6: Steer key
7: Split key
8: Focus key
9: Depth key
10: Body Marker key
11: Text key
12: PW mode key
13: Color mode key
14: 2D mode key
15: CW mode key
16: Gain/Active control
17: Clear key
18: Calcs key
19: Caliper key
20: Select key
21: Cursor key
22: M-Mode key
23: Zoom control
24: Update key
25: Left Enter key
26: Trackball
27: Right Enter key
28: Freeze key
29: Store key
30: Record key

Terason Console

Console Controls

The console includes an alphanumeric keyboard, a group of system keys, TGC sliders, softkey controls, and numerous controls for ultrasound imaging functions.

Ultrasound Imaging Controls

The numbered controls in the illustration Terason Console perform the functions listed below:

1. **Power**: Starts the system and shuts it down.

2. **Baseline**: Changes the Doppler baseline in PW, CW and Color Doppler modes. Pressing the top of the key moves the baseline up, and pressing the bottom of the key moves it down.
3. **Scale**: Changes the velocity scale (by changing the PRF) in PW, CW and Color Doppler modes. Pressing the top of the key increases the PRF, and pressing the bottom of the key decreases it.
4. **Page**: Changes which set of active softkeys are displayed.
5. This key is currently unassigned.
6. **Steer**: In 2D, Color Doppler or PWD modes, this key steers the ultrasound signal. Pressing the left end of the key steers left, and pressing the right end steers right.
7. **Split**: Pressing the left end of the key opens split-screen with the left screen active, or when split screen is already on, makes the left screen active. Pressing the right end of the key opens split-screen with the right screen active or makes the right screen active. Pressing the end of the key that corresponds to the active screen exits split-screen.
8. **Focus**: Changes the depth of the signal focus. Pressing the top of the key moves the focus up, and pressing the bottom of the key moves it down.
9. **Depth**: Changes the total image depth. Pressing the top of the key moves the image depth up, and pressing the bottom of the key moves it down.
10. **Body Marker**: Inserts body markers in the scan.
11. **Text**: Enables text entry and annotation on the scan.
12. **PW**: Enters and exits Pulsed-wave Doppler mode.
13. **Color**: Enters and exits Color Doppler mode.
14. **2D**: Enters 2D mode.
15. **CW**: Enters and exits Continuous-wave Doppler mode.
16. **Gain/Active**: Turning the knob changes the gain. Pushing the Active button toggles between the active scanning modes and the softkeys associated with those modes.
17. **Clear**: Erases the currently selected annotation or measurement.
18. **Calcs**: Opens the Calculations menu.
19. **Caliper**: Starts a generic measurement. Pressing the key repeatedly cycles through available calculations.
20. **Select**: Chooses a trackball function. The selected function is highlighted in blue above the softkey display.
21. **Cursor**: Selects and displays or deselects and hides the ultrasound cursor.
22. **M-Mode**: Enters and exits M-Mode.
23. **Zoom**: Push to enter ROI box Zoom, or exit Zoom mode. Turn for Quick Zoom
24. **Update**: Turns updating of the 2D image on and off in PWD and CW modes.
25. **Left Enter**: Selects and deselects items. When the Windows screen is active, the Left Enter key acts like the left button on a mouse.

26. **Trackball**: Controls movement of the cursor, the ROI, and other features.
27. **Right Enter**: Opens context menus.When the Windows screen is active, the Right Enter key acts like the right button on a mouse.
28. **Freeze**: Freezes and unfreezes the scan.
29. **Store**: Stores a single-frame image.
30. **Record**: Stores a loop.

System Keys

At the top left of the console is a group of system keys that control what the windows are active. They are:

- **Patient** – Opens the Patient window
- **Preset** – Opens the Preset menu
- **Review** – Opens the Review window
- **Report** – Opens the Report window
- **End Study** – Closes the current study
- **Probe** – Opens the Imaging window
- **Setup** – Opens the Setup window

Special Function Keys

At the top center of the console is a keyboard that includes the standard set of computer keys, except for the Function keys. A special set of function keys comprises the top row of the keyboard. These special keys are:

- **Help** – Opens the online Help file
- **PrtScr** – Copies the screen to the Windows clipboard
- Reduces screen brightness
- Increases screen brightness
- Mutes sound volume
- Decreases sound volume
- Increases sound volume

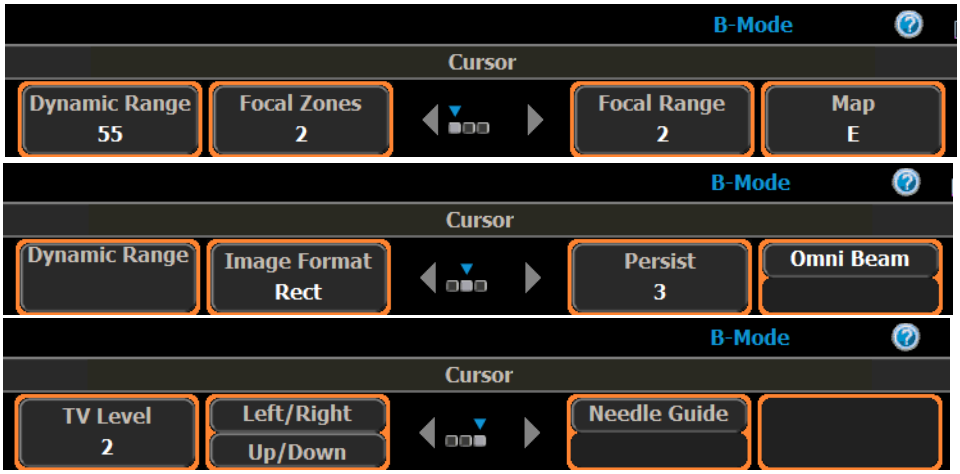
Softkeys

The keys just below the keyboard control the functions of the softkeys displayed across the bottom of the Imaging window. The softkey functions are dependent on what probe is connected, which scanning mode is chosen, and whether the scan is live or frozen.

The illustrations below show examples of the softkeys when the image is live and frozen.

Note: The softkeys the system displays depend on the probe that is connected, the selected scan mode, and the selected exam. **The display you see may differ from the illustrations in this guide.**

Example Softkeys



Example Live Image Softkeys

Example Frozen Image Softkeys

Beep Codes

The Terason Ultrasound system produces beeps when certain events occur. The following list explains the meaning of the different beep codes.

- **Two short beeps**: Produced when a probe is connected or disconnected, or when the system is started with a probe already connected.
  This is only a notification; it is safe to use the system.
- **Eight beeps**: Produced when communication between the computer and the ultrasound engine is lost.
  If the imaging function resumes, it is safe to use the system. If the imaging function does not resume, restart the ultrasound software. If the error persists, stop using the system and contact Terason Technical Support.
- **Two-tone beeps**: Indicates that the system detected and corrected an internal transmitter timing error.

It is safe to continue using the system. Freezing or unfreezing the scan turns the beeping off. If this occurs frequently, contact Terason Technical Support.

- **Continuous short beeps**: Produced when the system reaches an internal temperature of 72° C. The beeping stops when the internal temperature falls to less than 72° C.
  It is safe to continue using the system, but if the internal temperature rises to 80° C, the system shuts down.

Note: If the system continues to emit continuous short beeps even after it has cooled down, disconnect the power-supply cord from the computer. Wait a few minutes, then reconnect the power-supply cord.

Equipment List

The Terason Ultrasound System may include the following hardware:

- Terason uSmart3300 Ultrasound System.
- Online *Terason Ultrasound System User Guide* (this document)
- CD-ROMs containing the operating system and Terason ultrasound imaging software
- One (1) power cord
- Medical grade AC/DC power adapter (Protek PMP120-13-2.)
- ECG module
- ECG lead set - 10 sets of electrodes
- Cart
- Footswitch (Kinessis FS20A-USB-UL)
- Printer (the only approved printer is the Sony UPD-897 medical-grade printer.)
- One or more probes:

Warning: Using accessories, probes, or cables other than those specified, with the exception of those sold by the manufacturer as replacement parts for internal components, may result in increased electromagnetic emissions or decreased EMI immunity of the Terason Ultrasound System.

System Warranty

The warranty period for the Terason Ultrasound System is twelve (12) months, but you can purchase an extended warranty. To obtain warranty service, U.S. customers call Terason at 1-866-TERASON (1-866-837-2766); International customers call 781-270-4143.

The warranty on the Terason Ultrasound System is voided if unauthorized personnel perform service or maintenance on the ultrasound system, except for those service or maintenance actions specifically designated for local service technicians. To ensure correct system performance and to protect your warranty, contact Terason for service.

2 Setting Up Patient Information

Patient Information Overview

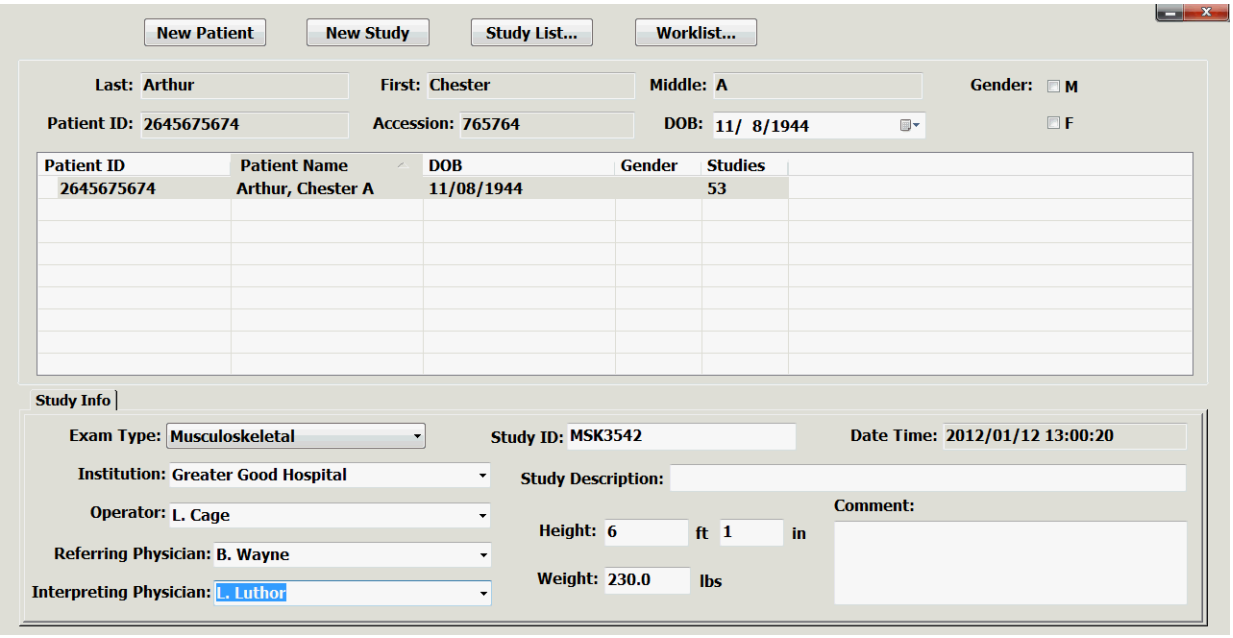
Although you can scan a patient without entering any information about that patient, you cannot save any images or loops from such an exam, so Terason recommends that you define the patient within the system. The patient data can be displayed on the scan to avoid mix-ups and is used to organize saved images.

When you save an image, the Terason software puts it in a study for the specified patient, along with a report.

To work with patient information, you should understand:

- Adding a New Patient, see page 33
- Working With Patient Information, see page 35
- Using an Existing Patient Profile, see page 37
- Updating Patient Information, see page 37
- Deleting Patient Studies, see page 37
- Configuring Reports, see page 38

To view the Patient window, press the Patient key on the console.



Patient Window

A patient profile remains loaded until one of these events occurs:

- You load a different patient's information
- You open an image or loop in the Imaging window for a different patient
- You click the New Patient button

Adding a New Patient

If you need to start the ultrasound exam immediately, the Terason software lets you skip entering patient information. However, you normally cannot save images without a patient profile. You can enter patient information after starting such an exam (by pressing the Patient key), and images saved after that are associated with the patient info file.

When you add a new patient, the Terason software creates a profile for that patient.

Starting an exam after creating or opening a patient info file creates a new study for the date, and a report. The report file and any saved images are saved in the study.

When you enter a patient name, the total number of characters of the first, last, and middle name is limited to 62 characters. You can type up to 64 alphanumeric or special characters in any one of these fields (not all special characters are supported). However, if the total of the three fields exceeds 62 characters, the Terason software displays an error message when you try to save the patient information.

To add a new patient, complete these steps:

1. Press the **Patient key**.
2. On the Patient window, click **New Patient**.

Caution: The fields are not case-sensitive. Do not enter data that relies on case-sensitive characters.

3. Enter the last, first, and middle **names**.
4. Enter a **patient ID** (sometimes called a Medical Record Number).

   You can enter up to 64 alphanumeric or special characters. You *cannot* use any of the following characters in the Patient ID field:

   *** \ | : " < > /?**
5. If appropriate, enter the **accession number** from the Hospital Information System.

   You can use up to 16 alphanumeric characters. You cannot use the '\' (backslash) character.
6. Enter the patient's **date of birth**.

   a. Click the **triangle button** at the right side of the DOB display.

   A calendar showing the current month appears.

   b. Click the **month** in the DOB display, and select the **month** from the drop-down menu.

   c. Click the **year** in the DOB display, then click the up or down arrow until the correct year displays.

d. Click the correct **day** in the calendar.

The calendar disappears, and the date you selected displays in the DOB field.

7. Click in the checkbox for the patient's **gender** - M for male, or F for female.
8. Enter the patient's **height and weight**.

   To change the units of measurements used, see Patient Info Units on page 162.
9. If appropriate, enter a **study ID** number using up to 16 alphanumeric characters.
10. Enter any **comments**.

    You can type directly in the field, or click Extended Comment to type a longer comment.
11. In the **Institution:** field, enter where the exam is taking place, or select the institution name from the drop-down menu.

    You can enter as many alphanumeric characters as fit in the field.
12. In the **Operator:** field, enter the name of the clinician performing the exam, or select the name from the drop-down menu.

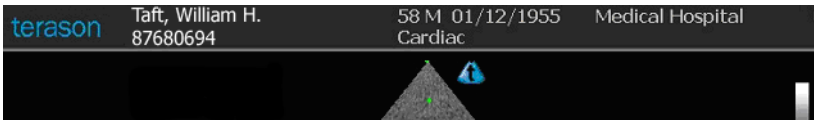
    You can enter as many alphanumeric characters as fit in the field.
13. In the **Study Description:** field, menter a description of the study.

    The description can be up to 62 characters long.
14. Press the **Accept** softkey to save the entered information and open the Imaging window.

The patient information is saved in a study associated with the patient's name. The Imaging window is ready for you to conduct the exam.

After you type in an institution name, an operator name, or a physician name, that name will appear in the associated drop-down list on the Patient window. The last-used institution name automatically fills the field on future patient windows.

The Terason software displays the patient information in the Imaging window, with the last-used scanning mode still selected. The patient information is shown across the top of the window and is saved with scanned images you create for the patient. The calculated age of the patient shows in front of the sex (M or F) indicator.



Patient Information at the Top of the Imaging Window

Working With Patient Information

You can edit and modify patient information files in several ways. See the following topics:

Default Names in Studies and Reports

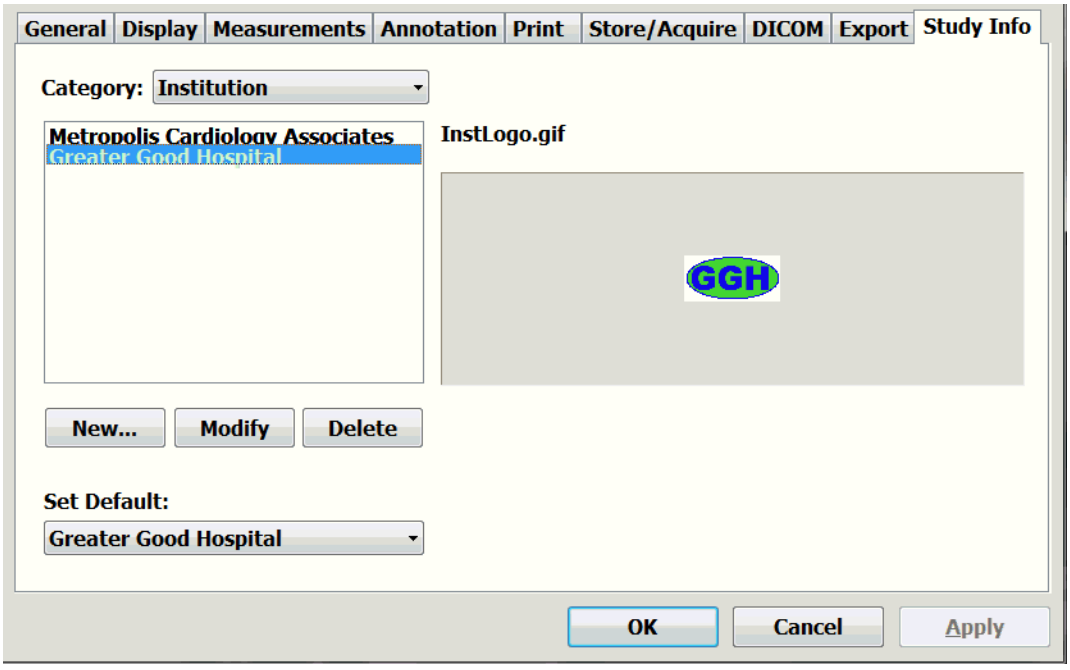
You can set defaults in the Institution, Operator, and Physician fields of Patient windows and reports. When defaults are set, those names will automatically appear in new Patient windows and reports. To change the names in the current report, choose or enter a different name in the Patient window.

Entering a name in one of the fields of the Patient window adds it to the menu of names available for that category in the Setup/Study Info window and in Patient windows.

To set a default name in Patient windows and reports:

1. Press the **Setup key**.
2. Click the **Study Info** tab.

   The Setup/Study Info window opens.

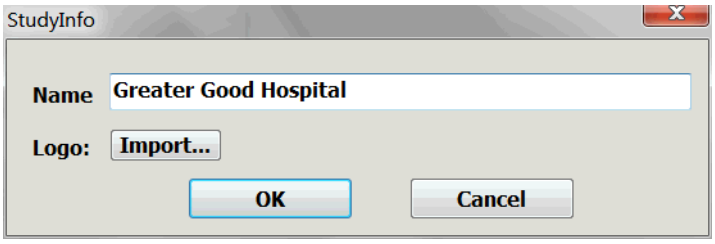


Setup/Study Info Window

3. In the **Category:** menu, select the category you want to set a default name for.
4. In the **Set Default:** menu, select the name you want to set as the default.
5. If the **desired name** is not listed in the menu, add it to the menu:

   a. Click **New...** .

The StudyInfo window opens.



StudyInfo Window

b. In the **Name:** field, enter the desired name..

c. Click **OK**.

d. In the **Set Default:** menu, select the name you want to set as the default.

6. Click **Apply**.
7. Click **OK**.

   The default name shows in green on the list of available names.

Modifying Names in Menus

You can modify an institution physician, or operator name and change the logo associated with the institution name.

To edit a name in the menus of the Patient or Setup/Study Info window:

1. Press the **Setup key**.
2. On the Setup window, click the **Study Info** tab.
3. On the Category: menu, select the **title** of the name you want to delete.
4. On the list of names for that category, select the **name** you want to delete.
5. Click the **Modify** button.

   A confirmation box opens.
6. Click in the **Name** field and .modify the name.
7. To change the institution logo, click **Import...**, and see the procedure Adding a Logo to Reports on page 38.
8. Click **OK.**
9. On the Setup/Study Info window, click **OK.**

Removing Names From Menus

You can remove institution names, physician names, and operator names from the Patient and Setup/Study Info window drop-down menus.

To remove a name from a menu:

1. Press the **Setup key**.

2. On the Setup window, click the **Study Info** tab.
3. On the Category: menu, select the **title** of the name you want to delete.
4. On the list of names for that category, select the **name** you want to delete.
5. Click the **Delete** button.

   The StudyInfo window opens.
6. Click **OK**.
7. On the Setup/Study Info window, click **OK.**

Using an Existing Patient Profile

If the patient has a profile from a previous study, you can load that profile for use with new exams.

To load a patient profile:

1. On the Patient Info window, click the **New Patient** button.
2. Double-click the relevant **patient listing**.
3. Press the **Accept** softkey.

If an exam of the patient was saved to a DICOM server that the Terason ultrasound system has access to, you can use DICOM Worklist to automatically fill in the Patient Info window fields. See Using DICOM Worklist on page 145.

Updating Patient Information

To update a patient's information, complete these steps:

1. Press the **Patient key**.
2. If the profile you want to update is not displayed, click the **New Patient** button, then click the profile to be updated..
3. Enter the **new information** in the appropriate fields.
4. Press the **Accept** softkey to save the changes.

Deleting Patient Studies

You can delete patient's studies.

Note: You cannot recover files deleted using the Terason software as you can when using Windows Explorer. Make sure you want to delete all the information in the profile, including saved scans, before you perform this procedure.

To delete a patient study:

1. Press the **Patient key** on the console.

2. On the Patient window, click the **Study List...** button.

   The Study List. window opens.

3. Click the **study** you want to delete to select it.

   To select multiple studies, hold down the Control key on the keyboard and click each of the studies you want to select.

4. When all the unwanted studies are selected, click **Delete**.

   A confirmation request appears.

5. Click **Yes** to delete the studies.

6. Press the **Close** button.

To archive the study and its associated images before you delete them, see Exporting Studies on page 119.

If you delete all the studies associated with a patient, the patient information is lost. To make a new study of that patient, you must re-enter the patient information as with a new patient.

Configuring Reports

You can set up reports to show the logo of an institution, and to automatically insert the names of an institution, an operator, an attending physician, and a referring physician.. You can also add a signature and a diagnosis to the report. See the following sections:

- Default Names in Studies and Reports on page 35
- Adding a Logo to Reports on page 38
- Adding a Signature to a Report on page 40
- Diagnoses On Reports on page 41

Adding a Logo to Reports

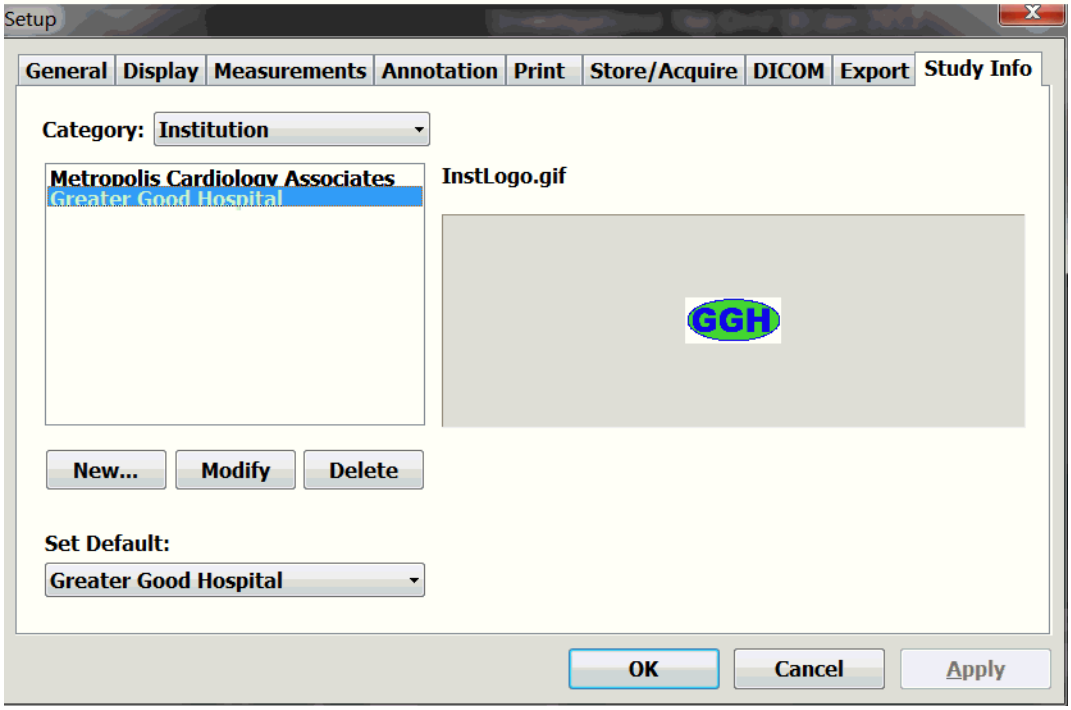
To add the institution logo:

1. Press the **Setup key**.

   The Setup window opens

2. Click the **Study Info tab**

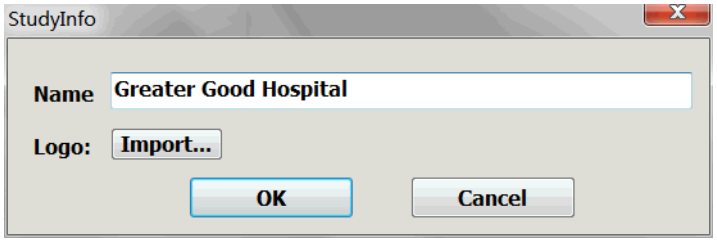
   The Setup/Study Info window opens.



Setup/Study Info Window

3. In the Category: menu, select **Institution**.
4. Click **New...**

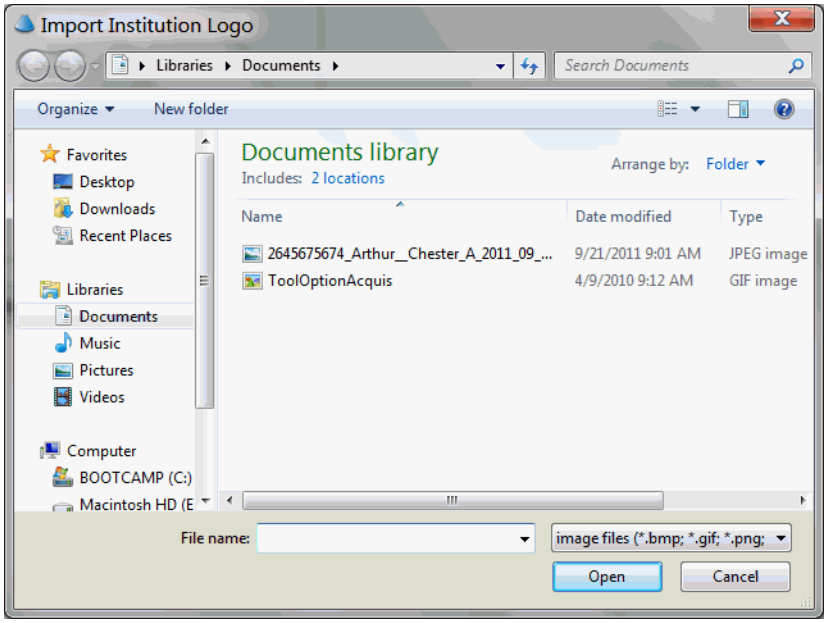
   The StudyInfo window opens.



Study Info Window

5. In the Name field, enter the **name of the institution**.
6. Click **Import...**.

   The Import Institution Logo window opens.



Import Institution Logo window

7. Navigate to the **logo image file** and select it.
8. Click **Open**.

   The software adds the logo to the report, and associates it with the institution name. The Import Institution Logo window closess.
9. In the StudyInfo window, click **Apply**.

When a study is performed and the institution name is chosen, the resulting report will include the institution logo.

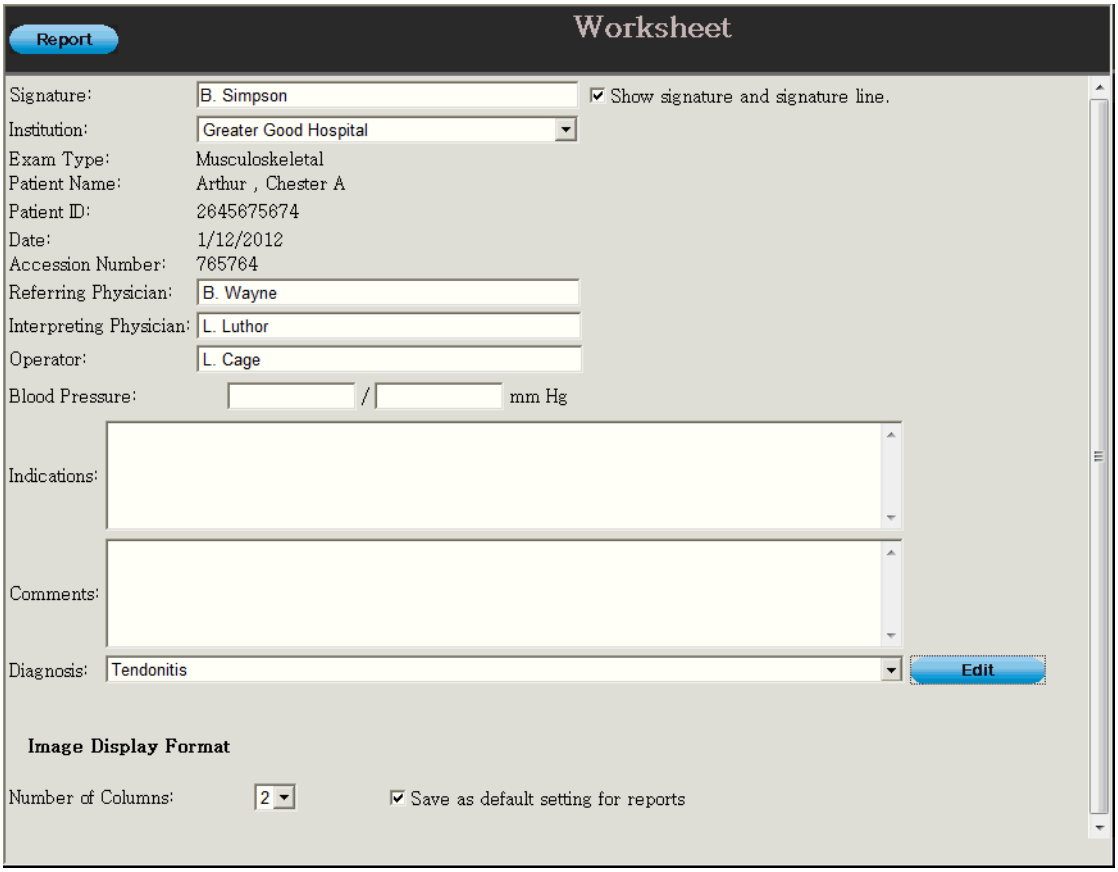
To delete a logo, remove the institution name from the drop-down menu on the Worksheet window. See.Removing Names From Menus on page 36.

Adding a Signature to a Report

To add a signature to a report:

1. On the report window, click **Worksheet**.

   The Worksheet window opens.



Worksheet Window

2. In the Signature: field, type the **signature**.
3. Click **Show signature and signature line** so the checkbox is checked.
4. To return to the report, click **Report**.

Diagnoses On Reports

A diagnosis can be added to the report using the Worksheet window, which opens when you click the Worksheet button on the Report window. The diagnoses available in the drop-down Diagnosis: menu on the Worksheet window are added by typing in the .Diagnosis:field. Diagnoses on the menu can be deleted from the drop-down menu.

Adding a Diagnosis to a Report

To add a diagnosis to a report:

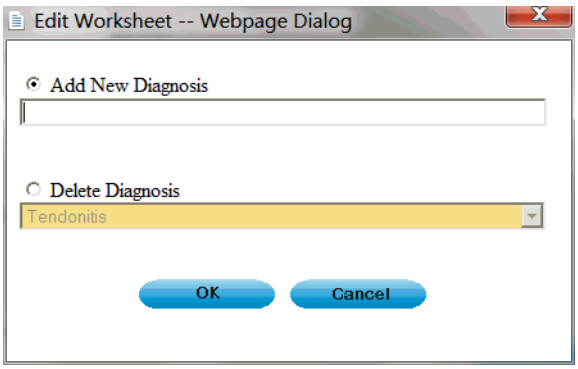
1. On the Report window, click **Worksheet**.

   The Worksheet window opens.

2. Select the **diagnosis** from the Diagnosis: drop-down menu.
3. If the necessary diagnosis is not on the menu, add it to the list:

   a. Click the **Edit** button next to the Diagnosis: field.

The Edit Worksheet window opens.



Edit Worksheet Window

b. Make sure the **Add New Diagnosis** radio button is selected.

c. Type the **new diagnosis** into the Add New Diagnosis field.

d. Click **OK**.

The new diagnosis is added to the menu.

4. To return to the report, click **Report**.

Removing Diagnoses From the Menu

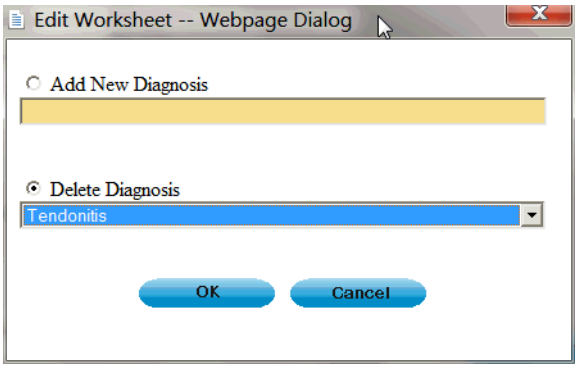
To remove a diagnosis from the drop-down Diagnosis: menu on the Worksheet window:

1. Click the **Edit** button next to the Diagnosis: field.

   The Edit Worksheet window opens.

2. Click the **Delete Diagnosis** radio button so it is selected.

   The drop-down menu is active.



Edit Worksheet Window with Menu Active

3. On the Delete Diagnosis menu, select the **diagnosis** you want to delete.
4. Click **OK**.

   The diagnosis is deleted from the menu.

3 Acquiring Images

To support image acquisition, you must understand:

To adjust the acquired scan data, see Chapter 4 - Working With Scan Modes.

Ultrasound Safety

The following is a Prudent Use Statement regarding the use of ultrasound:

> Use diagnostic ultrasound only when there is a good medical reason. Also, the Terason Ultrasound System does not provide explicit control of acoustic power output. Therefore, to minimize the exposure to ultrasound energy, limit the duration of ultrasound examinations.

For more safety-related information, see:

Acoustic Output Indices

The Terason uSmart3300 Ultrasound System complies with the *Particular requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment* (IEC 60601-2-37:2007/AMD1:2015) and *Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment* (UD3-2004).

When operating in any mode with the Freeze function disabled, the window displays the acoustic output indices relevant to the currently- active probe and operating mode.

Minimizing the real-time displayed index values, as described in this User Guide, allows the practice of the ALARA principle (exposure of the patient to ultrasound energy at a level that is As Low As Reasonably Achievable).

Warning: Ultrasound procedures should be used for valid reasons, for the shortest period of time, and at the lowest mechanical/thermal index setting necessary to produce clinically acceptable images. The ultrasound system incorporates an output display of Mechanical and Thermal Indices to allow you to monitor, and to limit, the amount of ultrasound energy that is transferred to the patient.
Note: For systems distributed in the United States of America, refer to the Medical Ultrasound Safety ultrasound education program brochure produced by the AIUM.

Infection Control

When performing intraoperative studies or scanning patients with open wounds, you must use a sterile sheath on the probe. See “Infection Control” in the Safety chapter of the *Terason Ultrasound Technical Manual* for information on sterile sheaths.

The ultrasound probe should also be cleaned and disinfected between patients. See “Processing Terason Probes Between Uses” in the Maintenance chapter of the *Terason Ultrasound Technical Manual* for information on disinfecting probes.

Powering the Ultrasound System On and Off

To power the uSmart3300 Ultrasound System on, press the power button at the top of the console.

To power off the uSmart3300 Ultrasound System, press and hold the same power button at the top of the console.

Starting and Exiting the Software

The Terason Ultrasound software normally starts as soon as you power up the system. If you have exited the Terason software for some reason, you can use either of these methods to start it up:

- Double-click the Terason shortcut  , on your computer desktop
- Select Start > Programs > Terason > Terason

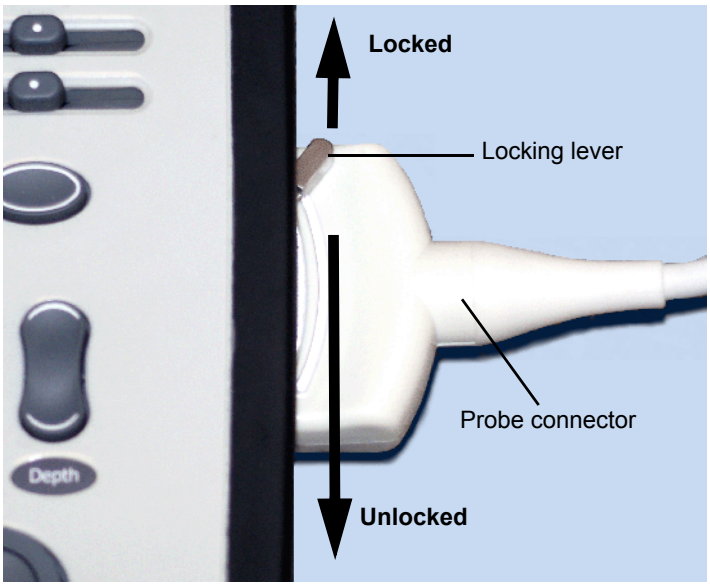
Note: When running an ultrasound system on battery power, always check the amount of power left. To check the battery power status, refer to the charge indicator at the top right of the Terason Ultrasound window (see Status Bar on page 24.) Terason recommends that you be prepared to power the system with the AC power adapter.

Make sure you save or print any needed images or loops before exiting the software.

To exit the Terason software, click the icon at the top right of the main screen

Connecting a Probe

Supported probes connect to the system through a special port on the right side of the system.



To connect a probe:

1. Make sure the locking lever is in the **unlocked position**.
2. Insert the **probe connector** (with the side that has a short peg facing up) into the port as far as it will go.
3. Move the locking lever to the **locked position**.

   If the Terason software is running, it detects the probe and displays the probe name on the Imaging window. If the software is started after the probe is connected, the Terason software detects and displays the probe name as soon as it starts.

To disconnect a probe:

1. Move the locking lever to the **unlocked position**.
2. Pull the **probe connector** straight out from the probe port.

Warning: To prevent harm to patients, check the outer surface of any insertable transducer assembly before inserting it into a patient, to ensure that there are no rough surfaces, sharp edges or protrusions.

Switching Probes

The Terason ultrasound system lets you change probes without exiting the program.

To switch between probes, complete these steps:

1. If necessary, **save** the active image or image loop. See Saving Images and Loops on page 118 for instructions.
2. Move the locking lever to the **unlocked position** and carefully unplug the probe.

   The Imaging window closes, and the Patient window opens.
3. Plug the new probe in and move the locking lever to the **locked position**.

   The Patient window closes, and the Imaging window opens, showing the new probe in the imaging information display (see Terason Imaging Window on page 24).

Conducting an Ultrasound Exam

To conduct an exam, complete this general procedure:

1. Load or create **patient information**.

   See Setting Up Patient Information on page 32.
2. Start **live imaging**.
3. Select an **exam type** and preset.

   (See Opening an Exam on page 113.)
4. Select a **scan mode** and adjust image controls.

   (See Chapter 4 - Working With Scan Modes)
5. When the desired anatomy is shown in the Imaging window, **freeze** the image.
6. Add **annotations** or measurements.

   See Working with Annotations on page 54 and Working With Measurements on page 88.
7. **Save** or print the image.

For more detailed instructions, complete the steps for the mode you use for the exam. See the following sections:

- Conducting a 2D, M-Mode, or Color Doppler Exam on page 47
- Conducting a PWD Exam on page 48
- Conducting an Exam in Triplex Mode on page 48

Using the Console

For information on using the console to control exam parameters, see The uSmart3300 Console on page 27. For console information that is specific to a selected mode, see the section on that mode in Chapter 4 - Working With Scan Modes.

Choosing a Scan Mode

To choose a scan mode, press the appropriate key on the console:

- For 2D, press the **2D** key.
- For M-Mode, press the **M Mode** key.
- For Color Doppler, press the **Color** key.
- For Pulsed-Wave Doppler, press the **PW** key.
- For Continuous-Wave Doppler, press the **CW** key.

Using the 8TE3 Probe

When using the 8TE3 probe, refer to the *Odelft Motorized Multiplane TE Probe User Manual,* which is packaged with the probe. That manual includes all required instructions for safe use of the probe.

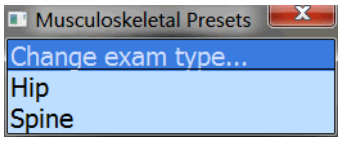
Warning: To prevent patient injury, be sure to read and understand the *Odelft Motorized Multiplane TE Probe User Manual* before using the 8TE3 probe.

Warning: To prevent patient injury, remove the 8TE3 probe from the patient before applying a defibrillator.

Conducting a 2D, M-Mode, or Color Doppler Exam

To conduct an ultrasound exam in 2D, Color Doppler, or M-mode, complete these steps:

1. Load or create the **patient information**. See Setting Up Patient Information on page 32 for instructions.
2. Press the **console key** for the required scan mode: See Choosing a Scan Mode on page 47.
3. Press the **Preset key**, then select a preset from the Presets menu.



Presets menu

The Terason software loads preset image control settings that are optimized for the selected preset and the connected probe. See Chapter 6 - Working With Exams for information about exam types and defining your own presets.

You can now use the probe to conduct an ultrasound exam. Refer to the appropriate clinical procedure for the exam you are conducting.

4. If necessary, use the softkeys to adjust the **image controls**.

- For 2D, See Using the Softkeys and Console Controls on page 64 for instructions.
- For M-Mode, see Using M-Mode Image Controls on page 72.
- For Pulsed-Wave Doppler, see Using Spectral Doppler Image Controls on page 74

5. Press the **Freeze key**. The softkey controls change to allow printing, measurements, and other functions. See Softkeys on page 29.
6. Add **annotations** as needed See Working with Annotations on page 54.
7. **Save or print** the ultrasound image. See Saving Images and Loops on page 118 and Printing Images on page 127.

Conducting a PWD Exam

To conduct an exam in Pulsed-Wave Doppler mode, complete these steps:

1. Conduct an **exam** in 2D mode, as described in Conducting an Ultrasound Exam on page 46 (do not freeze the scan).
2. Press the **PW** key on the console.
3. Move the **range gate** to the proper location, then press the Left Enter key on the console...
4. Use the **softkeys** to adjust any image control settings as needed.
5. Press the **Freeze key**. The softkey controls change to allow printing, measurements, and other functions.
6. Add **annotations** (see Working with Annotations on page 54) as needed.
7. **Save** and/or print the ultrasound image. See Saving Images and Loops on page 118 and Printing Images on page 127.

Conducting an Exam in Triplex Mode

To conduct an exam in Triplex mode, complete these steps:

1. Conduct an **exam** in Color Doppler mode as described in Conducting an Ultrasound Exam on page 46 (do not freeze the scan).
2. Press the **PW key** on the console.

   The software launches Triplex mode.
3. Move the **range gate** to the proper location, then press the Left Enter key on the console.
4. Use the softkeys to adjust any **image control settings** as needed.

   See Using Spectral Doppler Image Controls on page 74 for instructions.
5. Press the **Freeze key**.

   The softkey controls change to allow printing, measurements, and other functions. See Softkeys on page 29.
6. Add **annotations** as needed.

See Working with Annotations on page 54.

7. **Save or print** the ultrasound image.

   See Saving Images and Loops on page 118 and Printing Images on page 127.

When you switch to Triplex mode, both the original 2D scan mode and PWD mode are active. This depends on whether the options are set to simultaneous mode. See Updating the Displays on page 79 for more information.

Freezing Images

Live images are recorded by frame and temporarily stored on the computer. Depending on the mode you select, you record a certain number of frames. For example, 2D mode allows you to capture up to 10 seconds in a Cine loop.

Pulsed-Wave Doppler (including Triplex) and M-Mode scans only save a single frame for the 2D image, and you cannot save loops for these scan modes.

When you freeze a real-time image during a scan, all movement is suspended in the Imaging window. The frozen frame can be saved as a single image file or an image loop. For M-Mode, PWD, and Triplex modes, the software saves the Time Series data and a single 2D image.

You can unfreeze the frame and return to the live image display at any time. If you press the Freeze key without saving the image or image loop, you lose the temporarily-stored frames.

To freeze the displayed image when performing an ultrasound scan, press the Freeze key. When the scan is frozen, a Freeze icon appears just above the left softkey on the imaging screen. You can then use the Gain knob or the keyboard arrow keys to move through the frames acquired during the scan (see Working with Image Loops on page 49).

To start a new scan, press the Freeze key again.

Note: If you do not save the frozen image or loop, starting live scanning erases the frame data. Make sure you save or print any needed images before you acquire new scan data.

Working with Image Loops

Reviewing an image loop is useful for focusing on images during short segments of a scan session. When you freeze an image, you can use the Gain knob to review an entire loop, frame by frame, to find a specific frame. You can also do this when viewing a saved loop. Turn the Gain knob until the desired frame displays, then press the Store key.

To save the entire loop, you need not select a different frame. All acquired frames are saved in the loop when you press the Store key.

To view a loop, freeze the image and press the Play softkey. The Play softkey label changes to Pause. The loop plays continuously until you press the Freeze key or the Pause softkey. You can track the frames and the number of the current frame in the progress bar at the bottom of the Imaging window.

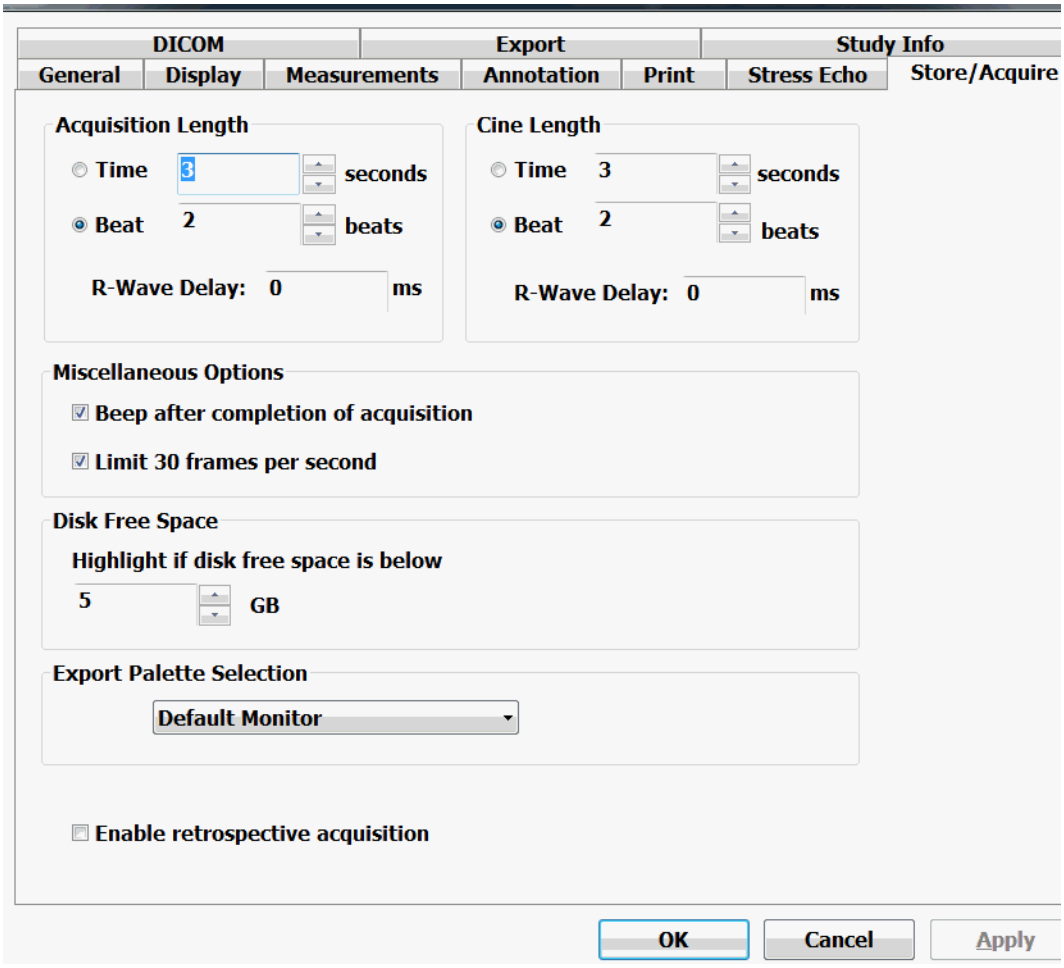
To stop a playing loop, press the Pause softkey.

Saving Prospective and Retrospective Loops

In 2D and Color modes, the Terason system can acquire loops either prospectively or retrospectively. Prospective acquisition captures a loop of live scan following the acquire command, while retrospective acquisition saves a loop of a frozen scan.

Saving Prospective Loops

During live imaging, pressing the Store key tells the system to acquire and save a loop of the scan following the key click. The loop displays in the Thumbnail window at the side of the Main Screen. The default length of the loop is 3 seconds, but this is adjustable between 1 and 10 seconds in the Acquisition Length section of the Setup Store/Acquire window.



Setup Store/Acquire Window

When the Beat radio button on the Store/Acquire tab of the Setup window is selected, and the system detects an ECG signal, the acquired loop is a number of heartbeats. The default is 2 beats, but this is adjustable between 1 and 10 beats in the Acquisition Length section. If no ECG signal is detected, the acquired loop is the length set in the Time field, even if the Beat radio button is selected.

You can apply an R-wave delay in the Acquisition Length section. You can also enable a beep that sounds when the acquisition is complete.

The default format for loops acquired in this way is .dcm, however, they can also be saved as any of the other available formats. Use the Export tab on the Setup window to choose a different file format.

Saving Retrospective Loops

During live imaging, pressing the Freeze key, then the Store key tells the system to acquire a loop of the frozen scan. The loop displays in the Thumbnail window on the Imaging screen. The default length of the loop is 3 seconds, but this is adjustable between 1 and 10 seconds in the Cine Length section of the Setup Store/Acquire window. (See Setup Store/Acquire Window on page 50.)

Retrospective loops are modified in the same way as prospective loops. They can be saved as .dcm or .avi files.

Adjusting the Displayed Image

The Terason software lets you adjust the contents of the Imaging window. You can perform the following operations:

Enlarging an Area of the Image

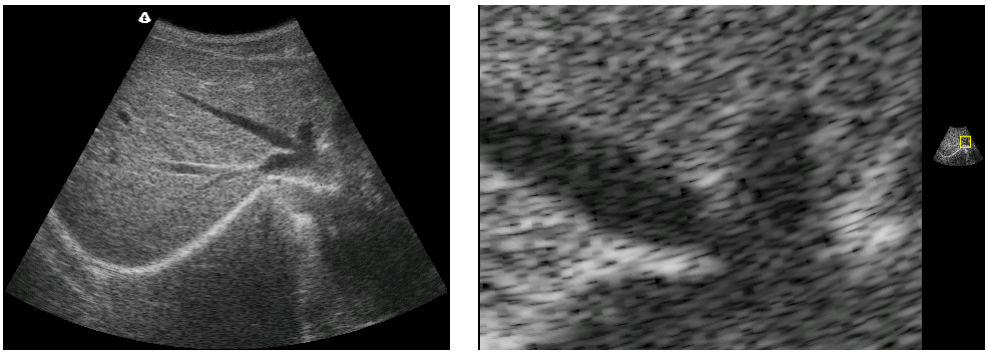
When you view a frozen or live image, you can use the Zoom tool to enlarge a region of the 2D image. You cannot use the Zoom tool in the Time Series window.

To zoom into the middle of the image:

1. Press the Gain knob until **Zoom** is selected in the Gain Knob menu. (See Terason Imaging Window on page 24.)
2. Turn the **Gain knob** to zoom in or out to the size you want.

To zoom an area that's away from the middle of the image:

1. Press the **Zoom Off** softkey.
2. Use the **trackball** to move the zoom box to the area you want larger, and press the Left Enter key.
3. Use the **Gain knob** to zoom in or out of that area.



Normal Image (Left) and Zoomed Image (Right)

To return to the original image view, use the softkeys to turn Zoom off.

Resizing the 2D and Time-series Displays

In M-mode and Spectral modes, you can make the 2D display larger relative to the Time-Series display, and vice-versa.

To resize the scanning displays:

1. Press the **Setup key**.
2. Click the **Display** tab.

M-Mode and Time-Series Scanning Display Size Options

- **To make the Time-Series display bigger** and the 2D Imaging display smaller, click the **S/L** radio button in the M-Mode Format or Spectral Format area.
- **To make the 2D display bigger** and the Time-Series Imaging display smaller, click the **L/S** radio button in the M-Mode Format or Spectral Format area.
- **To restore the default sizes of the displays**, click the **Equal** radio button in the M-Mode Format or Spectral Format area.

3. Click **OK** to apply the change.

Note: This selection applies whenever you use the preset that was chosen when you made the change. When you use a different preset, the selection does not apply unless you have also made the change in that preset.

Enhancing the Image Using TeraVision™ Optimization

TeraVision is an optional image-optimization package that sharpens images produced by the Terason ultrasound system. TeraVision requires a license. See the *TeraVision Image Enhancement Installation Guide* for instructions on installing the TeraVision software.

The default configuration starts TeraVision when the Terason ultrasound system starts. To change this so the Terason system starts with TeraVision off, make a preset with the TV Level softkey control set to 0.

If the system is not licensed for TeraVision, the TeraVision level control does not display. If the control is present but grayed-out, the connected probe is not supported by the TeraVision software. If either of these conditions occurs, call Terason for assistance.

The TeraVision level numbers range from 0 to 3. The 0 setting applies no image processing. The larger the number, the more processing is applied to the image.

To adjust the TeraVision level, when live imaging, press the TV Level softkeys until the desired level is set.

Adding Guides to the Image Display

The View Options section of the General tab on the Setup window lets you add or remove several guides on the scanned image. These guides provide details about the patient. probe, and image control settings. See Using General Setup Controls on page 155.

Working With Split Screen Mode

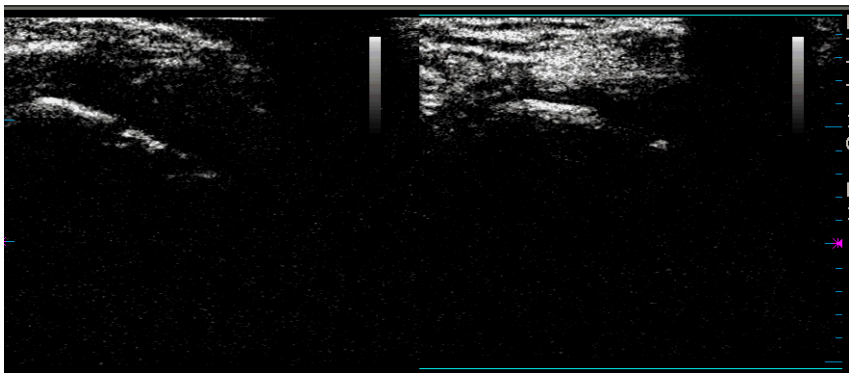
The Terason software lets you split the Imaging screen into two sections to view two current scans for a patient. You can acquire one scan for the patient, select Split Screen, and then acquire another scan from a different angle or location. Split Screen mode works with the 2D scanning modes (2D and Color Doppler).

Using Split Screen Mode

To enter split screen mode, press the **Split** softkey.

When you enter Split Screen mode, the Terason software copies the current settings for the Image Control window to the new screen. You can then apply any Image Control setting independently to either screen. You can go live or freeze either screen (only one screen can be live at a time), and you can use any of the tools and menus with either screen. In addition, you can scan in different modes in each screen. For example, you can acquire a 2D scan, enter split screen mode, then acquire a Color Doppler scan in the second screen.

The following figure shows an example of a split screen.



Split Screen

The active screen has cyan bars at the top and bottom.

To activate the other screen, perform either of these actions:

- Move the **arrow cursor** to the desired screen and press the **Left Enter** key.
- Press the **Toggle Screen** softkey.

To exit split screen mode, use any of these methods:

- Press the 2D key.
- Select a different exam
- Select M-Mode, PWD, or Triplex scan modes
- Press the Split softkey

When you exit Split Screen mode by pressing the Split softkey, the Terason software keeps the acquired data for the active screen (the one with the cyan lines at the top and bottom) and discards the acquired data for the other screen.

Note: If you create a custom exam in Split Screen mode, make sure the active window contains the Image Control settings you want to save before you proceed. When finished saving your custom exam, the Terason software displays a single screen in the Imaging window. See Creating Custom Presets on page 114 for information on saving custom exams.

Saving Split Screen Images and Loops

When you press the Store key, the software saves both screens as a single image. When you press the Store key, the software saves the active screen as a loop, and the other screen as a single image.

Working with Annotations

This section explains the following topics:

Working with Text

To place text on an image, you must first view the image in the Imaging window. If the image has been saved, retrieve it from the Patient window. See Reviewing Patient Studies on page 119 for instructions.

To work with text annotation, you should understand:

Text Mode

Text mode lets you add text and symbols to an image, using the softkeys.

Text Mode Softkeys

Softkey controls available in Text mode:

- **Laterality** places the word Left or Right on the image. Pressing the Laterality softkey cycles between Left, Right, and no text.
- **Location** opens a menu of body locations, or increments through a list of body locations. If a menu opens, click the appropriate item to place it on the image.
- **Anatomy** opens a menu of names for different anatomies, or increments through a list of anatomies. If a menu opens, click the appropriate item to place it on the image.
- **Orientation** opens a menu of patient orientations, or increments through a list of patient orientations. If a menu opens, click the appropriate item to place it on the image.
- **Body Marker** opens the Body Marker menu.
- **Text New** starts a new line of text at the home location.
- **Text Clear** deletes all text (including manually typed text and arrows) from the image
- **Home** moves the text cursor or selected text to the text home position.
- **Arrow** places an arrow at the text home position, or if there is text on the image, at the middle of the last line of text (see Placing Arrows on the Image on page 59.)
- **Set Home** sets the text home position. Move the text cursor to the desired location, then press the Set Home softkey.

To enter text mode, press the **Text key**.

The Terason software places a text cursor (I-beam) on the Imaging screen. Use the trackball to move it to where you want the new text, and either type the text, or use one of the Text-mode softkeys. When the text is done, press the Left Enter key.

If you added custom text using the Annotation tab of the Setup window, (see Custom Predefined Text on page 56), that text shows in the softkey list that it was added to.

Typing Text on an Image

To type text on an image:

1. Press the **Text key** on the console, or press the **Space bar** or a **letter key** on the keyboard when the image is frozen.

   The text cursor appears, and the softkeys change to controls for text and annotations.

   If there is already text in the Home position, you can place the new text in another location, or use the Text New softkey. You can also move the text home position using the Set Home softkey.

2. If necessary, move the **text cursor** to the desired location.
3. Type the desired **text**.

   The text appears in green.

4. Press the **Left Enter key** to add the typed text to the image and exit Text mode.

   The text changes to white, and the system exits Text mode.

Predefined Text

You can also add predefined text, using the softkeys. This lets you easily add labels and messages you need often, without having to type them each time.

To place predefined text on the image:

1. Press the **Text key** on the console, or press the **Space bar** on the keyboard.
2. Press one of the **softkeys** for predefined text:

   - **Laterality** places the word Left or Right on the image. Pressing the Laterality softkey cycles between Left, Right, and no text.
   - **Location** opens a menu of body locations, or increments through a list of body locations. If a menu opens, click the appropriate item to place it on the image.
   - **Anatomy** opens a menu of names for different anatomies, or increments through a list of anatomies. If a menu opens, click the appropriate item to place it on the image.
   - **Orientation** opens a menu of patient orientations, or increments through a list of patient orientations. If a menu opens, click the appropriate item to place it on the image.

   Selecting an item with one of the softkeys places it on the image.

3. When all the desired predefined text is in place, press the **Left Enter key**.

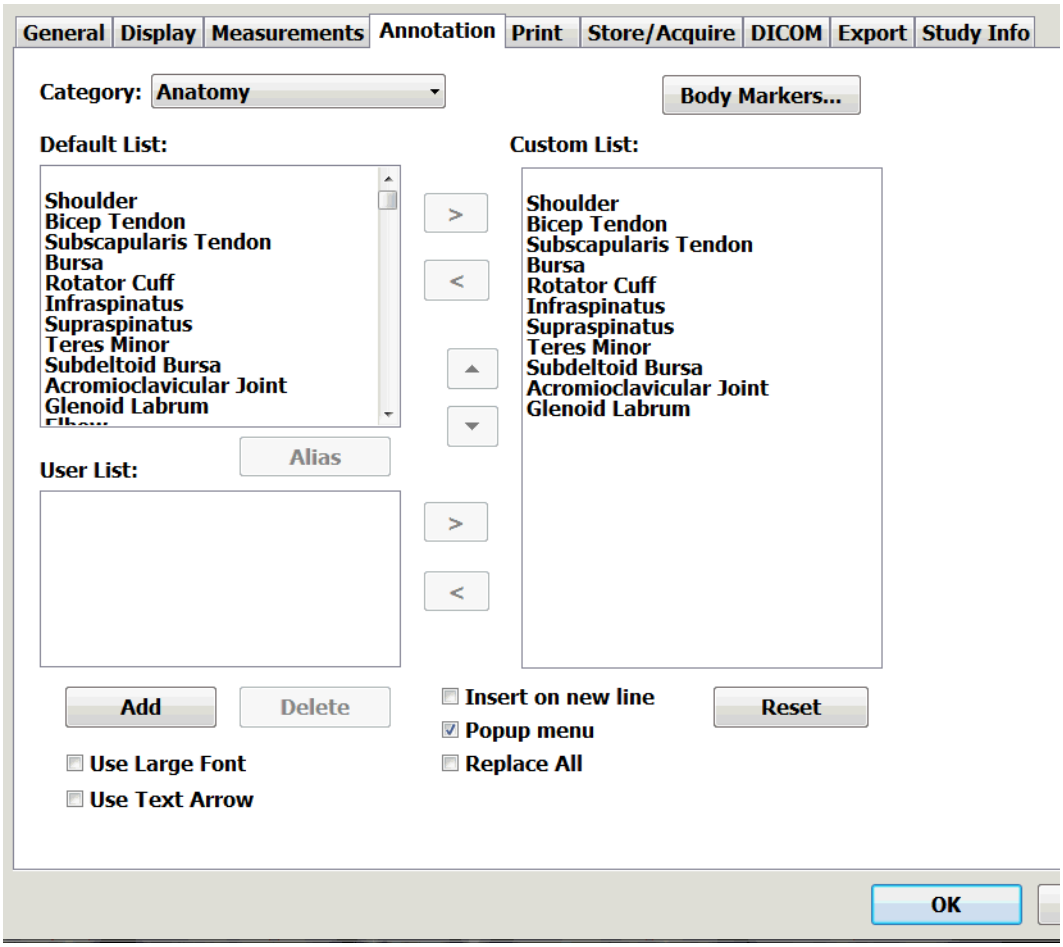
Custom Predefined Text

You can add custom predefined text items to the lists accessed by the softkeys, using the Setup window.

To add custom predefined text to the softkey lists:

1. Press the **Setup key**.
2. On the Setup window, click the **Annotation** tab.

   The Setup/Annotation window opens.

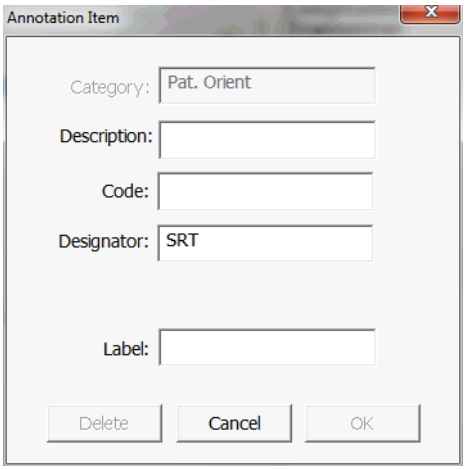


Setup/Annotation Window

3. Click the triangle button to the right of the **Category:** field, and choose the softkey you want to add text for.
4. **To add text that's in the Default List: area** to the custom list, click an item to select it, then click the right-pointing arrow.
5. **To add custom text:**

   a. Click **Add**

   The Annotation Item window opens.



Annotation Item Window

b. In the **Label:** field, type the text you want to have available for the softkey selected in step 3.

c. Click **OK**.

d. In the Setup/Annotation window, click the new **custom text** in the User List: area to select it.

e. Click the **right-pointing arrow**.

6. When the lists are configured properly, click **OK**.

To remove text items from the Custom list, click the items, then click the left-pointing arrow.

To delete custom text, remove it from the Custom list, select it, then click Delete. You cannot delete text items in the Default List: area.

Setting the Text Home Position

You can choose a default location in the Image Display as the text home position. The Terason software uses the specified position as the starting location whenever you enter Text mode.

Note: The text home position set in the Imaging window does not apply to the Review window. The text home position set in the Review window does not apply to the Imaging window.

To set a text home position, complete these steps:

1. Press the **Text key**  to enter Text mode.

2. Use the **trackball** to move the text cursor to the desired text home position.

3. Press the **Set Home** softkey.

The Terason software uses this location when adding text from the Annotation Window, and as the text cursor location when typing text. You can always move text after placing it.

Placing Arrows on the Image

You can place two kinds of arrow on a frozen image: marker arrows and text arrows. The default is marker arrows. You can place as many arrows as you want on an image.

Marker Arrows

Marker arrows are short, hollow arrows that indicate a spot on the image. When you place an arrow (see the procedure below), the arrow is green. You can use the trackball to move the arrow while it is green. You can select an arrow by clicking on it. When an arrow is selected, you can move it with the trackball and rotate it by pressing the Select key, then moving the trackball.

To place a marker arrow on an image, complete these steps:

1. Press the **Arrow** softkey.
2. Use the **trackball** to move the arrow to where you want it
3. To rotate the arrow, press the **Select key** and move the trackball.
4. To place another arrow on the image, press the **Arrow** softkey.
5. Press the **Left Enter key** to set the arrows and exit Text mode.

Text Arrows

Text arrows are dashed-line arrows that you can draw from text to a point on the scanned anatomy. You can also add an arrow without adding text. To use text arrows, you must make a selection on the Setup/Annotation window.

To place a text arrow on an image, complete these steps:

1. Press the **Setup key**.
2. Click the **Annotation tab**.
3. On the Setup/Annotation window (see Setup/Annotation Window on page 57), click the **Use Text Arrow** checkbox.
4. Click **OK**.
5. Press the **Text key**.
6. Press the **Arrow** softkey.
7. Use the **trackball** to drag the arrowhead to the feature you want the text to refer to.
8. Press the **Left Enter key** to set the arrow and exit Text mode.
9. To place another arrow:

   a. Press the **Text key.**

   b. Press the **Text New** softkey.

   c. Use the trackball to move the **text cursor** to where you want the arrow to start.

   d. Press the **Arrow** softkey.

   e. Press the **Left Enter key** to set the arrow and exit Text mode

10. To manipulate a previously-set arrow:

a. Move the windows cursor over **one end** of the arrow, until the cursor changes to a hand.

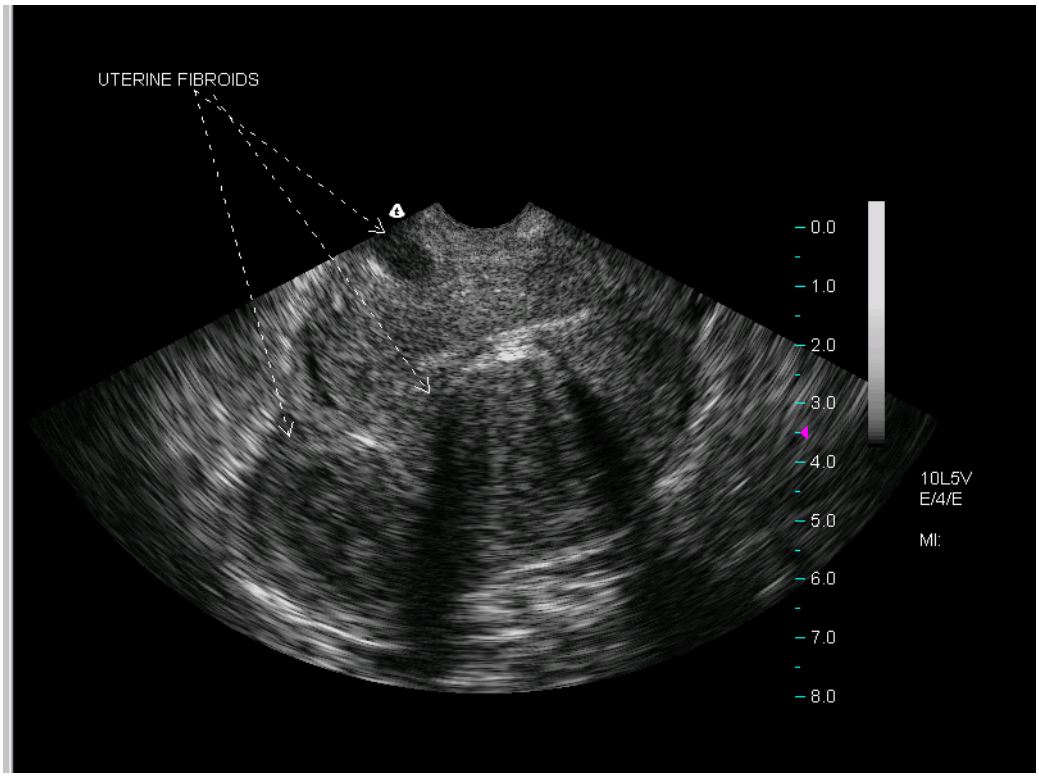
b. Click the **Left Enter key**.

The Cursor changes to the Text cursor I-beam, and the Text Pos and Arrow Pos options appear above the softkey display.

c. To move the text or beginning of the arrow when the Text Pos option is highlighted, move the **trackball**.

d. To move the point of the arrow, press the **Select** key so that Arrow Pos is highlighted, then move the trackball.

e. Press the **Left Enter key** to set the arrow and associated text in the new position.



Adding Arrows to Text

In this example, one arrow is tied to the text, and two arrows were added without accompanying text and positioned as shown.

When working with text arrows, you can:

- Add text before or after adding the arrow
- Move the arrow and text later if needed

Moving Text

After placing text on an image, you can easily move it to any location within the Image Display.

To move text, click the text, move it to a new location, and press the Left Enter key. If an arrow is attached to the text, the origin of the arrow also moves.

Deleting Text from an Image

You can only delete text that you added to an image. You cannot delete any text that is part of an image display property, such as the probe image control values. You can hide that text (see Adding Guides to the Image Display on page 53), but you cannot delete it.

To delete the last line of text, click the text to highlight it, then press the Delete key on the keyboard to delete the last character entered. Hold down the Delete key to remove preceding characters

To delete all added text, press the Text key, then press the Text Clear softkey. This removes all added text and arrows from the image.

Using Body Markers

You can add an icon to the 2D image that identifies the anatomy of the scan. Body Marker in the **Annotation** menu opens a window containing several anatomical views based on the current exam.

To work with body markers, you must understand:

Adding a Body Marker

To add a body marker to an image, complete these steps:

1. Press the **Text key**.
2. Press the **Body Marker** softkey.

   A body marker displays on the image.

Shoulder Body Marker

3. If the marker you want is not displayed, press the **Next Marker** or **Prev Marker** softkey**.**

   If another marker is available, it replaces the first marker.
4. When the marker you want displays, press the **Left Enter key**.

Changing the Body Marker

To change the body marker, complete these steps:

1. Click the **body marker**.

   The marker turns green and the softkeys change to the Body Marker set.

2. Press the **Next Marker** or **Prev Marker** softkey**.**

3. When the marker you want displays, press the **Left Enter key**.

Moving the Body Marker

You can move the body marker to any location on the image.

To move the body marker, complete these steps:

1. Click the **body marker** to select it.

2. Press the **Marker Position** softkey.

3. Use the **trackball** to move the body marker.

4. When the marker is where you want it, press the **Left Enter key** twice.

Moving the Probe Indicator

You can move the orange probe indicator to anywhere on the icon to more precisely indicate the scanned anatomy.

To move the orange marker, complete these steps:

1. Click the **body marker**.

   The text above the softkey display changes to show Probe Pos is selected.

2. Use the **trackball** to move the probe indicator to the desired location on the body marker.

3. When the marker is where you want it, press the **Left Enter key**.

Rotating the Indicator

To rotate the probe indicator to more positions complete these steps:

1. Move the Windows pointer over the body marker.

   The pointer changes to pointing hand.

Rotating the Body Marker Indicator

2. Press the Select key to highlight **Probe Orient** in the line above the softkey display.

3. Use the **trackball** to rotate the probe indicator to the desired orientation on the body marker.

4. Press the **Left Enter key** to lock the indicator in position.

Removing Body Markers

To remove the Body Marker from the image

1. Press the **Text key**.
2. Press the **Body Marker** softkey.
3. Press the **Erase Marker** softkey.

4 Working With Scan Modes

Scan Modes Overview

All of the information in this chapter pertains to live imaging. Many of the controls and functions change when you freeze the scan. For information on using functions when the scan is frozen, see Working with Annotations on page 54. and Chapter 5 - Working With Measurements.

Follow these general guidelines to choose which scan mode to use for an exam:

- Select 2D Mode to view a two-dimensional display of the anatomy. 2D controls adjust the depth, focus, overall image gain, brightness, and exam type. See Using 2D Image Controls on page 65.
- Select M-Mode (Motion Mode) to evaluate motion over time. See Using M-Mode Image Controls on page 72.
- Select Pulsed-Wave Doppler (PWD) mode when you want obtain frequency or velocity information from a specific point along the ultrasound cursor. See Using Spectral Doppler Image Controls on page 74.
- Select Color Doppler (CD) when you must view the mean velocity within an assigned region of interest. See Using Color Image Controls on page 80
- Use Triplex to combine Pulsed-Wave Doppler scanning with Color Doppler scanning. See Scanning in Triplex Mode on page 85.

Using the Softkeys and Console Controls

A set of softkey controls below the Imaging window display the currently available imaging controls (for example, see 2D Softkeys on page 65). The softkeys are operated by the keys on the console (see The uSmart3300 Console on page 27.) When you select a scan mode, the software configures the softkeys for that mode. The controls displayed vary depending on which probe is connected, and on other selections. Pressing the left and right arrow keys at the left side of the console changes the display to other controls available in the selected mode.

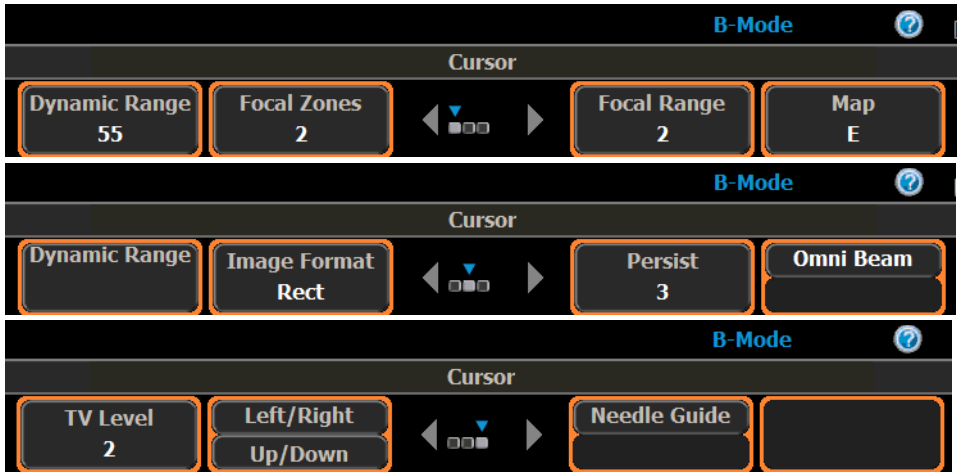
To change a setting, use the toggle keys on the console. Each toggle key controls the setting in one of the softkeys at the bottom of the Imaging window. The position of the key set corresponds to the position of the onscreen button – the leftmost key controls the setting in the leftmost softkey, and so on.

See Console Controls on page 27 for more information on using the console.

See Scan Properties Display on page 25 for a description of the display that lists current imaging settings.

Using 2D Image Controls

The figure 2D Softkeys shows an example of available 2D image controls. You can only adjust these image controls during live scanning. When you freeze a scan, the Terason software replaces the softkeys with a different set, for printing and making annotations and measurements on the scan image. (See Working with Annotations on page 54 and Chapter 5 - Working With Measurements.)



2D Softkeys

Note: The softkey display depends on the probe that is connected, the selected scan mode, and the selected exam. The display you see may differ from the illustrations in this guide.

You can adjust the following 2D image controls during live scanning:

- Frequency
- Scan Depth
- Focus depth
- Gain
- Time Gain Compensation (TGC)
- Image Format
- Omni Beam
- Left/Right and Up/Down invert
- Colorization
- Persistence
- Image map
- Needle guide
- Dynamic range
- TeraVision
- THI

Adjusting the Frequency

When you select an exam, the Terason software sets an appropriate frequency for that exam. You can select an alternate frequency to better suit specific circumstances. In general, a higher transmit frequency yields better 2D resolution, while a lower frequency gives the best penetration.

To select high, medium, or low frequency, use the Frequency softkey. The exact frequencies vary, depending on the connected probe. Each frequency has a number of other parameters associated with it, which depend on the type of exam. The selected frequency shows as H, M, or L in a character string in the information to the right of the Imaging window. In the example below, medium frequency is selected.

Selected Frequency Display

Adjusting the Scan Depth

The Depth key adjusts the field of view. You can increase the depth to see larger or deeper structures. You can decrease the depth to enlarge the display of structures near the skin line, or to not display unnecessary areas at the bottom of the window.

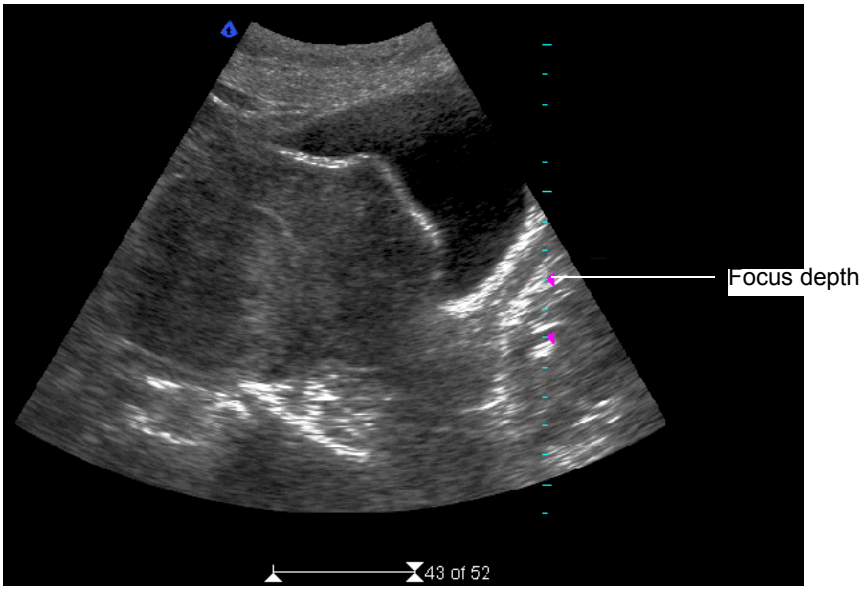
When you select an exam type, the Terason software enters a preset depth value for the specific exam type and probe.

To set the scan depth, use the Depth key. After adjusting the depth, you may want to adjust the gain, time gain compensation (TGC) curve, and focus control settings.

You can view a depth ruler on the image by selecting Depth Ruler on the General tab of the Setup window.

Adjusting the Focus Depth

Focus optimizes the image by increasing the resolution for a specific area. The figure below shows the depth ruler along the right side of the image.



Example Depth Ruler

A pink triangle on the depth ruler indicates the focus depth. This indicator is only visible if you show the depth ruler. The depth is also displayed as text in the scan information area (See Scan Properties Display on page 25).

When you select an exam type, the software updates the focus value to a preset value for the specific exam type, probe, and frequency.

In 2D mode, you can set up to four focus depths, using the Focal Zones softkey. In all the other modes, you can set only one focus depth. When you use more than one focus depth, you can choose the distribution of the focus depths.

To set the focus depth, use the Focus key.

To **set multiple focus depths** in 2D, complete these steps:

1. Use the Focal Zones softkey to select the desired number of focus zones.
2. Use the Focal Range softkey to select a distribution for the focus zones.

   The distribution is shown by the spacing of the depth indicators on the depth ruler. The actual spacing of the focus depths depends on the number of points selected and on the depth

Note: Increasing the number of focal zones decreases the frame rate.

Adjusting the Gain

2D gain allows you to increase or decrease amplification of the returning echoes, which increases or decreases the amount of echo information displayed in an image.

Adjusting gain may brighten or darken the image if sufficient echo information is generated. When you adjust the gain, the Terason software increases or decreases the overall gain while maintaining the shape of the TGC curve. See Adjusting Time Gain Compensation on page 68 for more information on TGC settings.

When you select a preset, the Terason software sets the gain to a preset value for the specific preset and probe.

To increase or decrease the gain, turn the Gain knob to the right or left.

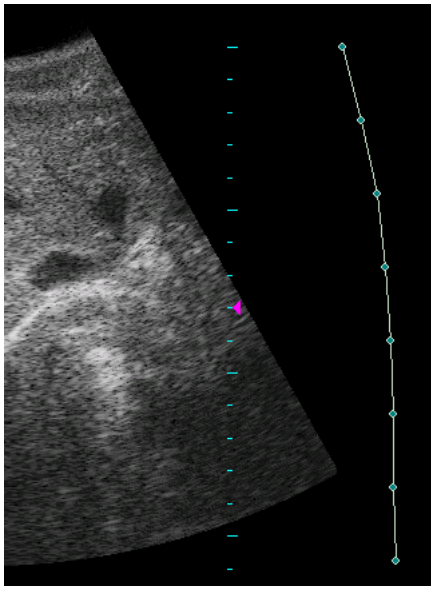
Adjusting Time Gain Compensation

Scanning tissues at greater depths causes attenuation of the returned signal. The TGC sliders adjust amplification of returning signals to correct for the attenuation. TGC balances the image to equalize the brightness of echoes from near field to far field.

The Terason software rescales the TGC settings when you do any of the following:

- Change the depth
- Load a new exam type
- Select a different frequency
- Adjust the gain setting

The TGC slider bar spacing is proportional to the depth. The TGC curve on the image display represents the TGC settings, and appears when you move one of the sliders.



Example TGC Curve on an Image

Each slider controls one dot on the curve. You can adjust the TGC sliders individually as needed. Drag a slider to the left to decrease the gain, or drag it to the right to increase the gain.

To show or hide the TGC curve, press the Setup key, then click the General tab, and select Show, Hide, or Time Out in the TGC box.

Select Show to always show the curve, or select Hide to always hide the curve. If you select Time Out (the default setting), the curve displays briefly when you start the application or adjust an individual TGC slider.

Adjusting the Image Format

When using a linear probe, the Image Format softkey lets you choose an image format of rectangular (Rect) or trapezoidal (Trap).

To select the shape of the sectors, press the Image Format softkey. It toggles between Rect and Trap.

See Setting Display Defaults on page 161 for information on choosing defaults associated with sector width and image format.

Omni Beam

Omni permits electronic steering of the ultrasound beam to acquire scans of an ROI from several directions. Omni works with linear and curved-linear array probes.

When Omni is on, the code OM shows in the scan information display, and the focus markers on the depth ruler change to this: 

Omni Beam Code in Information String

To turn Omni Beam on or off, press the Omni Beam softkey.

Inverting Images

The Left/Right and Up/Down softkeys control the orientation of the scanned image.

The following figure shows the effect of using the invert softkeys.

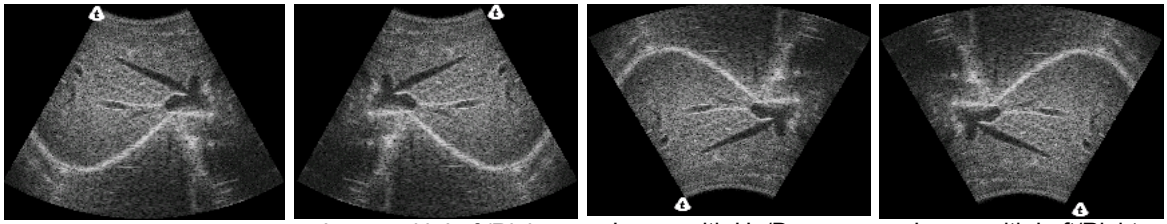


Image with no Invert | Image with Left/Right Invert | Image with Up/Down Invert | Image with Left/Right and Up/Down Invert

Effect of Inverting an Image

To invert the scanned image, click the Left/Right or Up/Down softkey.

Adjusting Persistence

Persistence refers to image frame averaging of real-time images or loops. When the persistence rate is high, the image appears less speckled and smoother. However, increasing the persistence rate may produce a blurred image if the tissue is moving when you freeze the image. When the persistence is low, the opposite is true.

To change the amount of frame averaging, press the Persist softkey to select a value from 0 to 7. The 0 setting represents 0% and 7 represents 100% persistence.

The persistence setting displays onscreen as a character in the information text string, as shown in the following figure.

Persistence Setting in Information String

Adjusting the Image Map

The Map control lets you choose how grayscale is distributed across the image. Each map emphasizes certain regions of the signal amplitude range. This feature is useful for close viewing of certain anatomical features and for detecting subtle pathologies.

To change the number of gray levels, press the Map softkey. You can choose any of nine maps, labeled from A to I.

Note: The change in image quality from one map to the next is not a linear sequence. Observe the reference bar to see the effect of the various maps. (See Image Map Reference Bar, below.)

The current map setting displays on the Map softkey. The information text string on the Imaging window also includes a code for the selected map setting. In the example below, the second item (D) is the map setting.

Map Setting (D) in Information String

Image Map Reference Bar

The effect of your map choice is represented by a reference bar to the left of the depth scale on the image.

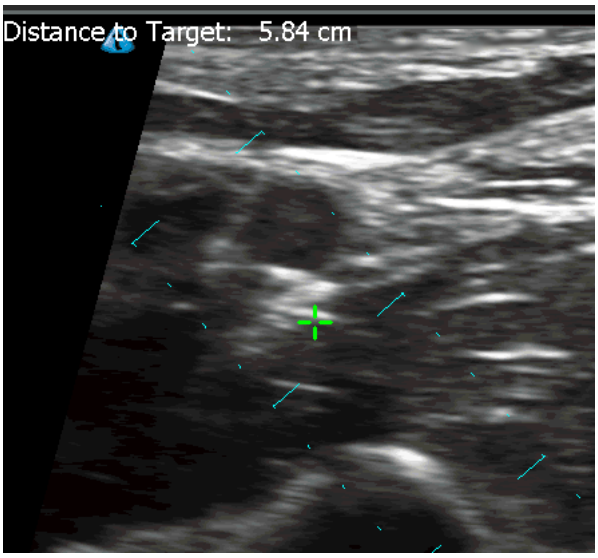
Selecting a Needle Guide

The needle guide softkey is active only when a probe that supports biopsies or other medical procedures is connected. To display a needle guide, use the softkeys to turn on the needle guide and to select the correct needle guide, if more than one guide is available.

Depending on the connected probe, you may only see one needle guide option. If the bracket for that probe supports more than one angle or depth, options for each supported angle or depth are displayed.

To toggle the needle guide on or off, press the Needle Guide softkey. If more than one guide is available, press the Guide Type softkey to select a different guide.

See Performing a Biopsy on page 131 for more information on using needle guides.



Needle Guides and Target for a Biopsy

On the 2D image, the cyan dashed lines are the guide lines, and the green is the needle guide target indicator.

To toggle the target indicator on and off, press the Target softkey. Use the trackball to set the target depth.

The distance from the probe to the target displays in the upper left corner of the Imaging window.

Adjusting Dynamic Range

The Dynamic Range softkey controls the range of acoustic levels displayed in the image, which affects the contrast of the image. A number on the softkey indicates the amount of compression, from 0 to 100.

To adjust dynamic range, use the Dynamic Range softkey. The 0 setting gives greatest contrast, and 100 gives the least contrast.

TeraVision

TeraVision is an image-enhancement option. See Enhancing the Image Using TeraVision™ Optimization on page 53.

To enable or disable TeraVision, use the TV Level softkey. Using the softkey, you can set TeraVision levels of Off, 1, 2, or 3.

Using Tissue Doppler Imaging

Selecting tissue Doppler imaging (TDI) optimizes the image controls for imaging tissue motion. The control settings vary with the selected scan mode. The control values can be adjusted and preset independently of non-TDI settings. TDI is disabled when the image is frozen. TDI works only with the 4V2A probe.

To apply tissue Doppler imaging, press the TDI softkey while in 2D mode.

Tissue Harmonic Imaging (THI)

The transmitted ultrasound signal generates harmonics (signals at frequencies that are multiples of the transmitted signal frequency) in tissue. Tissue harmonic imaging processes a returned harmonic signal to enhance the displayed image. The harmonic used for THI is twice the frequency of the transmitted signal.

THI is only available when a 4V2A or 5C2A transducer is connected. When a different type of transducer is connected, the THI button does not display.

THI is most effective at mid-range depths. Shallow and deep scans do not benefit from THI. When scan depth is 4 cm or more, THI is disabled.

To turn THI on or off, tap the **THI** button in 2D mode.

Note: When using the 4V2A probe, THI is on by default, and cannot be disabled.

Using M-Mode Image Controls

When you select M-Mode, the Terason software applies a group of preset image settings and changes the available softkey controls. When you freeze a scan, the Terason software replaces the imaging softkey controls with controls for measuring features of the M-mode image and for examining frames and playing loops. (See Measuring in the M-Mode Window on page 94.)

M-Mode Softkeys

For information on the M-Mode image controls, see:

- Using the Gain Knob in M-Mode on page 73
- Adjusting the Sweep Speed on page 73
- Adjusting the Ultrasound Cursor Position on page 73

When M-mode is chosen, the Terason software automatically selects the ultrasound cursor, and moving the trackball controls the cursor position. Pressing the Left Enter key deselects the cursor and locks it in place. Pressing the Cursor key selects the ultrasound cursor.

Using the Gain Knob in M-Mode

The Active button in the center of the Gain knob controls which set of imaging controls for the active modes displays. In M-Mode, those are controls for 2D and M-Modes. The currently-selected control set name displays in blue above the softkeys. To select a different control set, press the Active button.

In M- mode, the available Gain Knob controls are:

- 2D Gain

See Console Controls on page 27 for more information on using the console.

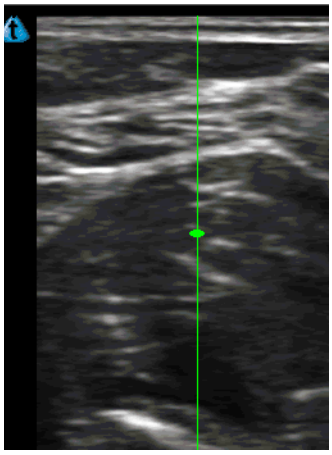
Adjusting the Sweep Speed

The Sweep Speed softkey sets how fast the timeline is scanned across the Time Series window.

To set the sweep speed, press the Sweep Speed softkey to select Slow, Medium, or Fast. The tick marks in the Time Series window are closer or farther apart depending on the speed. Each large tick mark represents one second.

Adjusting the Ultrasound Cursor Position

The following figure shows the ultrasound cursor:



Ultrasound Cursor

To move the ultrasound cursor, press the Cursor key to select the ultrasound cursor, then use the trackball to move it to a new location. When the cursor is where you want it, press the Left Enter key.

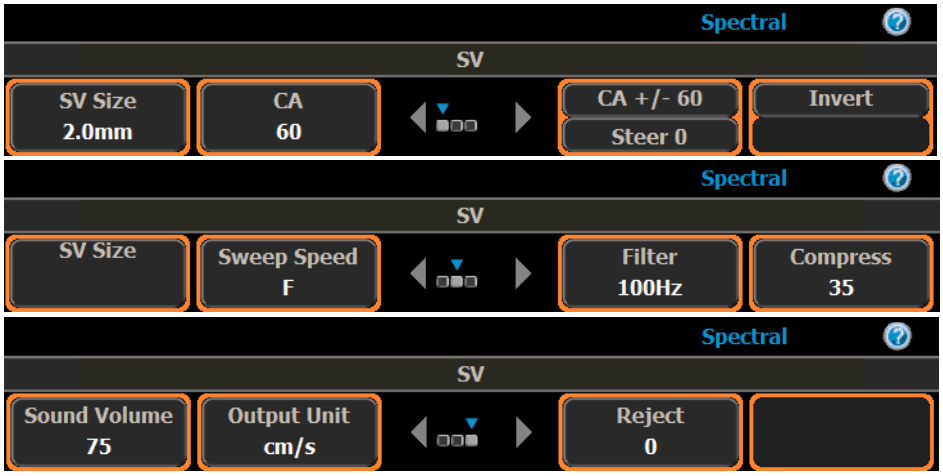
When the ultrasound cursor is selected, it turns green. When locked in position, it returns to its normal color.

Anatomical M-Mode

Enabling Anatomical M-Mode with the Anatomic softkey allows you to rotate and move the scan line vertically.

Using Spectral Doppler Image Controls

When you select Pulsed-Wave Doppler, the Terason software applies a group of preset image settings and changes the available softkey controls. When you freeze a Pulsed-Wave scan, the Terason software replaces the imaging softkey controls with controls for measuring features of the PWD image and for examining frames and playing loops.



PWD Mode Softkeys

For information on spectral Doppler image controls, see:

Using the Gain Knob in PWD Mode

The Active button in the center of the Gain knob controls which set of imaging controls for the active modes displays. In PWD mode, those are controls for 2D and Spectral modes. The currently-selected control set is displayed in blue above the softkeys. To select a different control set, press the Active button. Special Trackball Responses to PWD Mode

When Pulsed-Wave Doppler mode is chosen, the Terason software automatically selects the ultrasound cursor and the Sample Volume Gate (SVG), and moving the trackball controls the ultrasound cursor and SVG position. Pressing the Left Enter key sets the ultrasound cursor and SVG in position. Pressing the Cursor key selects the ultrasound cursor and the SVG when in PWD mode

Adjusting the Sweep Speed

The Terason software lets you choose the sweep speed for Spectral Doppler modes. A slow speed shows more waveforms over time but less detail. A medium speed is suitable for normal use. Fast speed shows fewer waveforms over time but with more detail.

The spacing of the ticks along the top of the Time Series window indicates the sweep speed. Each large tick represents one second. When an image is frozen, you cannot change the setting.

The Sweep Speed softkey sets how fast the timeline is scanned across the Time Series window.

To set the sweep speed, press the Sweep Speed softkey to select Slow, Medium, or Fast.

Setting the Velocity Display Units

The Time Series window shows the velocity of flow in cm/s or kHz. You can change the units at any time, so long as the cursor angle is 70° or less.

To change the velocity display units, press the Output Unit softkey. Pressing the softkey toggles between cm/s and kHz.

Adjusting Scale

Pulse Repetition Frequency defines the velocity range of the display, which manifests as scale. The maximum value (in Hz) for the PRF depends on the specific probe and the location of the sample volume.

The PRF should be set high enough to prevent aliasing, and low enough to provide adequate detection of slow blood flow. It may be necessary to vary the PRF during an exam, depending on the speed of the blood flow, or when pathology is present.

Aliasing occurs when the frequency of what you are observing exceeds one half of the sample rate. If the blood is moving faster than the pulse repetition rate, then the waveform on the display will alias, or wrap around, the baseline.

You can only change this setting when viewing a live image, not when an image is frozen. The Terason software may automatically change the PRF value when you move the region of interest, to ensure that the maximum PRF value does not exceed its limit.

To adjust the PRF value, use the Scale key. The Velocity (cm/s) scale to the left of the Time Series window changes in response to the Scale setting, and the PRF value shows in the Scan Properties display.

The increment value for each click depends on the current range. For example, if the Scale setting is 4000, each time you press the up or down softkey, the Terason software adds or subtracts 500 Hz from that value, until the selected value falls into a lower or higher range.

Increasing the PRF also increases the Thermal Index (TI) value (refer to "General Description of Indices" in Volume 2 of the *User Guide* for more information about thermal indices).

Note: In Triplex scanning only, the PRF value is tied to the setting in 2D mode (Color Doppler). If you change the PRF value on one mode, the Terason software also changes the PRF value on the other mode. This depends on whether you are scanning in simultaneous or non-simultaneous mode, which is controlled by the Update key.

Adjusting the Wall Filter

Doppler systems use a wall filter (high pass frequency filter) to eliminate unwanted low-frequency high-intensity signals (known as clutter) from the display. Clutter can be caused by tissue motion or by rapid movement of the probe.

Increasing the wall filter setting reduces the display of low velocity tissue motion. Decreasing the wall filter setting displays more information, but more wall tissue motion.

Use a wall filter setting that is high enough to remove clutter but low enough to display information near the baseline.

To adjust the wall filter value, use the Filter softkey.

The wall filter range is from 1% to 25% of the PRF, so changing the PRF with the Scale key also changes the range of the wall filter and the increments by which the Filter softkey changes its setting. The increment value for each click depends on the current range. For example, if the wall filter range is 1000Hz, each time you click the Filter softkey, the Terason software adds or subtracts 100 Hz from the filter value.

Adjusting the Steering Angle

When using Spectral Doppler, be aware of the Doppler angle-to-flow (the angle between the axis of the ultrasound beam and the plane that the blood flows in). When the ultrasound beam is perpendicular to the flow (90º angle-to-flow), an absent or confusing color pattern displays, even when the flow is normal. An adequate Doppler angle-to-flow is required to obtain useful Spectral Doppler information. In most instances, the more nearly parallel to the flow the Doppler beam is (the lower the angle-to-flow), the better the received signal. Angles less than 60º provide the best quality Spectral Doppler.

Electronic steering is useful when the flow is at a poor angle to the Doppler beam. However, it is often also necessary to press on one end of the probe or the other to improve the Doppler angle-to-flow.

Electronic steering is only available with flat linear-array probes (the 4V2A and 15L4). This option does not display with any other probes. Curved linear probes are not capable of electronic steering, and depending on the clinical situation, may require that you press down on one corner of the probe to obtain an adequate angle to flow.

The steering angle does not directly affect the calibration of the velocity scale.

To select a different steering angle, press the Steer key to get the desired angle.

You can only use this control when viewing a live image. When an image is frozen, you cannot change the setting.

Adjusting the Correction Angle

To obtain accurate velocities, you must maintain Doppler angles of 60º or less. It is often necessary to press on one end of the probe or the other to improve the Doppler angle-to-flow.

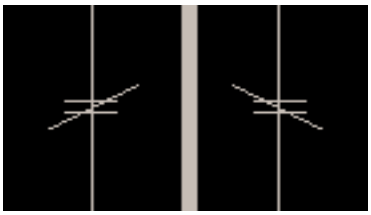
In the Terason Ultrasound System, the velocity display in centimeters per second is shown only in the correction angle range between +70º and –70º. At angles greater than 70º, the error in the velocity calculation is too large, and the velocity scale is converted to frequency (in kHz), independent of the correction angle. The flow-direction indicator still shows on the window, for reference.

To adjust the correction angle, press the CA softkeys to increase or decrease the angle. The angle setting displays in the image information section of the Imaging window, to the right of the depth scale.

To set the correction angle to 0 or 60º, press the CA+/– 60 softkey or the Steer 0 softkey. The CA+/– 60 softkey toggles the correction angle between –60º and +60º and the Steer 0 softkey sets the angle to 0º.

The correction angle controls are active on live images only.

The following figure shows adjustments made to the correction angle and sample volume:



60 Angle, 4.5 mm (Left) and 45 Angle (Right)

Inverting the Waveform

You can invert the Pulsed Doppler waveform. The Doppler scale is separated by a zero baseline across the width of the spectral display. (See Adjusting the Baseline on page 79.) The data above the baseline is classified as forward flow. The data below the baseline is classified as reverse flow.

When the waveform is inverted, reverse flow displays above the baseline and forward flow is below the baseline.

To invert the waveform, press the Invert softkey.

You can only use this control when viewing a live image. When an image is frozen, you cannot change this setting.

Adjusting the Ultrasound Cursor Position

To adjust the ultrasound cursor in the 2D image display, press the Cursor key**,** use the trackball to move the cursor, and press the Left Enter key to lock the cursor in position.

Adjusting the Sample Volume (SV) Size and Depth

The sample volume size control adjusts the size of the Doppler region being examined. The lower the value, the narrower the sample size used in the calculation of flow velocity. The sample volume displays along the ultrasound cursor as two parallel lines. The distance between the two parallel lines is the size of the sample volume in millimeters.

To adjust the sample volume (SV) size, press the SV Size softkeys. The SV Size displays on the softkey and in the image information area to the right of the depth scale on the Imaging window. You can set a value from 0.5 to 20 mm (in 0.5 mm increments).

To adjust the position of the sample volume, select it using the Cursor key**,** then the use the trackball or the touch pad to move it to the desired location. Press the Left Enter key to anchor it.

You can only use this control when viewing a live image. When an image is frozen, you cannot adjust the sample volume.

Modifying the depth location of the sample volume affects the Thermal Index (TI) value (refer to “General Description of Indices” in Volume 2 of the *User Guide* for more information about thermal indices).

Setting the PWD Gate Position

The sample volume indicator allows you to start a scan in a 2D scan mode, set the sample volume location, and switch to Spectral Doppler mode. The sample volume locks in position. When scanning in CD mode, this procedure switches to Triplex mode (if enabled by your license).

To locate the sample volume, in the 2D window, press the Cursor key, then use the trackball to set the gate position.

Adjusting Spectral Gain

The PW gain setting (not the 2D gain setting) increases or decreases the amplification of the returning signal (live or playback) for the Time Series display. The gain should be adjusted so that the spectral waveform is bright, but not so high that the systolic window fills in, or other artifacts are created.

To adjust the PWD gain, use the Gain knob. Make sure Spectral shows above the softkeys display.

You can adjust gain for live images or saved loops being played. You cannot adjust the gain for frozen images or paused loops.

Adjusting Noise Rejection

Noise Rejection controls rejection of low-level returned signals. Increasing rejection darkens the image background. A number on the softkey indicates the level of noise rejection.

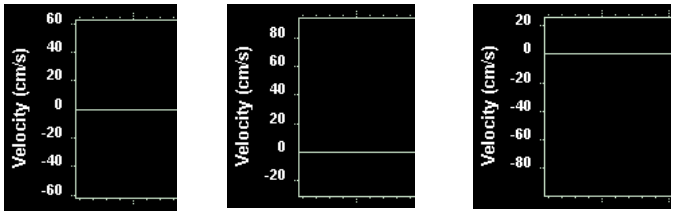
To adjust noise rejection, use the Reject softkey. A number on the softkey indicates the level of noise rejection.

Adjusting the Baseline

The baseline refers to the zero baseline in the Time Series Display window. Adjusting this control moves the zero baseline up or down. When you adjust the baseline, you can display more forward or reverse flow, taking advantage of the full scale available at that particular PRF value.

To adjust the baseline, press the Baseline key.

The figure below shows a centered baseline (the default), and adjusted baselines.



Centered Baseline (default) | Lowered Baseline | Raised Baseline

Effects of Altering the Baseline

You can adjust baseline for live images, but not for frozen images or paused loops.

Adjusting the Sound Volume

The Sound Volume control lets you define the volume of the Doppler signal.

Adjust the sound volume of the signal to a comfortable level. If it is too high, system noise may interfere with the sound produced by the blood flow.

To adjust the volume, use the Sound Volume softkey. A number on the softkey indicates the sound volume level, from 0 to 100.

The computer speaker should be turned on and its volume set to the mid-range. You can also use a high quality headphone or external speaker.

Updating the Displays

The **Update** key lets you choose whether or not to continue scanning the anatomy (displayed in the 2D window) while acquiring Spectral Doppler scan data (displayed in the Time Series window). When Update is selected, the key lights up blue, and the Terason software continuously updates the 2D scan while acquiring Spectral Doppler data. When not selected, the key lights up white and the Terason software freezes the 2D data while acquiring Spectral Doppler data.

The default setting for this key in most exams is *selected* (continuous scanning of the 2D and Spectral Doppler data).

When you de-select the Update key (but do not freeze the scan), you cannot adjust some of the 2D image controls. The following table lists the image controls that can and cannot be adjusted when Update is not selected.

Availability of 2D Image Controls When Update Disabled

Available	Not Available	
Exam	Depth	TGC curve
Frequency	Focus	Sector width
Noise Rejection	Gain	Map
	Left/Right invert	Colorization
	Up/Down invert	Persistence

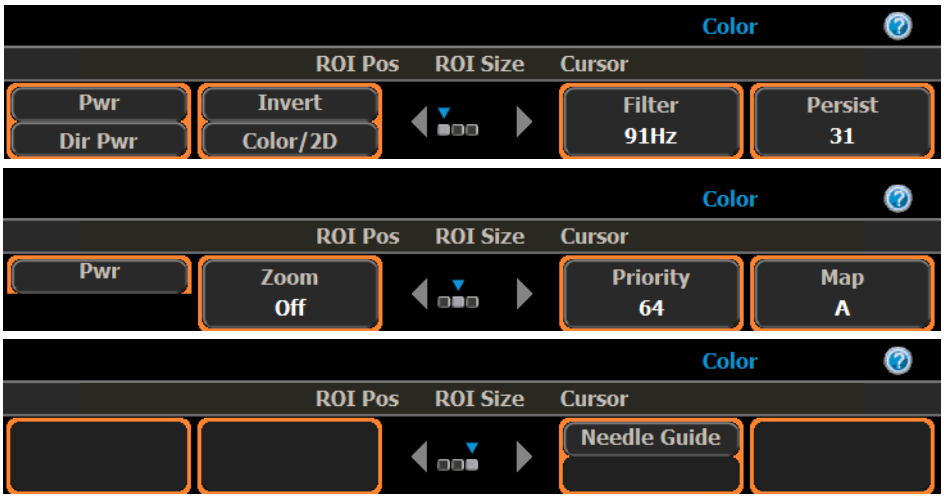
To toggle the 2D window between live and frozen, press the Update key.

Using Color Image Controls

When you select Color mode, the Terason software displays softkeys and a Gain Knob menu for Color mode.

To use Color mode image controls, see the following topics:

- Using the Gain Knob in Color Mode on page 81
- Special Trackball Responses to Color Mode on page 81
- Adjusting the Scan Area on page 81
- Adjusting Scale on page 82
- Inverting the Doppler Display (Color Invert) on page 83
- Adjusting the Color Gain on page 84
- Adjusting the Color Priority on page 84
- Adjusting the Color Persistence on page 84
- Adjusting the Color Baseline on page 85
- Choosing a Color Map on page 85



Color Mode Softkeys

Note: Softkey displays shown in this manual are examples. The displays on your system may be different.

Using the Gain Knob in Color Mode

The Active button in the center of the Gain knob controls which set of imaging controls displays. In Color mode, those are controls for 2D and Color modes. The currently-selected control set is displayed in blue above the softkeys. To select a different control set, press the Active button.

Special Trackball Responses to Color Mode

When Color mode is chosen, the Terason software automatically selects the ROI Position (ROI Pos), and moving the trackball changes the position. A click of the Select key above the trackball changes control to the ROI Size; and rolling the trackball shrinks or expands the ROI. When the ROI is in the correct position and is the correct size, click the Left Enter key to set the ROI. Pressing the Cursor key selects the ultrasound cursor, and the trackball controls the cursor position.

See Console Controls on page 27 for more information on using the console.

Adjusting the Scan Area

The size of the scan area (also referred to as the region of interest, or ROI) is one of the major controls that affect the frame rate. The smaller the scan area, the faster the frame rate. The larger the scan area, the slower the frame rate.

You can move the scan area by pressing the Select key, moving the ROI to a new position, and pressing the Left Enter key to anchor it. Pressing the Select key twice selects the ROI Size, and lets you resize and reshape it using the trackball.

You cannot move or resize the ROI when the image is frozen.

To move the region of interest, complete the following steps:

1. Press the **Select key** to select the ROI.

   The cursor disappears, and ROI Pos displays in blue above the softkeys.

2. Use the **trackball** to move the ROI.

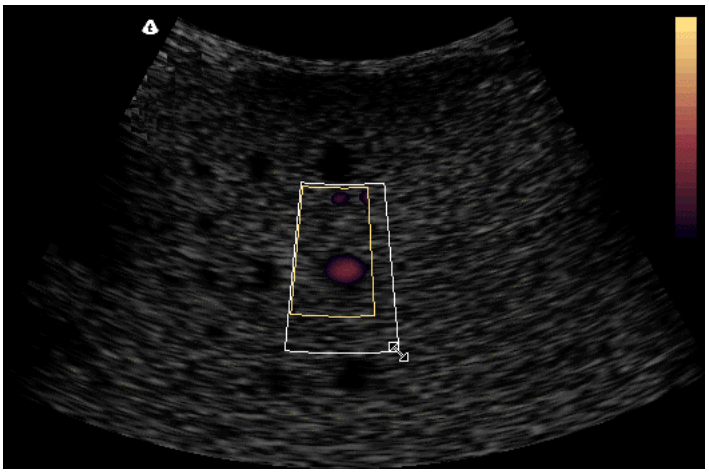
3. Press the **Left Enter key**.

To adjust the size of the region of interest, complete the following steps:

1. Press the **Select key twice** to select the ROI.

   The cursor disappears, the ROI outline becomes a dotted line, and ROI Size displays in blue above the softkeys.

2. Use the **trackball** to resize the ROI.



Resizing the Scan Area

3. Press the **Left Enter key**.

The Terason application may automatically adjust the PRF value when you move the region of interest to ensure that the maximum PRF is not exceeded for the new depth.

Adjusting Scale

Pulse Repetition Frequency defines the velocity range of the display, which manifests as scale. The maximum value (in kHz) for the PRF depends on the specific probe, and the location of the region of interest.

The PRF should be set high enough to prevent aliasing, and low enough to provide adequate detection of low flow. It may be necessary to vary the PRF during an exam, depending on the speed of the blood flow, or if pathology is present.

Aliasing occurs when the frequency of what you are observing exceeds one half of the sample rate. If the blood is moving faster than the pulse repetition rate, then the Doppler display will alias, or wrap-around, the baseline.

If the PRF is set too high, low-frequency shifts caused by low-velocity flow may not show.

As PRF increases, the maximum Doppler shift that can display without aliasing also increases.

You can only use this control when viewing a live image. When an image is frozen, you cannot change PRF.

To adjust the PRF value, use the Scale key.

The increment value for each click depends on the current range. For example, if the PRF setting is 4.0 kHz, each time you click the right or left arrow, the Terason software adds or subtracts 500 Hz from that value, until the selected value falls into a lower or higher range.

Increasing the PRF also increases the Thermal Index (TI) value (refer to "General Description of Indices" in Volume 2 of the *User Guide* for more information about thermal indices).

Inverting the Doppler Display (Color Invert)

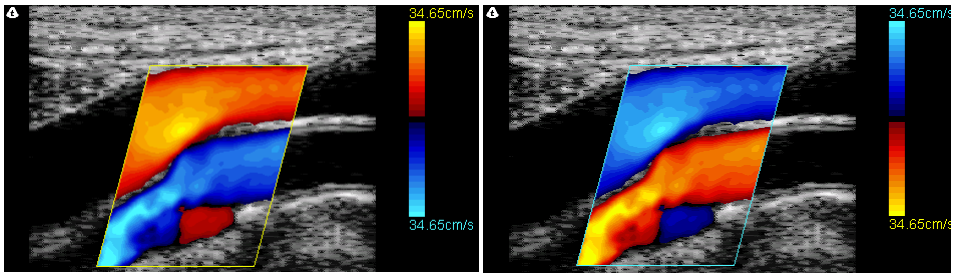
In Color Doppler, you can invert the color scale.

Normally, the color red is assigned to positive frequency shifts (flow toward the probe), and blue is assigned to negative frequency shifts (flow away from the probe). This color assignment can be reversed by pressing the Invert softkey. Flow toward the probe is always assigned the colors of the top half of the color bar, and flow away from the probe is assigned the colors of the bottom half of the color bar.

When you press the Invert softkey, the Color Doppler reference bar and the color of the scan data within the Region of Interest are both inverted.

Invert may be used when scanning the internal carotid artery (ICA), for example. In general, flow in this vessel goes away from the probe. If Invert is enabled, the ICA flow displays in shades of red. The color bar displays shades of blue on the top half, and shades of red on the bottom.

To invert the Doppler colors, press the Invert softkey:



Color Invert Not Selected Color Invert Selected

Effects of the Color Invert Softkey

Notice that the colors on the reference bar are also inverted.

The figure above should be viewed in color; when printed in black and white, the effect may be obscured.

Adjusting the Wall Filter

Doppler systems use a wall filter (high pass frequency filter) to eliminate unwanted low-frequency, high-intensity signals (also known as clutter) from the display. Clutter can be caused by tissue motion or by rapid movement of the probe.

Raising the wall filter setting reduces the display of low velocity tissue motion. Lowering the wall filter setting displays more information. However, more wall tissue motion is also displayed.

The wall filter setting should be set high enough to ensure that Color Doppler flash artifacts from tissue or wall motion are not displayed, but low enough to display slow flow. If the wall filter is set too high, slower flow may be not seen.

Set the wall filter setting higher for applications where there is significant tissue motion, or in instances where the probe is moved rapidly while scanning in Color Doppler mode. Set the wall filter setting lower for small parts or instances where flow is slow but there is not much tissue motion.

Use a wall filter setting that is high enough to remove clutter but low enough to display Doppler information near the baseline.

To adjust the wall filter value, use the Filter softkey. The current value displays on the softkey and on the Image Information area of the Imaging window (as a number following "WF").

The wall filter range is from 1% to 50% of the Scale value.

Adjusting the Color Gain

Color gain can be increased to correct an inadequate fill of color within a vessel, and decreased to correct an unacceptable amount of color outside of a vessel.

You can adjust the color gain to increase or decrease the amplification of the returning signal being played or displayed. There is no indicator in the scan properties list for Color gain like that for 2D gain.

To change the color gain, turn the Gain knob to the left (decrease) or right (increase).

Adjusting the Color Priority

The color priority of the image defines the amount of color displayed over bright echoes, and helps confine color within the vessel walls. Color priority affects the level at which color information overwrites the 2D information. If you must see more flow in an area of some significant 2D brightness, increase the color priority. To better contain the display of flow within the vessels, decrease the color priority. If the color priority is set to zero, no color is displayed.

To change the color priority, use the Priority softkey. The current Color Priority setting shows on the softkey display.

Adjusting the Color Persistence

The color persistence setting determines the amount to be averaged between frames. Increasing the persistence causes the display of flow to persist on the 2D image. Decreasing the persistence allows better detection of short duration jets, and provides a basis for better flow/no flow evaluations. Adjusting color persistence also produces better vessel contour depiction.

To change the color persistence, use the Persist softkey. The current Color Persistence setting shows on the softkey display.

Adjusting the Color Baseline

Color baseline adjustments are usually unnecessary. The baseline refers to the zero baseline within the Color Doppler image. To adjust it, move the baseline down to display more positive flow (forward) and move the baseline up to display more negative flow (reverse). This adjustment can be used to prevent aliasing in either direction.

To move the color baseline, use the Baseline key. The current setting of the baseline shows on the Color Doppler reference bar.

You can see the effect of your change on the color reference bar. If the bar is not visible, select **Setup** > **General** > **Reference Bar** to add it to the image display.

Choosing a Color Map

The Map softkey chooses one of five color maps to show Color Doppler data. You can configure the color map independently for each exam by selecting an exam, then a color map. When you select a different exam, the Terason software loads the color map for the selected exam.

The color maps are designated A through E. Some maps use more colors than others, and some display in a smoother gradient than others.

To select a color map, use the Map softkey. The current map letter shows in the softkey display.

Scanning in Triplex Mode

Triplex scan mode combines Pulsed-Wave Doppler scanning with Color Doppler scanning.

To activate Triplex scanning, select Color Doppler mode, then press the PW key on the console.

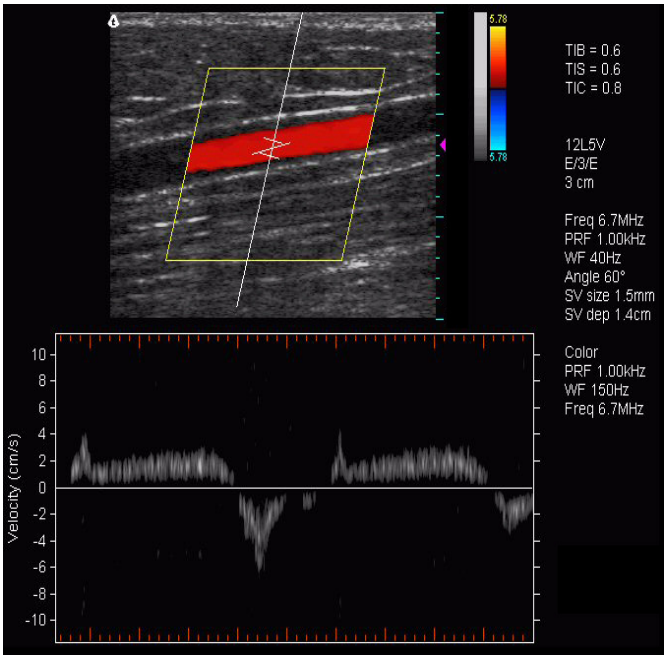
Note: In Triplex scanning only, the PRF value is tied to the setting on the 2D mode (Color Doppler). If you change the PRF value in one mode, the Terason software also changes the PRF value in the other mode. This depends on whether you are scanning in simultaneous or non-simultaneous mode, which is controlled by the Update console key. See Updating the Displays on page 79.

To adjust image controls for Triplex scanning, first adjust the image controls for the 2D scan mode, then go to the Color Doppler window and press the Cursor key to select the PWD ultrasound cursor and Sample Volume location.

Some of the 2D image controls cannot be adjusted when scanning in Triplex, so you must adjust the image controls in 2D mode (described in Using 2D Image Controls on page 65). You can only adjust these image controls during live scanning. When you freeze a scan,

the Terason software replaces the softkeys with a different set, for printing and making annotations and measurements on the scan image. (See Working with Annotations on page 54 and Chapter 5, Working With Measurements, on page 88).

The application adds the Time Series window for PWD to the 2D image.



Live Triplex Scan

Adjusting the ROI and Range Gate

When scanning in Triplex mode, you can move the region of interest, adjust its size, or move the range gate.

To move the region of interest, complete the following steps:

1. Press the **Select key** to select the ROI.
2. Use the **trackball** to move the ROI.
3. Press the **Left Enter key**.

To adjust the size of the region of interest, complete the following steps:

1. Press the **Select key twice** to select the ROI.
2. Use the **trackball** to resize the ROI.
3. Press the **Left Enter key**.

To move the range gate, complete the following steps:

1. Press the **Cursor key**.
2. Use the **trackball** to set the range gate.
3. Press the **Left Enter key**.

Using Image Controls in Triplex

When Triplex scanning, the PW softkeys are available.

The Image Information display shows two PRF values in Triplex mode. The Terason software sets the Color PRF to an integral fraction (1/2, 1/3, 1/4, etc.) of the PWD PRF. If you change the PRF value in one mode, the Terason software changes the other PRF setting as well.

You can independently set the Wall Filter for the 2D and PWD scans.

Using the Gain Knob in Triplex Mode

The Active button in the center of the Gain knob controls which set of imaging controls for the active modes displays. In Triplex mode, those are controls for 2D, Spectral, and Color modes. The currently-selected control set is displayed in blue above the softkeys. To select a different control set, press the Active button.

5 Working With Measurements

Measurement Overview

Measurements accompanying ultrasound images supplement other clinical procedures available to the attending physician. Accuracy of the measurements is determined by the Terason Ultrasound software and by proper use of medical protocols.

When you freeze a scan, the Terason software changes the set of available softkey controls and enables the Caliper key. Pressing the Caliper key enables the measurement controls. Repeatedly pressing the Caliper key cycles through the Distance, Trace, and Ellipse measurement options.

When you save an image, all measurements are saved with the image.

You can create measurements on the currently acquired image (with frames stored temporarily).

To make measurements on scanned images, you must understand:

- Measurement Results Display Location on page 89
- Measurement Sets; see page 89
- Measuring in the 2D Window; see page 89
- Measuring in the M-Mode Window; see page 94
- Measuring in Spectral Doppler Modes; see page 95
- Measuring Cardiac Exams; see page 96
- Stress Echo; see page 101
- Deleting Measurements; see page 111
- Restoring All Measurement Groups to Defaults; see page 111

You can also make measurements on both screens when using Split Screen mode. See Split-Screen Measurements on page 93.

To obtain a complete set of measurements, you often have to acquire multiple scans. You can make as many scans and measurements as required for the study without losing any measurements. Measurements remain on the Imaging window until you:

- Select a different exam
- Select a different scan mode
- Load a different patient
- Press the Delete softkey
- Press the Clear All softkey

Measurement Results Display Location

The default location for the display of measurement results is the top left of the image. To move the results to the bottom of the image, press the Results softkey (enabled when a measuring tool is active). You can also change the default location to the bottom of the image using the Result Display Location radio buttons on the Setup/Measurements window.

Measurement Sets

When you choose an exam preset, the Terason software makes a default set of measurements available. The default set may vary from one supported probe to another. You can also add custom measurements to the available lists. See:

- Default Measurement Sets on page 89
- Setting Measurement Defaults on page 163

Default Measurement Sets

The system loads a set of measurements tailored for the preset you've selected. The measurements are selected using the Calcs key.

To select a measurement type, press the Calcs key, and click the desired measurement.

Measuring in the 2D Window

When you freeze a 2D scan, the Terason software displays softkeys and a Gain Knob menu for measuring, printing, and playing loops in 2D mode.

2D Mode Measure Softkeys (When Scan is Frozen)

The Measure function in the 2D window allows:

- Measuring Distances; see page 90
- Measuring Elliptical Circumference and Area; see page 91
- Tracing Areas on the Image; see page 92
- Split-Screen Measurements; see page 93

In general, select what you want to measure from the menu of Measurements. If you select a specific measurement, such as Area, only the softkeys that work with that measurement are available.

Measuring Distances

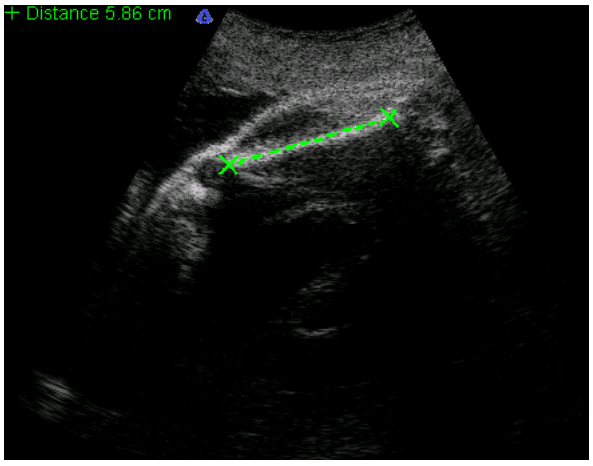
To measure a distance in the 2D window, complete the following steps:

1. If the image is live, press the **Freeze** key.

   The image freezes and the softkey controls change.

2. Press the **Caliper key**.
3. To measure a detailed area with precision, use the **Zoom** function (see Enlarging an Area of the Image on page 51) to enlarge an area of the 2D scan.
4. Press the **Caliper key**.
5. Click where you want to **start** measuring, move the target cursor, and click where you want to **finish** measuring.

   The Terason software displays the results in the top left corner of the 2D window.



Distance Measurement on an Image

If you do not see the measurement value, press the Setup key, then select General > Measurement Value.

To make more than one measurement of the same type on an image, press the appropriate softkey again, then make the additional measurement.

When making a series of 2D measurements using the Caliper key, you can keep the caliper active by checking the Keep caliper active box on the Setup/Measurements window. When the box is checked, a new caliper cursor appears when you set the end point of a caliper measurement. When you finish making measurements, save the image, then press the Freeze key to turn off caliper measuring.

Measuring Elliptical Circumference and Area

You can use either the Ellipse softkey or the Trace softkey to measure a circumference on the image. To measure an oval area, use the Ellipse softkey. To measure the area of an irregular shape, use the Trace softkey. See Tracing Areas on the Image on page 92 for instructions on using the trace tool.

To measure a small area, use the Zoom function before you measure.

To use the ellipse tool to measure an elliptical area, complete the following steps:

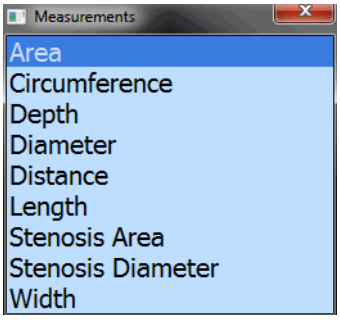
1. If the image is live, press the **Freeze** key.

   The image freezes and the softkey controls change.

2. Press the **Caliper key**.

3. Press the **Calcs key**.

   The Measurements menu opens.



Measurements Menu

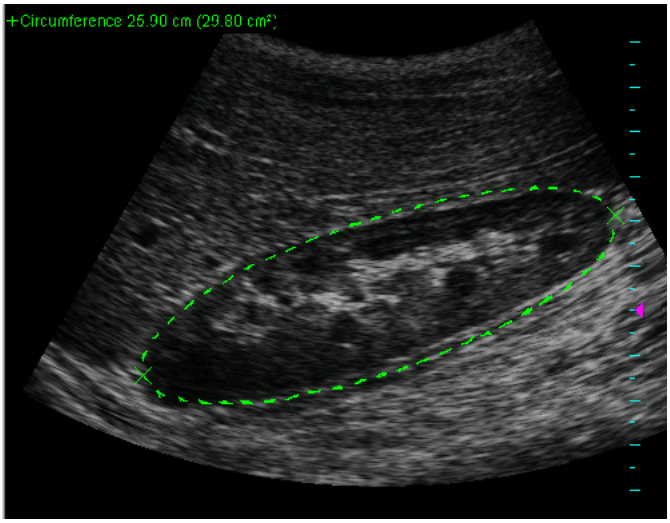
4. Select the **measurement type** by clicking it in the Measurements menu.

   If you select Circumference from the Measurement menu, the Ellipse tool is automatically activated.

5. Position the target cursor at **one end** of the area that you want to measure and click.

6. Move the target cursor to the **other end** of the desired area, and click.

   The Terason software displays a green line and shows the circumference or area values at the top of the image.



Ellipse Measurement on an Image

If the measurement value does not show on your computer, select Setup > General > Measurement Value.

7. To adjust the other axis of an ellipse, press the **Select key** so that Axis is highlighted (above the softkey display), then use the trackball to adjust the width of the ellipse.
8. When the measurement is correct, press the **Left Enter key** to lock it in.

   You cannot change a measurement after locking it in. You can now make another measurement without deleting the measurements you've locked in.
9. To save the measurements, press the **Store Key.**

   The image is saved with all measurements.

Tracing Areas on the Image

The Terason software lets you measure an area by tracing the contour of any shape on an image. You can also use the Ellipse tool to measure an area (see Measuring Elliptical Circumference and Area on page 91 for instructions.)

You can use the trace tool to:

- Trace an irregular shape by sketching the outline
- Draw a polygon by clicking on corners of the shape

You can also combine these methods to trace an area on the image.

To trace an area on an image, complete the following steps:

1. If the image is live, press the **Freeze** key.

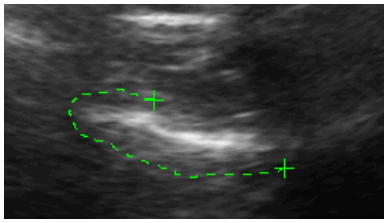
   The image freezes and the softkey controls change.
2. Press the **Caliper key**.
3. Use one of the following methods to select **the trace tool**:

- Press the **Caliper key** until Trace displays on the softkeys.
- Select **Area** from the Measurement menu.

4. To **trace an outline**:

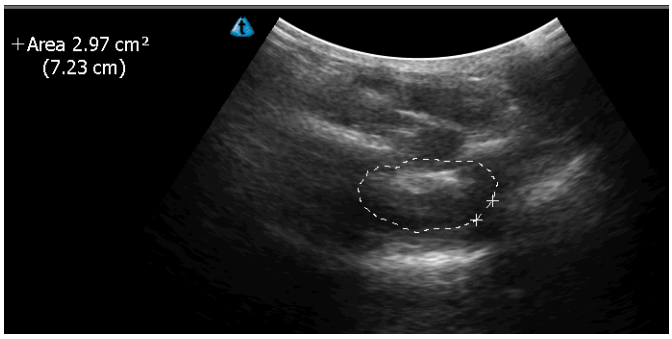
   a. Click where you want to **start** measuring.

   b. Use the **trackball** to drag the tracing cursor around the object you want to trace.



Tracing an Outline

   c. When your trace is nearly complete, press the **Left Enter key**, and the software completes the loop by drawing a straight line from the current cursor position to the starting point.



Trace Measurement on an Image

   When you press the Left Enter key, the trace turns white, and can no longer be edited. Before you click the Left Enter key, you can reverse the track of the cursor to delete parts of the trace.

5. To **edit the uncompleted trace**:

   a. Press the **Select key**, so that Erase is highlighted above the Softkey display.

   b. Use the **trackball** to erase the unwanted part of the trace, from most recent back toward the beginning.

   c. When all the unwanted parts of the trace are erased, press the **Select key** again, so that Draw is highlighted above the Softkey display.

   d. Use the **trackball** to finish the trace.

   e. Press the **Left Enter key** to complete the trace.

Split-Screen Measurements

When measuring in Split Screen mode (see Working With Split Screen Mode on page 53), all measurements are displayed in a single list, even if both screens contain measurements.

You can make a measurement on either screen or across both screens.

To make alternating measurements on split screens, you must Disable Return to live imaging:

1. Press the **Setup key**.
2. Click the **Display tab**.
3. Click **Return to live imaging on toggle active screen**, so that the box is not checked.
4. Click **OK**.

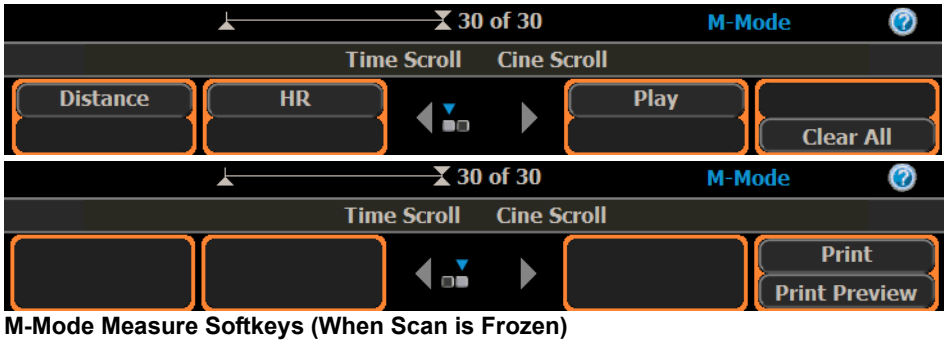
This allows you to make a measurement on one screen, switch to the other screen and make a measurement there, then return to the first screen and make additional measurements. If the box in the Setup/Display window is checked, returning to the first screen makes it live and erases all measurements on it.

To make a measurement across both screens:

1. Disable Return to live imaging, as described above.
2. **Freeze a scan** on one screen.
3. Press the **Toggle Screen** softkey.
4. **Freeze a scan** on the other screen.
5. Press the **Caliper key** repeatedly until the tool you need displays.
6. Click the **start point** of the measurement.
7. Click the **end point** of the measurement.
8. Press the **Left Enter key**.

Measuring in the M-Mode Window

When you freeze an M-mode scan, the Terason software displays softkeys and a Gain Knob menu for measuring, printing, and playing loops in M-mode.



M-Mode Measure Softkeys (When Scan is Frozen)

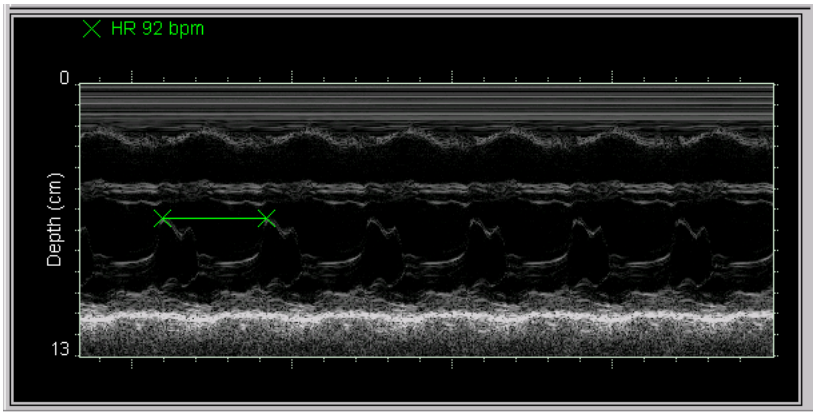
Making M-Mode Measurements

In the Time Series window of an M-Mode scan, you can measure:

- Heart rate (HR)
- Distance (includes time over distance [TD] and Slope values)

To measure in the M-Mode Time Series window, complete the following steps:

1. Press the **Freeze key**.
2. Press the **Caliper key** until the measurement type you need displays.
3. Click the target cursor where you want to **start** measuring.
4. Move the target cursor and click at the desired **end** location. The measurement displays at the top left of the Time Series window.

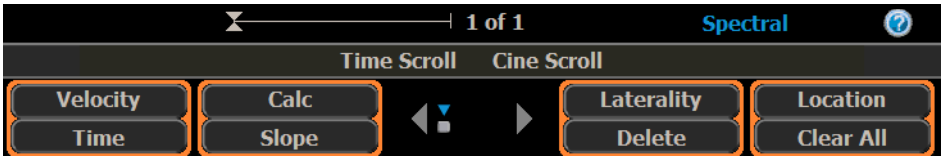


M-Mode Measurement

5. **Print and save** the image, if required.

Measuring in Spectral Doppler Modes

When you freeze a Pulsed-Wave Doppler or Triplex scan, the Terason software changes the softkeys to allow measurement, printing, and other functions.



PWD Measurement Softkeys

The Measurement section of the panel controls the following measurement operations:

- Velocity
- Time
- Slope
- Calc

You can use the CA (correction angle) softkey and the 0/+-60 softkey to adjust the angle on the frozen scan. This function works the same as the Correction Angle on the PWD tab as described in Adjusting the Correction Angle on page 77.

If you have added 2D measurements to the Spectral measurement set, you can perform 2D measurements in Spectral Doppler imaging screens.

To make 2D measurements on Spectral Doppler imaging screens, press the Calcs key. Any 2D measurements you have added to the Spectral measurement set appear in a Measurements menu at the top right corner of the imaging screen. See Measuring in the 2D Window on page 89 for instructions in making 2D measurements.

Measuring Cardiac Exams

You can make any of a number of cardiac measurements and then generate a report. The Terason software provides Cardiac measurements for the 2D Image Display window, the M-Mode Time Series window, and the PWD/CW Time Series window.

When you make a measurement in the 2D Image Display window, the value of the measurement displays at the top left of the window.

Intima Media Thickness (IMT)

IMT measurements are useful for diagnosing atherosclerosis, by measuring the thickness of an arterial inner wall.

To measure the carotid artery inner wall:

1. Connect a **linear probe** to the system.
2. In 2D mode, select the **Carotid preset.**
3. Scan the **carotid artery**.
4. **Freeze** the scan.
5. Press the **Calcs key**.

   The Measurements menu appears.
6. From the menu, select **IMT**.

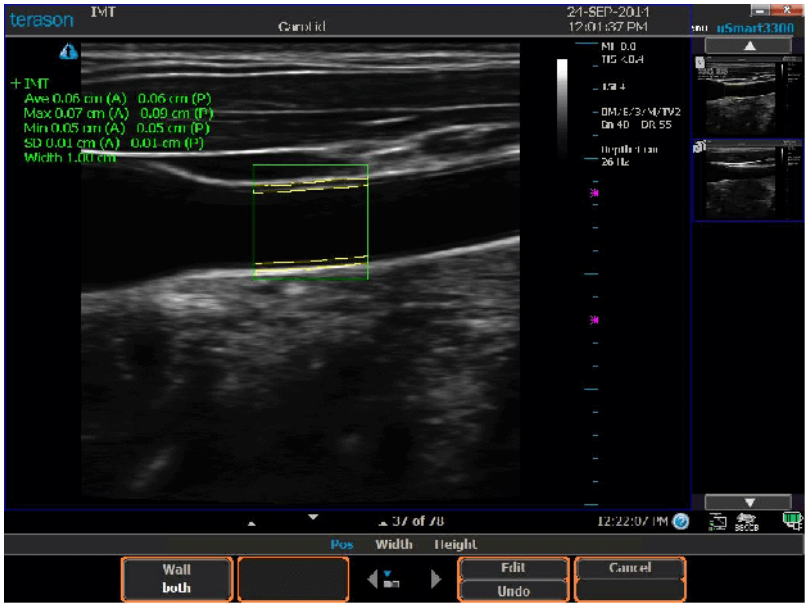
   A green square displays on the image.
7. Use the trackball to move the **green square** so that it covers both walls of the artery.

Note: For correct measurements, the green box must include both walls of the artery. It need not be closely sized, so long as both wall are included.

   If necessary, press the Select key to allow resizing the box using the trackball. Pressing the Select key once allows horizontal resizing; pressing twice allows vertical resizing. The width of the box displays at the top left of the Imaging window.

   If the display does not trace the inner walls of the artery correctly, press the Edit softkey, then click the proper location of the wall on the image.
8. Press the **Wall softkey** to select the anterior wall, the posterior wall, or both.

   The measurements display at the top left of the Imaging window.



IMT Measurement

Cardiac Measurement Groups

The Terason software includes default groups of commonly-used measurements that are available in the Measurements menu when an image is frozen. You can add or remove measurements from groups, and create or delete groups.

Available Cardiac Measurements

The following tables list the measurements that are available for the various scan modes.

Cardiac Measurements in the 2D Image Display Window

Measurement Group	Measurement	Definition	Tool Used
LV Volume	LVd Ap4C	Left ventricle area, apical 4 chamber in end-diastole	MOD Trace
	LVs Ap4C	Left ventricle area, apical 4 chamber in end-systolic	MOD Trace
	LVd Ap2C	Left ventricle area, apical 2 chamber in end-diastole	MOD Trace
	LVs Ap2C	Left ventricle area, apical 2 chamber in end-systolic	MOD Trace
LV Mass	LVAd SAX Epi	Left ventricle short-axis epicardial, in end-diastole	Trace
	LVAd SAX Endo	Left ventricle short-axis endocardial, in end-diastole	Trace
	LVAs SAX Endo	Left ventricle short-axis endocardial, in end-diastole	Trace
	LVLd	Left ventricle length in end-diastole	Caliper

Cardiac Measurements in the 2D Image Display Window (Continued)

Measurement Group	Measurement	Definition	Tool Used
Ventricle Dimensions	RVAWd	Right ventricle anterior wall thickness in end-diastole	Caliper
	RVIDd	Right ventricle internal dimension in end-diastole	Caliper
	IVSd	Interventricular septal thickness in end-diastole	Caliper
	LVIDd	Left ventricle internal dimension in end-diastole	Caliper
	RVAWs	Right ventricle anterior wall thickness in end-systolic	Caliper
	RVIDs	Right ventricle internal dimension in end-systolic	Caliper
	IVSs	Interventricular septal thickness in end-systolic	Caliper
	LVIDs	Left ventricle internal dimension in end-systolic	Caliper
	LVPWs	Left ventricle posterior wall thickness in end-systolic	Caliper
Valves and Atria	LVOT diam	Left ventricle outflow tract diameter	Caliper
	Ao Root diam	Aortic root diameter	Caliper
	RVOT diam	Right ventricle outflow tract diameter	Caliper
	PA diam	Pulmonary artery diameter	Caliper
	AV diam	Aortic valve diameter	Caliper
	AV area	Aortic valve area	Trace
	MV diam	Mitral valve diameter	Caliper
	MV area	Mitral valve area	Trace
	PV diam	Pulmonic valve diameter	Caliper
	TV diam	Tricuspid valve diameter	Caliper
	LA diam	Left atrium diameter	Caliper
	RA diam	Right atrium diameter	Caliper
Shunts	ASD Qp diam	Atrial septal defect pulmonic diameter	Caliper
	ASD Qs diam	Atrial septal defect systemic diameter	Caliper
	VSD Qp diam	Ventricular septal defect pulmonic diameter	Caliper
	VSD Qs diam	Ventricular septal defect systemic diameter	Caliper
	Gen Qp diam	Pulmonic diameter	Caliper
	Gen Qs diam	Systemic diameter	Caliper

Cardiac Measurements in the M-Mode Time Series Window

Measurement Group	Measurement	Definition	Tool Used
Ventricle Dimensions	RVAWd	Right ventricle anterior wall thickness in end-diastole	Depth Caliper
	RVAWs	Right ventricle anterior wall thickness in end-systole	Depth Caliper
	RVIDd	Right ventricle internal dimension in end-diastole	Depth Caliper
	RVIDs	Right ventricle inside diameter in end-systole	Depth Caliper
	LVPWd	Left ventricle posterior wall thickness in end-diastole	Depth Caliper
	LVPWs	Left ventricle posterior wall thickness in end-systole	Depth Caliper
	LVIDs	Left ventricle internal dimension in end-systole	Depth Caliper
	LVIDd	Left ventricle internal dimension in end-diastole	Depth Caliper
	IVSd	Interventricular septal thickness in end-diastole	Depth Caliper
	IVSs	Interventricular septal thickness in end-systole	Depth Caliper
Ao / LA	Ao Root Diameter	Aortic root diameter	Depth Caliper
	LA Diameter	Left atrium diameter	Depth Caliper
	MM R-R interval	M-Mode R-wave-to-R-wave interval	Time Caliper
Valves	AV R-R interval	Aortic valve R-wave-to-R-wave interval	Time Caliper
	AV Cusp	Aortic valve cusp separation	Depth Caliper
	MV D-E	Mitral valve D-to-E	Depth Caliper
	TV D-E	Tricuspid valve D-to-E	Depth Caliper
	MV E-F slope	Mitral valve E-to-F slope	Slope Caliper
	MV EPSS	Mitral valve E point septal separation	Depth Caliper
	MV excursion	Mitral valve excursion	Depth Caliper

Cardiac Measurements for PWD/CW Time Series Window

Measurement Group	Measurement	Definition	Tool Used
AV	AV Mean	Aortic valve mean velocity	Velocity Trace
	AV Peak	Aortic valve peak velocity	Velocity Point
	AV PHT	Aortic valve pressure half-time	Slope Caliper
	AV HR	Aortic valve heart rate	Heart Rate
	AI Peak	Aortic insufficiency peak velocity	Velocity Point
	LVOT Velocity	Left ventricle outflow tract mean velocity	Velocity Trace
	LVOT Peak	Left ventricle outflow tract peak velocity	

Cardiac Measurements for PWD/CW Time Series Window (Continued)

Measurement Group	Measurement	Definition	Tool Used
MV	MV Mean	Mitral valve mean velocity	Velocity Trace
	MV E Peak	Mitral valve E peak velocity	Velocity Point
	MV A Peak	Mitral valve A peak velocity	Velocity Point
	MV PHT	Mitral valve pressure half-time	Slope Caliper
	MV IVRT	Mitral valve isovolumetric relaxation time	Time Caliper
	MV HR	Mitral valve heart rate	Heart Rate
	MR Peak	Mitral regurgitation peak velocity	Velocity Point
	LVOT Mean	Left ventricle outflow tract mean velocity	Velocity Trace
	LV dp/dt[a]	Left ventricular contractility	Velocity Point
	PA Mean	Pulmonary artery mean velocity	Velocity Trace
PV	PV Mean	Pulmonic valve mean velocity	Velocity Trace
	PV Peak	Pulmonic valve peak velocity	Velocity Point
	PV HR	Pulmonic valve heart rate	Heart Rate
	PI Peak	Pulmonic insufficiency peak velocity	Velocity Point
TV	TV Mean	Tricuspid valve mean velocity	Velocity Trace
	TV E Peak	Tricuspid valve E peak velocity	Velocity Point
	TV A Peak	Tricuspid valve A peak velocity	Velocity Point
	TV PHT	Tricuspid valve pressure half-time	Slope Caliper
	TV HR	Tricuspid valve heart rate	Heart Rate
	TR Peak	Tricuspid regurgitation peak velocity	Velocity Point
	RV dp/dt[b]	Right ventricular contractility	Velocity Point
RVSP	TR Peak	Tricuspid regurgitation peak velocity	Velocity Point
	RA Pressure	Right atrium pressure	Entry
	VSD Peak	Ventricular septal defect peak velocity	Velocity Point
	Sys BP	Systolic blood pressure	Entry
ASD Shunt	ASD Qp TVI	Atrial septal defect pulmonic time-velocity integral	Velocity Trace
	ASD Qp HR	Atrial septal defect pulmonary heart rate	Heart Rate
	ASD Qs TVI	Atrial septal defect systemic time-velocity integral	Velocity Trace
	ASD Qs HR	Atrial septal defect systemic heart rate	Heart Rate
VSD Shunt	VSD Qp TVI	Ventricular septal defect pulmonary time-velocity integral	Velocity Trace
	VSD Qp HR	Ventricular septal defect pulmonary heart rate	Heart Rate
	VSD Qs TVI	Ventricular septal defect systemic time-velocity integral	Velocity Trace
	VSD Qs HR	Ventricular septal defect systemic heart rate	Heart Rate
General Shunt	Gen Qp TVI	Pulmonic time-velocity integral	Velocity Trace
	Gen Qp HR	Pulmonary heart rate	Heart Rate
	Gen Qs TVI	Systemic time-velocity integral	Velocity Trace
	Gen Qs HR	Systemic heart rate	Heart Rate

a. This calculation is available in CW mode. The Time-Series window must display a velocity range that includes -300 cm/s. Use the Scale softkey to achieve this.

b. This calculation is available in CW mode. The Time-Series window must display a velocity range that includes -200 cm/s. Use the Scale softkey to achieve this.

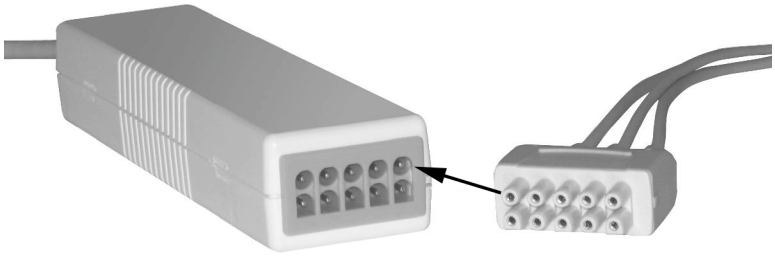
Stress Echo

The uSmart3300 system license level 7 includes tools for performing cardiac stress studies.

Connecting ECG

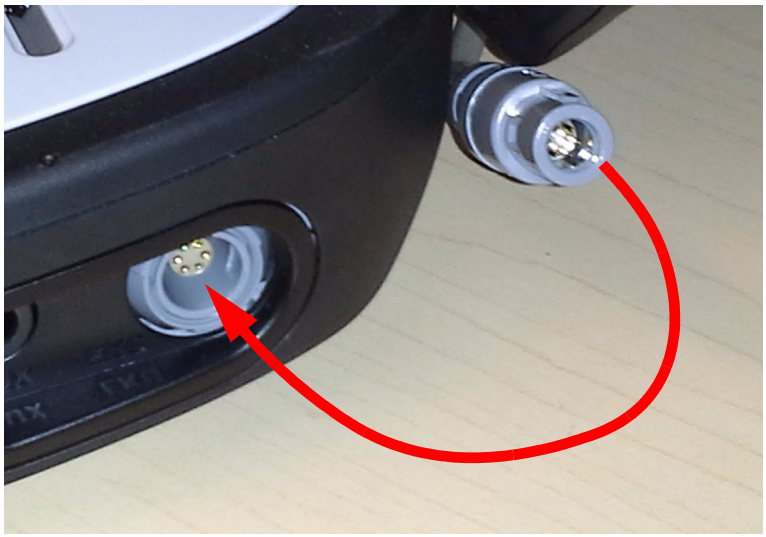
To connect ECG electrodes to the uSmart3300 ultrasound system:

1. Visually **inspect** the ECG connectors and cables. Do not use the ECG function if a connector or cable is damaged.
2. Couple the **connector** from the ECG 3-lead wireset to the ECG cable connector.



ECG Cable connectors

3. Connect the ECG cable to the **EKG port** on the right side of the ultrasound system.



ECG Cable Connection to uSmart3300

Connecting Leads to the Patient

In keeping with existing international standards, the ECG leads for systems that operate at 115V (for example, North and South America) are red, white, and black. They are labeled RA (right arm), LA (left arm), and LL (left leg). Leads for systems that operate at 230V (for example, Europe) are green, red, and yellow. They are labeled R (right arm), L (left arm), and F (left leg).

ECG Lead Color Coding

Patient Location	100V	115V	230V
Left leg	Green	Red	Green
Right arm	Red	White	Red
Left arm	Yellow	Black	Yellow

Note: Only use ECG leads that comply with the requirements of your country.

To connect the leads to the patient:

1. Attach the **ECG electrode patches** to the patient in the locations specified above.
2. Connect each **lead** to the appropriate patch.

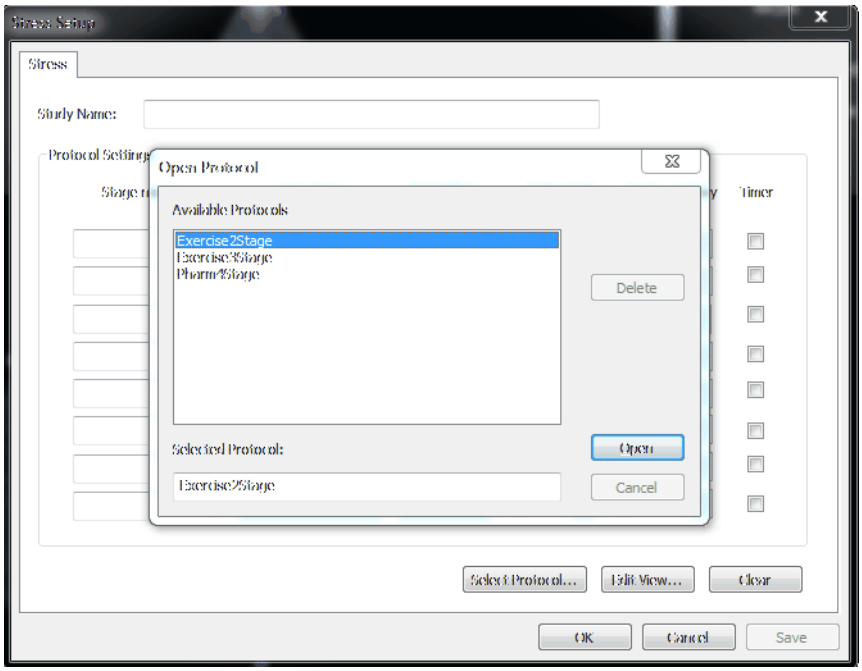
Performing a Stress Echo Study

To perform a stress echo study:

1. Connect an 8V3 or a 4V2A probe to the ultrasound system.
2. In the Setup/General window, make sure that the **ECG option** is checked.
3. Choose a **Cardiac exam**.
4. Select or create a **Patient Info** file for the patient.

   This enables the Stress key.
5. Press the **Stress key** in the top row of the keyboard.

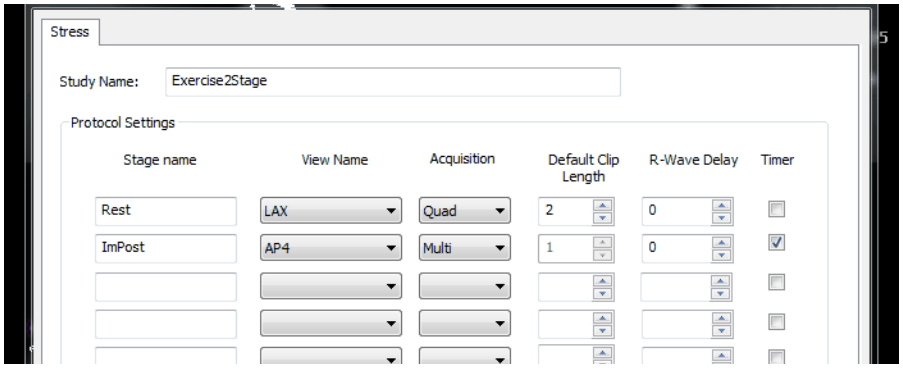
   The Open Protocol window opens in front of the Stress Setup window.



Open Protocol Window and Stress Setup Window

6. Click one of the protocols in the list to select it, then click **Open**.

   The Open Protocol window closes, and the Stress Setup window displays the default settings for the selected protocol.



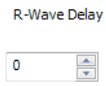
Stress Setup Window With Settings Loaded

The default acquisition type is Quad. This records four complete heart-cycle loops.

7. Add or edit **Stage names** by clicking the appropriate field and entering data with the keyboard.

8. Add or edit **View names** by clicking the appropriate field and entering data with the keyboard.

9. To advance or delay the **loop start** relative to the R-wave peak, click the R-Wave Delay up or down arrow.



R-Wave Delay Adjustment

- **0** (zero) starts the loops at the R-wave peak.
- Entering a positive number delays the loop start by the entered number of milliseconds after the R-wave peak.
- Entering a negative number advances the loop start by the entered number of milliseconds before the R-wave peak.

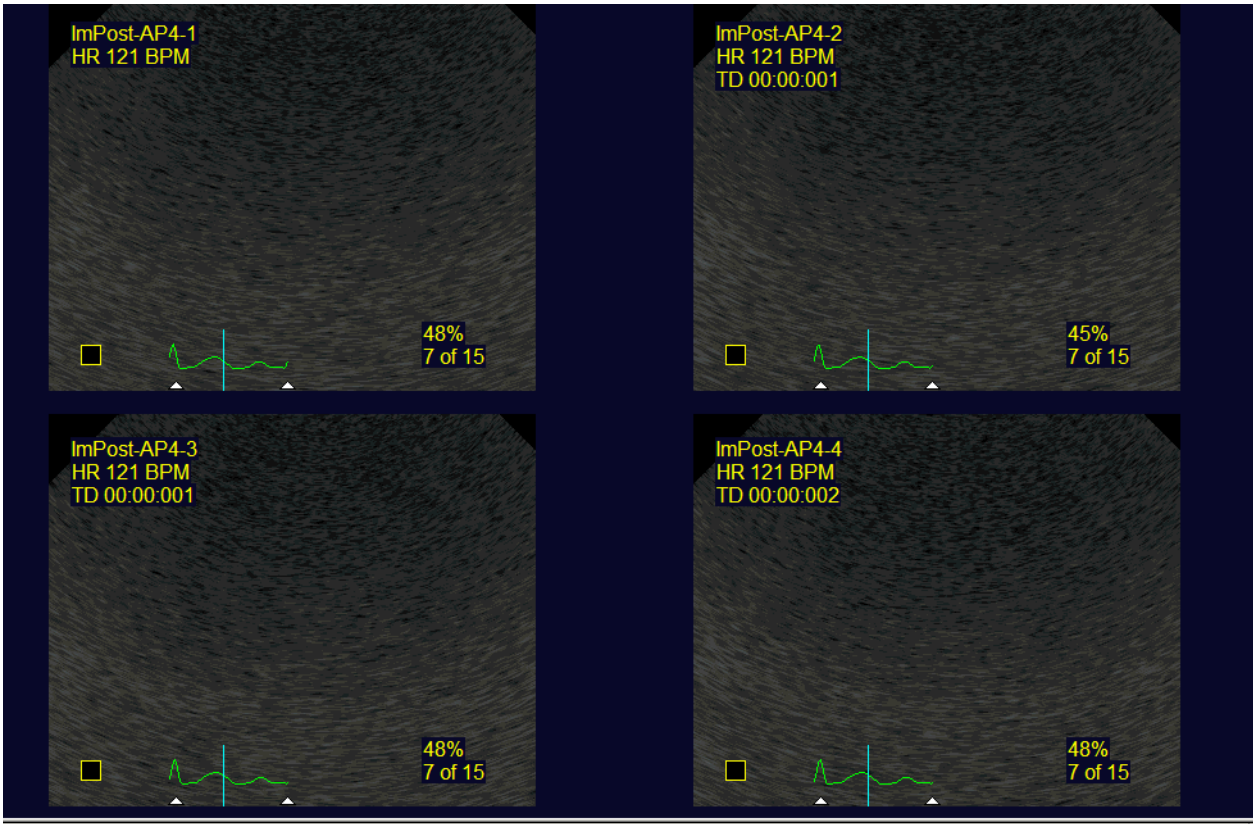
10. When the study settings are correct, click **OK**.

    The Stress Setup window closes.

11. Click inside the ROI rectangle (or select it with the console), drag it to the left ventricle, and press the **Enter key**.
12. Press the **Stage softkey** to choose either Rest or ImPost.
13. Press the **View softkey** to select a different view.
14. Press the **ECG Settings softkey** to open a menu for selecting the sweep speed, inverting the display, or turning beeps on or off.
15. Acquire the **Rest loops**.

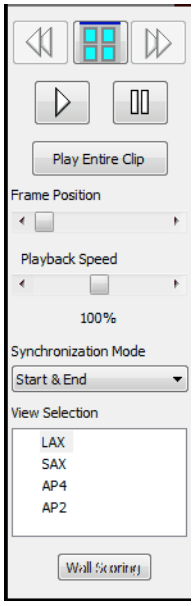
    a. Press the **Record key**.

    The software captures loops of the heart cycle and displays them in the Review screen.



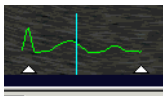
Heart Cycle Loops on Review Screen

b. Use the Review **control panel** to control the loop playback. (See Features of the Stress Echo Review Window on page 108.)



Review Controls

Note: You can change the systolic portion of the heart cycle by dragging the white triangles in the loop image. Only the portion of the cycle that is between the triangles is played.

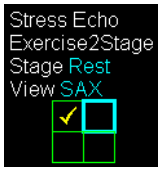


Loop Image

c. Select the loop for a particular view by clicking the **checkbox** ■ in that loop's pane of the Review window (see Heart Cycle Loops on Review Screen on page 104).

d. Press the **2D key** (or the Freeze key) to return to the scanning window.

The software advances the Acquire view indicator to the next view, and places a checkmark in the completed view's square in the indicator. Live thumbnail images of selected loops display in the column at the left of the scanning window.



Acquire View Indicator

e. Reposition the **probe** to scan another view.

f. Repeat **steps a through e** until all the Rest loops are selected.

g. Press the **2D key** to return to the scanning window.

The software advances to the Impost loop acquisition phase, and the Acquire view indicator displays empty squares.

16. Acquire the **Impost loops** (immediate post-exercise loops).

Note: The imaging settings chosen during the Rest portion of the study are automatically loaded during the Impost portion.

a. Press the **Record key**.

b. The software captures loops of the heart cycle and displays them in the Review screen.

c. Select the loop for a particular view by clicking the **checkbox** ■ in that loop's pane of the Review window.

d. Press the **2D** key to return to the scanning window.

The software advances the Acquire view indicator to the next view, and places a checkmark in the completed view's square in the indicator. Live thumbnail images of selected loops display in the column at the left of the scanning window.

e. Reposition the **probe** to scan another view.

f. Repeat **steps a through e** until all the Impost loops are selected.

17. To **change** the selected loops:

a. Use the Stage and View softkeys to **select the view** you want to choose a different loop for.

b. Press the **Record key**..

c. Click the **checkbox** in the pane of the Review window that includes the desired loop.

Selected images display in the Review window.

Closing a Stress Echo Study

To close a stress echo study, press the Close Study softkey.

Saving and Sending Studies

You can save the study with only the selected loops, or with all the acquired loops.

To save a study:

1. Open the **Review window**.
2. To save a study or selected loops from a study, use the **Save** or **Save Sel.** buttons on the toolbar. (See Stress Echo Review Window on page 108.)
3. To send all saved DICOM files or selected saved DICOM files to a DICOM storage server, use the **Send** or **Send Sel.** buttons on the toolbar. (See Stress Echo Review Window on page 108.)

Pausing and Resuming a Stress Study

You can pause a stress study by clicking the Pause/Resume softkey. When the study is paused, you can make other examinations and save them. Clicking the Pause/Resume softkey again resumes the stress study.

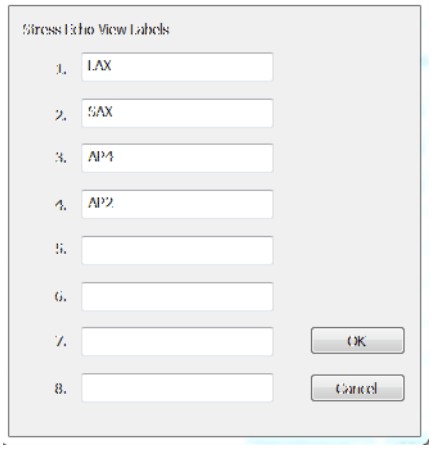
Editing Stress View Labels

You can edit the names of the stress views.

To edit the stress view labels:

1. In the Stress Setup window, click **Edit View...**

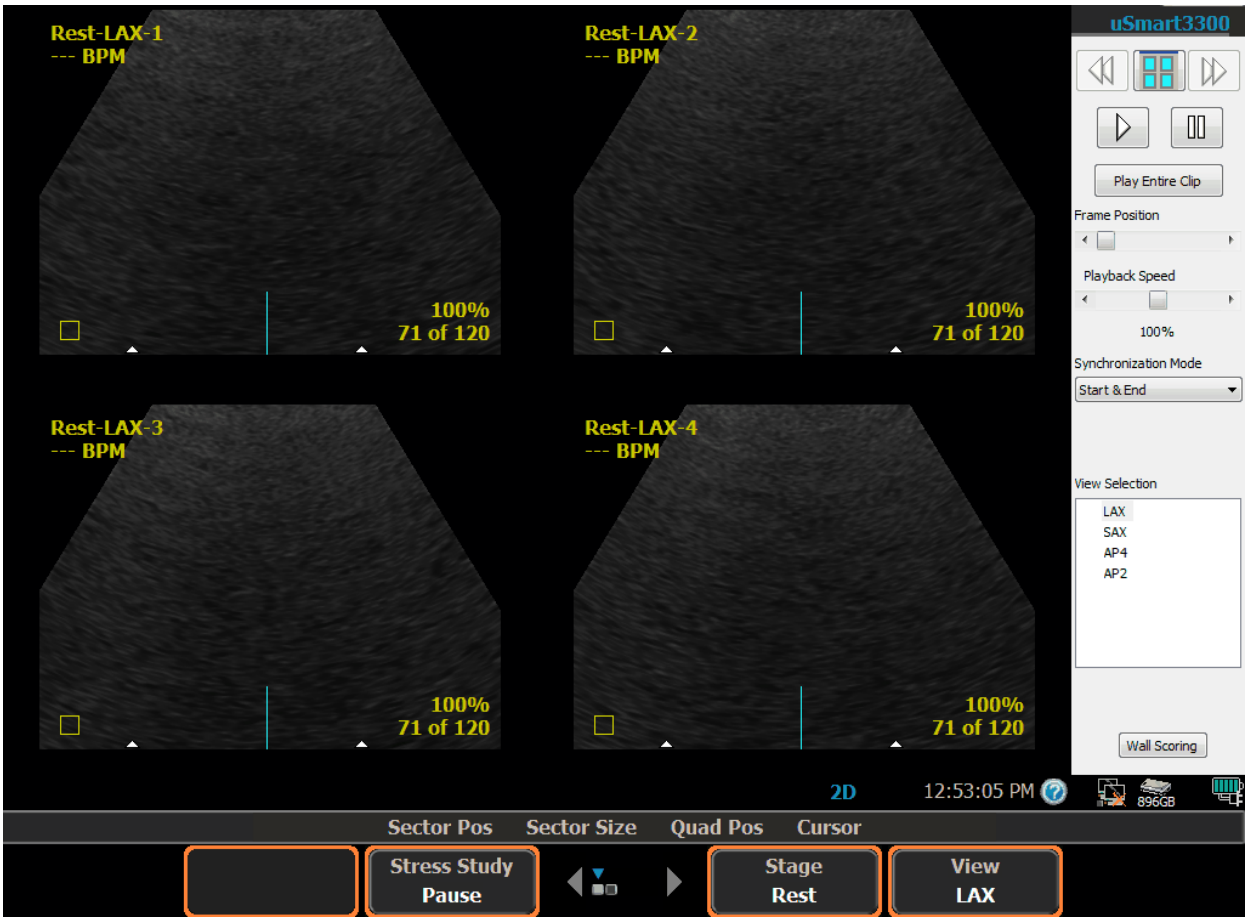
   The Edit View Labels window opens.



Edit View Labels Window

2. Select the label you want to rename, then enter a **new label**.
3. Click **OK**.

Features of the Stress Echo Review Window



Stress Echo Review Window

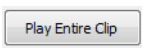
Playback Navigation Controls

Playback Navigation Controls

When more than four loops are displayed (so that a scroll bar appears), the double-arrow buttons move back and forth between groups of loops.

The windowpane button toggles between thumbnail view of all the loops in the study and selected loops, or when selecting, between the selection and the set of loops already selected.

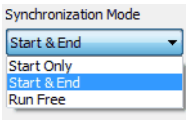
Play Entire Clip Button



Play Entire Clip Button

Clicking this button makes the playback ignore the playback-limit triangles in the loop windows. To show only a portion of a loop, set the playback-limit triangles, and make sure the Play Whole Clip button is not enabled.

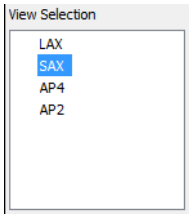
Synchronization Mode



Synchronization Mode Menu

This drop-down menu selects whether to synchronize the displayed loops as they play, and whether they all start together or end together. When they are synchronized, loops of different lengths will either start at the same time (and shorter loops will pause at their ends until longer loops finish), or end at the same time (and longer loops will start before shorter ones).

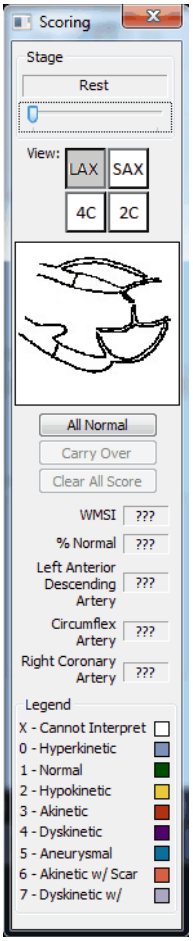
View Selection



View Selection Menu

This menu lets you view either individually selected loops, all the loops in a stage of the study, or all the loops in the study. Use this menu in conjunction with the playback navigation controls. The selection you make here determines what appears in the Stage Selection menu.

Wall Scoring Window



Wall Scoring Window

This window lets you characterize vessel walls for each stage of the exam. Clicking the All Normal button characterizez all the vessel walls as normal. Wall scoring is displayed in the study report.

To characterize a vessel wall:

1. Click the part of the **diagram in the Wall Scoring window** that corresponds to the wall you want to characterize.

   A list of abnormal condidtions appears.

2. Click the **condition** that applies.

   The selected part of the diagram changes color to correspond to the legend at the bottom of the Wall Scoring window, and the corresponding number is superimposed on the selected wall in the diagram.

3. Click the **View: grid** to display diagrams for characterizing vessels using other views.

Deleting Measurements

You can delete the most-recent measurement, or you can delete all measurements on the current image.

To delete the most recent measurement, press the Delete softkey.

To delete all measurements, press the Clear All softkey.

Restoring All Measurement Groups to Defaults

To restore all measurement groups to the defaults:

1. Press the **Setup key**.
2. Click the **Measurements** tab.
3. Click the **Configure Measurements...** button.
4. Click the **Restore** button.
5. Click **OK**.

6 Working With Exams

Choosing an exam loads optimized presets for many image control settings, based on the anatomy to be scanned, the probe used, and the scanning mode. The exam presets also specify the measurements appropriate for the exam. You can use these optimized presets as is, or you can adjust any of the image control settings as necessary for the specific patient and the specific exam.

You can create additional presets to store sets of image control settings for specific kinds of exams. Customized presets can minimize the number of settings you must change each time you perform a specific ultrasound exam.

To work with exams, you must understand:

About Exams and Presets

The Terason Ultrasound System provides predefined presets for all supported probes. Although several probe models may support the same exam types, the preset image control settings are unique to each probe model.

An exam includes predefined image control settings used for high, medium, and low frequencies. When you select a frequency range on the console, the Terason software loads other exam settings optimized for that frequency. When you select a different frequency, you need not reload the preset or load a different preset; the Terason software automatically updates the settings for the selected frequency.

The following table lists the image control settings that are preset for different modes.

Exam Presets Provided with Scan Modes

Mode	Image Control Settings		
2D	Frequency Depth Focus Left/Right invert Up/Down invert Colorization	Gain TGC Curve Sector Width Smoothing Persistence Map Needle guide (when supported)	Dynamic range Noise rejection

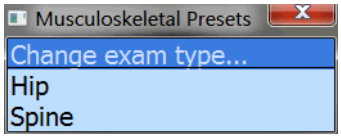
Exam Presets Provided with Scan Modes (Continued)

Mode	Image Control Settings		
M-Mode	Sweep Speed	Ultrasound cursor position	
PWD	Scale Sweep Speed Velocity display Wall filter	Invert Correction angle Sample volume size Gain Dynamic range	Noise Rejection Baseline Sound volume Update
CD	Scan area Scale Wall filter Color Invert	Color Gain Color Priority Color Persistence Color Baseline	Color Threshold Spatial Resolution and Frame Rate

Choosing a Preset

Terason provides customized exam presets for scanning different anatomies. When you choose a preset, the Terason software loads image controls settings that are customized for that anatomy, the chosen scanning mode, and the connected probe.

To select a preset, choose it from the Presets menu. Highlight the preset by clicking it, then press the Left Enter key. If you do not see a preset name that corresponds to the kind of study you want to perform, you can create a custom preset. See Creating Custom Presets on page 114.



Choosing an Exam

The software displays only those exams supported by the connected probe. If you created any custom exams, they show at the bottom of the Exam menu.

Opening an Exam

When you select an exam and preset, the Terason software loads the optimal scan settings for that preset, determined by the probe, the frequency, and the selected scan mode. If you select a different frequency or scan mode, the Terason software updates the scan settings.

You cannot open a preset when viewing a saved image.

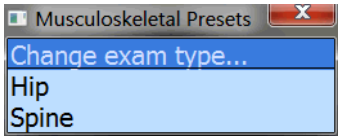
To choose an exam type:

1. Press the **Preset key**.
2. Click **Change exam type...**
3. Click an **exam** in the Exam Types menu to select it.

You must also choose a preset from the Presets menu for the selected Exam type.

To select a preset:

1. Press the **Preset key**.
2. Click a **preset** in the Presets menu to select it.



Example Presets Menu

Creating Custom Presets

In addition to using the provided exam presets, you can create custom presets. Custom presets include your own specific modifications to the preset image control settings. You can then load the custom preset and skip setting the image control parameters. You can customize any preset to include your specific control settings.

You cannot change the default settings for a system preset. However, you can edit the image control settings of a system preset, then save it with a different name.

Creating a New Preset

Before you start, make sure that the probe you want to use for the new preset is connected. (If a different probe is connected, see Switching Probes on page 46 for instructions.)

To create a preset or to modify an existing custom preset, complete these steps:

1. Select the **system preset** or custom preset that has settings close to the one you want to create. See Opening an Exam on page 113.
2. Modify the image control **settings** as required. See Working With Scan Modes on page 64 for instructions.
3. Press the **Preset key**.

   The software displays softkeys for saving the scan settings and for deleting custom exams.

Presets Softkeys

4. Press the **Save Settings** softkey.

   The Save Settings window opens. It contains a list of presets, with system presets at the top and custom presets at the bottom.

Save Settings Window

5. Type a name for the custom preset in the **Name:** field.

   The name can be up to 16 characters long. If you are modifying an existing custom preset, make sure that name is in the field.

6. Click **Save**.

   The Terason software saves the image control settings.

The new preset is now available for use whenever the current probe is connected to the computer. If you connect a different probe, this new preset is not available.

Deleting Custom Presets

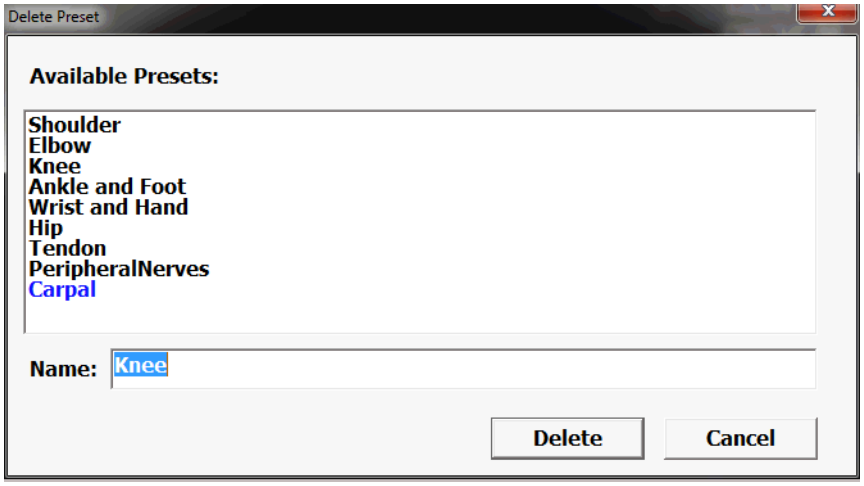
If you no longer want a particular preset, you can delete it. You can only delete custom presets; you cannot delete any of the system presets.

You cannot delete a currently-loaded preset. If the unwanted preset is loaded, select a different preset before you start this procedure.

To delete a preset, complete these steps:

1. Press the **Preset key**.
2. Press the **Delete** softkey.

   The Delete Preset window opens



Delete Preset Window

3. Click the preset that you want to delete from the list, and click **Delete**.

   The Terason software prompts you to confirm that you want to delete this preset.

4. Click **Yes** to confirm the deletion.

If you select the active preset, a message box opens to tell you that you cannot remove the current preset. If that happens, click OK, then open a different preset. Now you can delete the previous preset.

7 Working With Studies

The Terason software provides many tools for you to work with studies. These tools allow:

Storing Images and Loops

You can save acquired images either as individual image files, or as Cine loop files. To store images and loops, you must understand:

Images and loops are saved in the DICOM format and have a file extension of **.dcm**.

You can also copy the image in the 2D Image window by pressing the F4 key. This saves the image in the Windows clipboard, and you can paste the image into another application on your computer.

Monitoring Disk Space

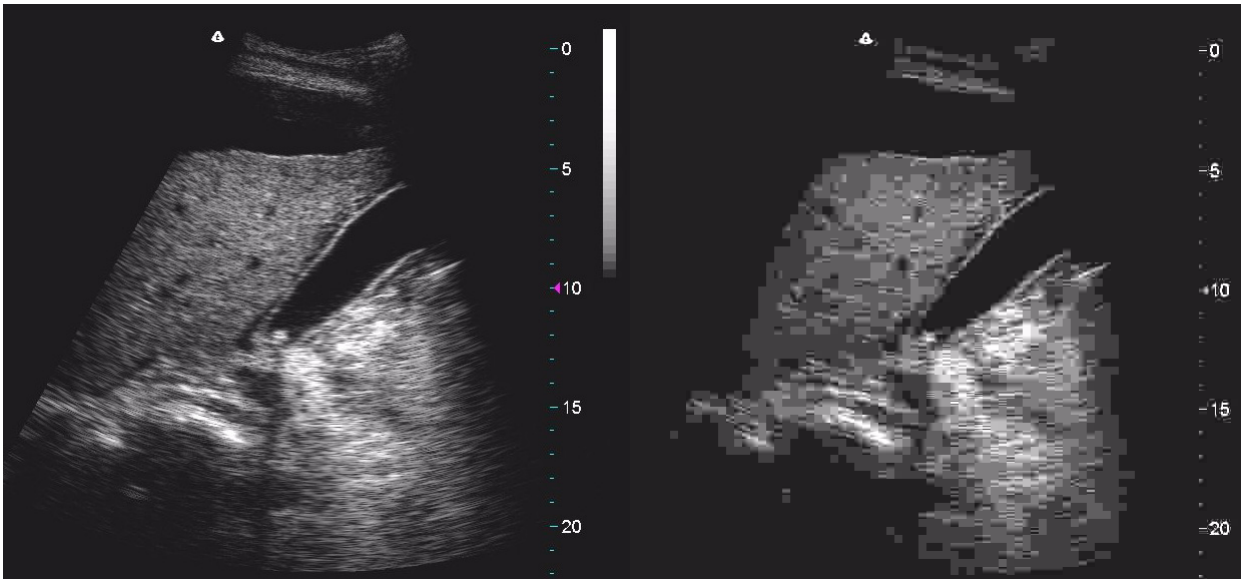
Be aware of the amount of free space on your C: drive (the default drive where the application is installed). If the hard drive is full, the system cannot save files.

Many factors, such as the scan mode and measurements or annotations, can contribute to the size of an image file. A single frame (a saved image) can range from 300 KB to 700 KB. An image loop can be from 2 MB to 18 MB.

The Imaging window includes an indicator showing free disk space, next to the DICOM Status indicator at the top of the screen.

Disk Free Space Indicator

When free disk space is less than 2 GB, the background of the indicator changes from gray to yellow. You can select a different level for this change on the Store/Acquire tab of the Setup window. If the free disk space becomes smaller than 1 GB, you should move files to a backup CD (see Exporting Studies on page 119) and delete them from the C: drive, or just delete unimportant files (see Deleting Studies and Images on page 126).



Scan Uncompressed (Left) and JPEG Compressed (Right)

The compressed scan shows squares throughout. If you see squares like these, or an occasional block, interpret them as JPEG artifacts.

Saving Images and Loops

Images and loops are saved to the Study directory, in the appropriate patient folder. If no patient is associated with a scan, no images or loops can be saved. All images and loops for a given patient saved on the same day are saved in the same study, unless the New Study button in the Patient window is clicked before a later image is saved. A single study cannot include images and loops saved on different days.

For Split Screen mode, you can save the Split Screen image (as a single frame showing both screens).

You can save the Split Screen image as a loop file. When you do, the Terason software saves the active screen as an image loop, and the other screen as a single frame.

To save an image or loop, complete these steps:

1. Press the **Freeze key** if viewing a live image.
2. To save an image, press the **Store key**.

   You can also save an image by pressing F8 on the computer keyboard.
3. To save an image loop, press the **Store key** when live imaging (not frozen).
4. To add the saved image or loop to the report for the current study, place the cursor on the image or loop, press the **Right Enter key,** and select Add to Report.

5. To delete an image or loop, place the cursor on the image or loop, press the **Right Enter key,** and select Delete.

If you did not load patient information for an exam, you cannot save images or loops.

You can view the saved studies as described in Finding Studies in the Patient Window on page 119.

If you open an image file and then save it again, the Terason software creates a new file; it does not overwrite the original file.

Viewing saved Images and Loops

When you save an image or loop, a thumbnail of it appears in the area at the right of the Imaging window. When more than 12 images or loops are included in the study, some will be hidden. To view them, click the scroll arrow at the bottom of the thumbnail area. To scroll back up, click the scroll arrow at the top of the thumbnail area.

To review a saved image or loop in the current study, double-click the thumbnail of the image or loop. It displays in the Imaging window.

Reviewing Patient Studies

You can find saved patient studies by using the Study List... button on the Patient window.

Finding Studies in the Patient Window

To find previously-saved studies in the Patient window:

1. Press the **Patient key**.
2. In the Patient window, click the **Study List... button**.

   The Study List window opens, displaying a list of saved studies.
3. The default is to show all the studies. To find studies done on a specific day or range of days, click the **Study Date** menu, and select Today, Last 7 days, Last 30 days, or In date range.

   If you click In date range, a box opens where you can select a range of dates to show studies from.
4. Find the desired **study** in the list, and click it to select it.
5. Press the **Review key**.

   The selected study loads in the Imaging window.

Exporting Studies

You can export studies, images to a CD, a DVD, a DICOM server, a USB drive, or another location on a network. When exporting a study, image, or loop, the system creates a uniquely-named subdirectory for each study, image, or loop.

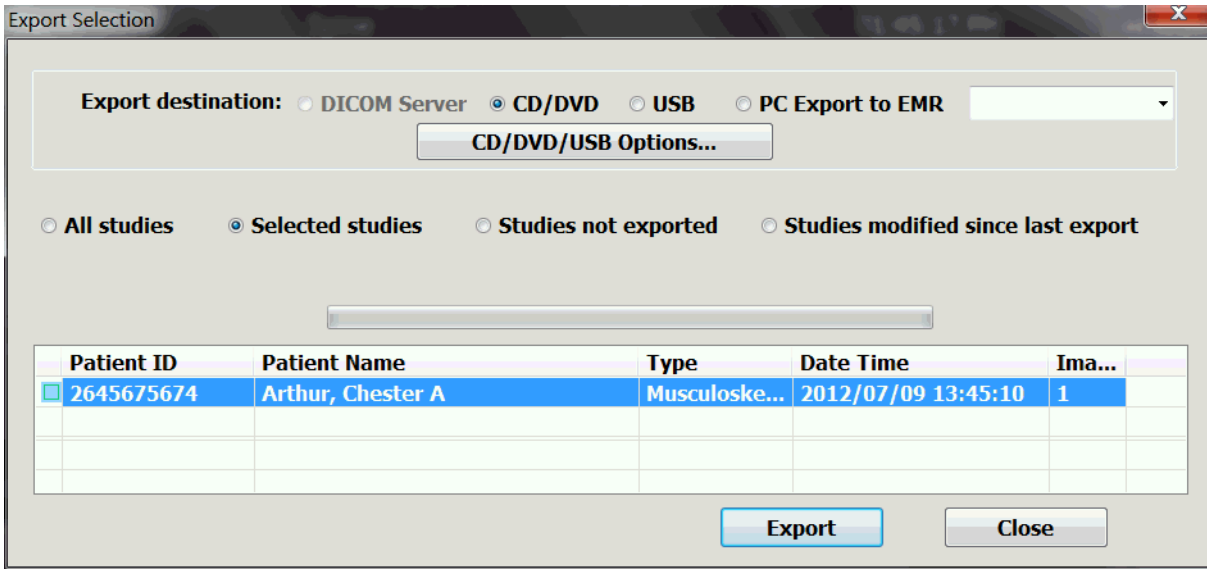
Study Exporting Procedure

To export a study, complete the following procedure:

1. **Save** the study. See Saving Images and Loops on page 118.
2. Press the **Patient key**.
3. On the Patient window, click the **Study List...** button.
4. On the Study List window, select the **study** you want to export

   To select multiple studies, hold down the Shift key while you click the first and last study you want to export. If that selects studies you do not want to export, hold down the Control key and click on the unwanted studies.
5. Click the **Export** button.

   The Export Selection window opens. A row of radio buttons lets you choose different parameters for selecting studies to export.



Export Selection Window

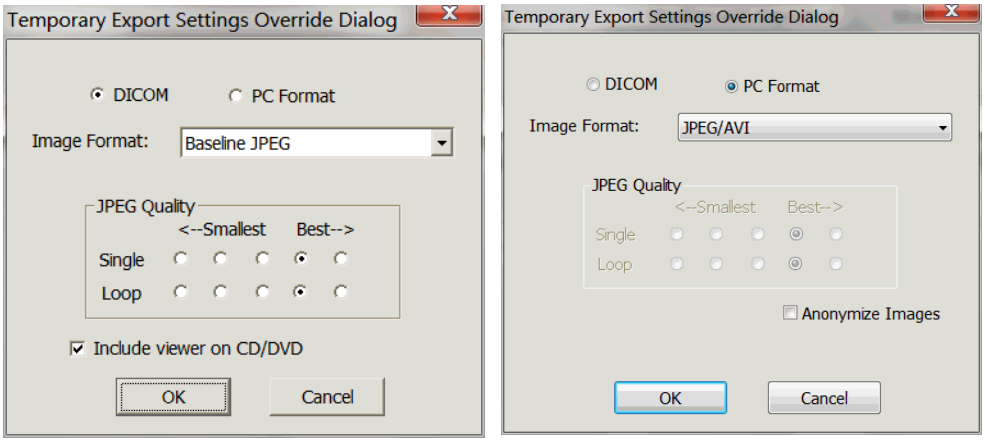
6. To **export to a CD or DVD**, configure the image format and other parameters.

   a. Click **CD/DVD**.

   The DICOM Server button changes to a CD/DVD/USB Options button.

   b. Click the **CD/DVD/USB Options button**.

   The Temporary Export Settings Override Dialog box opens.



Temporary Export Settings Override Dialog Box

c. To change the image format, choose a format from the **Image Format:** drop-down menu.

Note: If the PC Format radio button is selected, only the image is exported. None of the patient information is exported.
If the DICOM radio button is selected, the patient information is exported.

d. To change the JPEG quality, select a **radio button** in the JPEG Quality area.

e. To copy a DICOM image viewer onto the CD, select **Include viewer on CD/DVD** so the box is checked.

See Using the DICOM Image Viewer on a CD or DVD on page 144.

f. To **remove patient information** from a PC Format study, click Anonymize Images.

g. When the selections are correct, click **OK**.

7. To **export to a USB drive:**

a. Click **USB** on the Export Selection window.

b. Click the **CD/DVD/USB Options button**.

The Temporary Export Settings Dialog box opens. It has the same controls as the CD/DVD box (see step 6, above), except that it has no option for including a viewer on the target drive.

c. When the selections are correct, click **OK**.

8. To export to **an electronic medical records (EMR) location on a network**:

a. Click the **PC Export to EMR** radio button.

b. If no EMR destination is set as a default, or if you want to send to a different destination, select a destination from the drop-down menu.

For information on setting defaults for PC Export, see PC Export Options on page 159.

9. On the Export Selection window, click the **Export**. button.

The Select Path window opens.

10. On the Select Path window, navigate to the **target drive** and select it.
11. Click **OK**.

    The Terason software exports the image or loop to the target drive.

Exporting Studies Automatically

An option on the Setup/Export window (see Setup Export Window on page 158) enables exporting studies automatically to the designated default location when the Close Study or End Study button is pressed, or when a new patient is selected. To export automatically, the following conditions must be met:

- The destination must be either:
  - PACS, if one or more DICOM servers is configured for image or structured report exporting

  or

  - EMR, if no PACS DICOM server is configured and a default EMR PC Export location is set as the default
- The study must never have been exported or must be modified since a previous export. Studies exported to PACS are considered exported when the status is Pending, but not when the status is Failed.

Auto exports start automatically with the Export dialog displayed. The buttons on the dialog are disabled until the export is finished queuing for PACS or finished exporting to EMR. The Export dialog window closes automatically when the export is finished.

Export Status Indicator

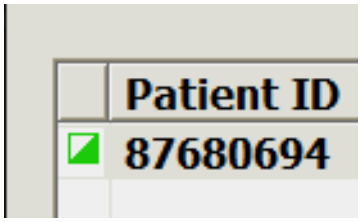
In the left column of the study list in the Export Selection window is a small box that indicates by its color whether the study has been exported. The upper left area of the box refers to exports to USB drives, CDs, and DVDs. The lower right area of the box refers to exports to a PACS system.

.The meanings of the colors are given in the following table.

Export Status Indicator color meanings

USB / CD / DVD	PACS
Blank: study not sent	Blank: study not sent
Green: study sent[a]	Green: study sent
	Yellow: send pending
	Red: sending failed
	Black: study has been modified since being sent (the file on PACS is not up to date)

a. During export to a USB drive or disc, the status indicator turns green. If writing to the target fails, the indicator goes back to blank.



Export Status Indicator

In the illustration above, the indicator shows that the study has been sent to a PACS system, and that it has not been exported to a USB drive, CD, or DVD.

Exporting Images and Loops

You can export an image onto the computer hard drive or an external drive, as a JPEG, BMP, or AVI format. You can also attach an image in one of those formats to an email message.

See:

- Selecting File Types for Export on page 123
- Exporting an Image in a PC Format on page 124
- Attaching an Image to an Email Message on page 125

Selecting File Types for Export

The Terason software allows you to export an image or loop to external media in any of these formats:

- AVI
- Bitmap
- DICOM
- JPEG

You can email image and loop files or include them as graphics in other applications.

If you save images using the JPEG format, be aware of the effects of data compression. By default, the Terason software uses a lossy JPEG compression algorithm. After compression, some of the image data is gone. When viewed, the compressed image may show artifacts caused by the JPEG compression. The artifacts may also show if you view the image on a medical viewing station that allows you to window and level the image.

The amount of compression on an image cannot be selected or predicted. One scan may compress at a ratio of 10:1, and another may compress at a ratio of 5:1. It is possible that medically-significant structures could be lost as a result of compression, regardless of the amount of compression. In addition, compression may result in artifacts appearing on the image.

To demonstrate what JPEG artifacts look like, the following example shows an uncompressed ultrasound image, and a JPEG compressed image of the same scan. The JPEG version was compressed at a ratio of 2500:1.

Exporting an Image in a PC Format

To export an image in a PC format:

1. Place the cursor on the image or loop in the thumbnail area at the right side of the Imaging window, and press the **Right Enter key**.

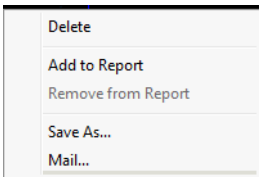
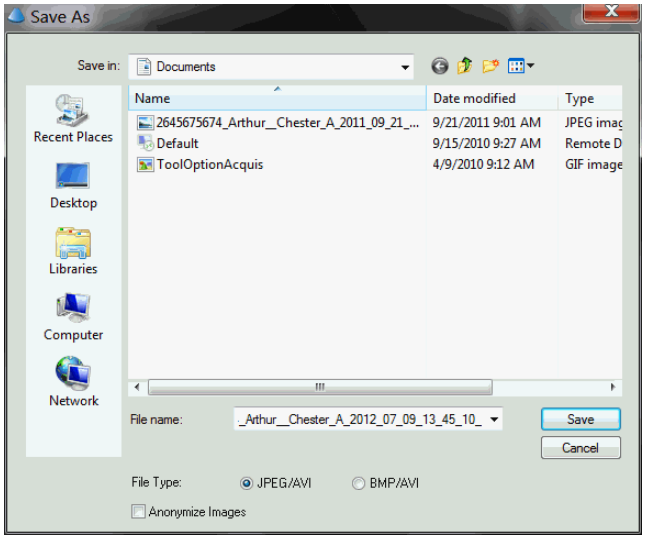


Image Context Menu

2. Select **Save As** from the Image Context menu.

   The Save As window opens.



Save As Window

3. To remove the patient identification from the file name, click **Anonymize Images** so that the box is checked.
4. Click the radio button for the **format** you want to export as, either JPEG/AVI or BMP/AVI.
5. If you clicked Anonymize Images, enter a **file name** for the image file in the File Name: field.
6. Click the arrowhead at the right-hand end of the **Save in:** field, and navigate to the directory you want to save the image file in.
7. Click **Save**.

   The system saves the image to the specified drive in the format you selected, in a new directory.

Attaching an Image to an Email Message

When you choose the Mail... option on the image context menu, you can attach the selected image to an email message.

Note: You must have an email program installed on the Terason Ultrasound System computer to use this feature.

To attach an image to an email message:

1. Place the cursor on the image or loop in the thumbnail area at the right side of the Imaging window, and press the **Right Enter key**.

   The Image Context menu appears.

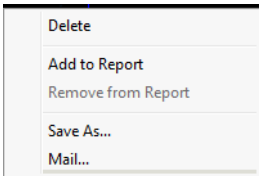


Image Context Menu

2. Click **Mail...**.

   The E-mail Options window opens.

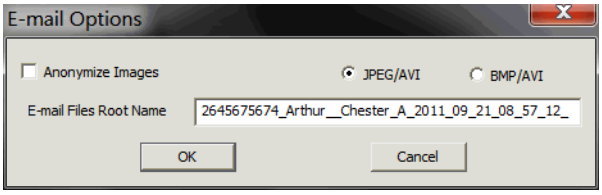


Image E-mail Options Window

3. Configure the **email options**.

   a. To remove the patient identification from the file name, click **Anonymize Images** so that the box is checked.

   b. Click the radio button for the **format** you want to export as, either JPEG/AVI or BMP/AVI.

   c. If you clicked Anonymize Images, enter a **file name** for the image file in the E-mail Files Root Name field.

   d. Click **OK**.

   The system launches the email program and opens a new email message with the image attached.

4. Enter the **recipient and title** of the email.
5. Add any desired **text** in the message area of the email.
6. Click **Send**.

Deleting Studies and Images

Terason recommends that you delete unnecessary studies and images to free up disk space.

Files are immediately and permanently removed from the system, and cannot be retrieved.

Deleting Studies Manually

Deleting a study also deletes its component images and loops. Deletion is permanent, and the images and loops cannot be retrieved.

To delete studies, complete these steps:

1. Press the **Patient key**.
2. Click the **Study List...** button.
3. If the study was not done today, click the **Study Date** menu, and select All Dates.
4. Click to **select the study** you want to delete.
   - To select **multiple consecutive studies**, hold down the Shift key, then click the first and last studies.
   - To select **multiple non-consecutive studies**, hold down the Control key, and click on each study you want to select.
5. Click the **Delete** button.

   A dialog asks you to confirm that you want to delete the files.
6. Click **Yes**.

   The study is permanently deleted, and cannot be retrieved.

Deleting Studies sAutomatically

You can configure the system to automatically delete studies that have been exported. See Auto Delete Exported Studies on page 156 to set up auto deletion.

Deleting Images

To delete images, complete these steps:

1. Place the cursor on the image or loop in the thumbnail area at the right side of the Imaging window, and press the **Right Enter key**.

   A menu appears.

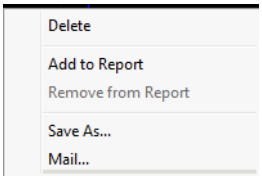


Image Context Menu

2. Click **Delete**.
3. In the confirmation dialog box, click **Yes**.

   The image is permanently deleted, and cannot be retrieved.

Printing Images

You can print any image file from the Terason system. If you print an image loop, the Terason software only prints the currently displayed frame.

Warning: Non-medical grade report printers cannot be used within a patient environment.

Warning: During use of a non-medical grade report printer or when a non-medical grade report printer is connected to the ultrasound system, the printer must be outside of the patient environment and the ultrasound system cannot in any way be in contact with a patient.

You can use any of the following methods to print images (described in more detail in the subsequent sections):

- Setting Up Printing; see page 127
- Printing the Displayed Image; see page 129
- Printing in Split Screen Mode; see page 129
- Printing Multiple Images; see page 130

Before printing, use Print Setup... on the Print tab of the Setup window to select a default printer and default print settings, such as page size and orientation.

Setting Up Printing

Before printing, you must connect the ultrasound system to a printer and select default print settings.

Connecting a Printer

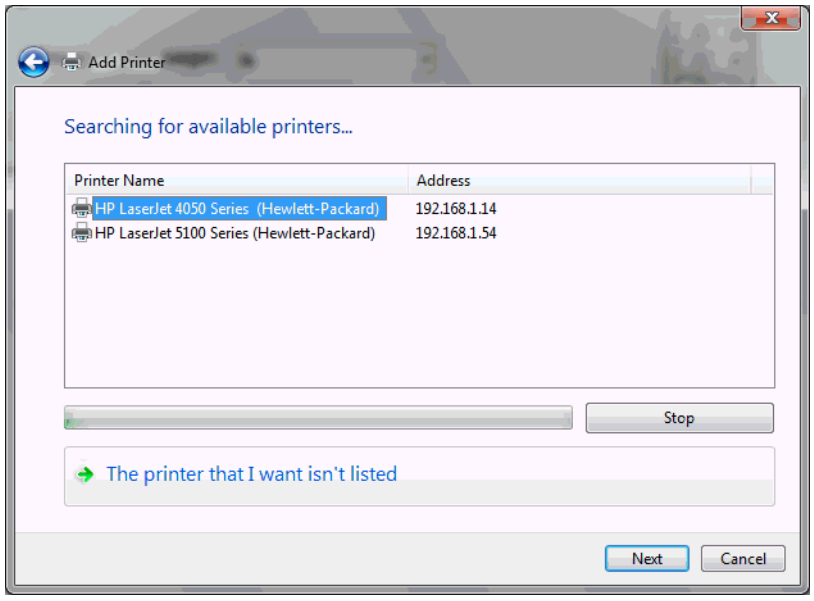
To physically connect a printer, use a USB cable connected to the printer and to a USB port on the side of the ultrasound system. Windows automatically recognizes the printer.

To connect a remote printer on a wired or wireless network, complete these steps:

1. Press the **Setup key**.
2. On the Setup window, click the **Print tab**.
3. Click **Add Printer...**.

   The Add Printer window opens asking whether you want to connect to a local (non-USB) printer or a network printer.
4. Click **Add a network, wireless or Bluetooth printer**.

The software begins searching for printers on all networks that the system is connected to.

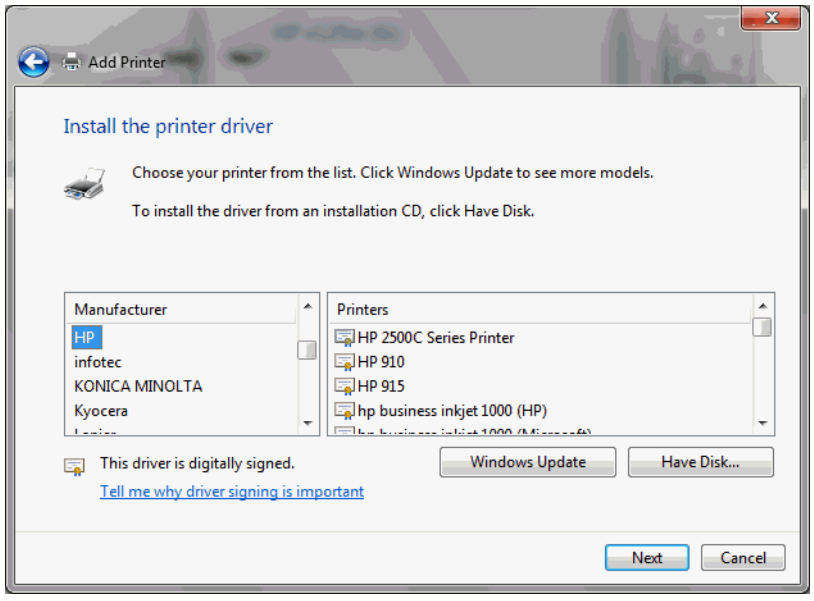


Add Printer Window

When it is done searching, the progress bar below the list turns completely green.

5. Click the name of the printer you want to connect to, then click **Next**.

   The Add Printer window changes, showing a list of printer manufacturers and a list of models.



Getting the Printer Driver

6. Click the **printer manufacturer name** in the left pane of the window.
7. Click the **model of printer** you want to connect to in the right pane of the window.
8. Click **Next**.

You may see a dialog box saying a driver is already installed, and asking if you want to use that driver or replace it.

9. Click **Next**.

   A confirmation message box opens.

10. Click **Next**.

    You may see a dialog box asking about sharing the printer.

11. Click **Next**.

12. Click **Print a test page** to verify that the connection to the printer is working.

13. Click **Finish**.

Configuring Printing

You must configure the printer defaults before printing. When you press a Print softkey, the image or images are sent to the printer using the defaults.

To configure the printer defaults, complete these steps:

1. Press the **Setup key**.
2. On the Setup window, click the **Print tab**.
3. Under **Layout**, select the number of images to print on a page.

   Multiple images print only from the Thumbnail window. In all other cases, only one image prints, on one page.

4. Click **Print Setup...** to configure setting such as Orientation (landscape or portrait), paper size, etc.

   The window that opens when you click Print Setup... is generated by the printer software, and is different for every printer.

Printing the Displayed Image

When viewing an image in the Imaging window, you can print the image. You must freeze live images before you can print them.

To print the displayed image:

1. If the image is not already frozen, press the **Freeze** key.
2. Press the **Print** softkey.

Printing in Split Screen Mode

When in Split Screen mode, the Terason software prints both screens.

To print a split-screen image:

1. Make sure that both screens are **frozen** and that you have added any necessary measurements or annotations.
2. Press the **Print softkey**.

The Terason software prints the Imaging window, including both screens.

Printing Multiple Images

You can print more than one image on a page. The images must be saved.

In Setup > Page > Layout, you can set a default number for printing when multiple images are selected. The available options are 1, 2, 4, 6, or 9 images to a page.

To print more than one image on a page, complete these steps:

1. Press the **Review key**
2. Press the **Thumbnail** softkey.
3. Select the **images** you want to print, by clicking them.
   - To select a **continuous sequence** of images, hold down the Shift key, then click the first and last image in the sequence.
   - To select a group of images that are **not a continuous sequence**, hold down the Control key and click each of the images you want to print.
4. Press the **Print** softkey.

   The selected images are sent to the default printer, and printed at the number per page previously selected in the Setup window.

8 Performing Medical Procedures

The Terason Ultrasound System can aid in performing medical procedures such as biopsies. Depending on whether you purchased the additional equipment required for these procedures, you may have to understand:

Equipment Description

To perform a biopsy, you need a probe, needle, needle guide kit, and bracket. The biopsy feature can be used with the following probes:

- 5C2A
- 15L4

Performing a Biopsy

When all of the preparatory steps are complete, and you have recently verified the alignment (see Verifying the Alignment on page 137), perform the biopsy on the patient. Note the following warnings that pertain to the biopsy procedure.

Warning: For each procedure, use a straight, new needle. Using a bent needle, or re-using a needle, can injure or infect the patient.

If the needle does not follow the expected path, discontinue the biopsy and contact a Terason representative.

The biopsy guide lines indicate only the expected path of the needle. Verify the actual needle position by identifying the echoes from the needle.

Note: If the needle strays outside of the guide lines, no warning displays.

Performing a biopsy requires that you understand:

- Assembling the Bracket and Guide on page 133
- Biopsy Procedure on page 134
- Needle Guides and Image Enhancement on page 134
- Verifying the Alignment on page 137

The Terason software displays guide lines for the specific probe, bracket, and needle gauge used in a biopsy or other medical procedure.

The needle guides work only in these modes:

- 2D
- Color Doppler mode

You cannot use the needle guides in:

- M-Mode
- Pulsed-Wave Doppler mode
- Triplex
- Zoom mode
- Split Screen mode

The Terason software freezes the Target Indicator when you freeze the image.

probe.

Needle Guide Kits

A needle guide kit contains several parts that fit together to attach the needle to the probe and provide a guide that directs the needle into the patient.

There are two types of needle guide kits, which are ordered directly from Civco (www.civco.com) or Protek (www.protekmedical.com):

- Starter needle guide kit
- Replacement needle guide kit

Starter and replacement needle guide kits contain only disposable parts that you need to perform a biopsy. You must use a new replacement needle guide kit each time you perform a biopsy. Needle guides used with the 5C2A and 15L4 probes are single-use disposables.

Different needle guide kits are required for each type of probe. The following table lists the Terason probes that can be used to perform biopsies, and lists the contents of the starter and replacement needle guide kits that must be ordered for each probe.

Terason Needle Kit Numbers

Model	Starter Kit Contents	Part #	Replacement Kit	Part #
5C2A	Protek starter kit • Disposable biopsy bracket • (2) 16 Ga biopsy kits • (2) 18 Ga biopsy kits • (2) 22 Ga biopsy kits • Guideline verification kit	7138 6138 4216 4218 4222 4200	16 Ga biopsy kit 18 Ga biopsy kits #4218 22 Ga biopsy kits Biopsy kits include disposable needle guide, probe cover and gel	4216 4218 4222

Terason Needle Kit Numbers (Continued)

Model	Starter Kit Contents	Part #	Replacement Kit	Part #
15L4	Civco disposable bracket and needle guide with sterile cover for In-plane Civco disposable bracket and needle guide with sterile cover for Transverse	612-085 683-002	Civco	610-579

Observe the following warnings with regard to the needle guide kits and their contents.

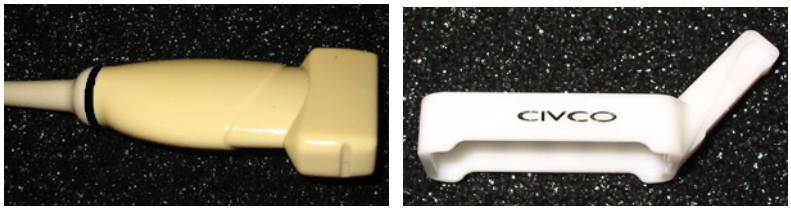
Warning: Do not attempt to use a needle guide kit until you have read the instructions for selecting the settings and verifying the alignment of the guide lines. Improper use of biopsy needles can cause injury to the patient.

If a needle guide kit is open when you receive it, or if it has been damaged or has condensation inside, do not use it. Contaminated medical equipment can cause patient infection.

Caution: Prevent heat damage to needle guides. Keep them below 50ºC (122ºF).

Warning: To eliminate the possibility of exposing patients, operators, or third parties to hazardous or infectious materials, always dispose of hazardous or infectious materials according to local, state, and regional regulations.

The following figure shows the correct bracket for the 15L4 probe:



15L4 Probe and Civco Bracket for Use With the 15L4

Assembling the Bracket and Guide

Each probe works with only one bracket. The manufacturer's instructions describe how to assemble the bracket for the 5C2A and 15L4 probes.

You can also follow the procedure provided in the biopsy kit to assemble the bracket and needle guide.

Before performing a biopsy, you must assemble the needle guide parts and prepare the probe for the biopsy by completing the following steps:

1. Place an appropriate amount of **gel** inside the cover or on the probe face. Poor imaging may result if no gel is used.
2. Insert the probe into the **cover**, making sure to use proper sterile technique. Pull the cover tightly over the probe face to remove wrinkles and air bubbles, taking care to avoid puncturing the cover.
3. Secure the cover with the **bands** packaged with the cover.
4. **Inspect** the cover to ensure there are no holes or tears.
5. Using proper sterile technique, snap the unlocked **needle guide** onto the attachment area of the bracket.
6. Push the **lock** into the locked position.
7. Select the appropriate size needle guide **insert** and slide it into position.
8. Use the appropriate length **needle** to reach the target area.

Biopsy Procedure

The Terason Ultrasound software provides two types of needle guides, which are used with different physical needle guides. A needle guide is only available when a probe that supports that guide is connected to the ultrasound system. If more than one needle guide is available for the connected probe, you must verify that the selected guide matches the hardware installed on the probe.

The in-plane guides work with the standard needle guide hardware. These guides are two parallel lines that indicate the path of the needle when the appropriate hardware is used. Use the procedure Using In-Plane Needle Guides on page 135.

The transverse guide is a circle that indicates the depth obtained when guide hardware that includes clips to set the angle and depth of insertion is used. Use the procedure Using Transverse Needle Guides on page 137.

To turn off the needle guides, press the lower Needle Guide softkey. If you were using the transverse needle guide, you may have to press the lower Needle Guide softkey several times.

Needle Guides and Image Enhancement

The Terason Ultrasound System offers onscreen needle guides, and with the 12L5A, 16L5, 15L4 and 15L4A probes, enhanced imaging of the needle. Refer to the following topics in this section:

Using Needle Image Enhancement

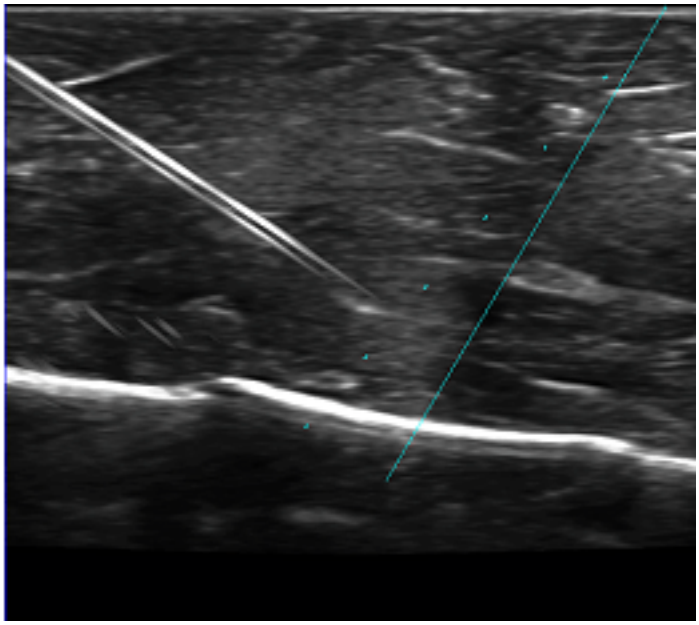
If your system is licensed for needle enhancement, the system brightens the needle image if all of the following conditions are met:

- 2D mode is selected
- A 12L5A, 16L5,15L4 or 15L4A probe is connected to the system
- A patient profile is selected
- The N key on the console is pressed

Pressing the N key displays a solid blue line and a diverging dotted blue line on the scanning window, which mark the limits of needle enhancement. If the point of the needle goes beyond these limits, the part of the needle image that is beyond the limit is not brightened. The dotted line applies to steeper needle insertions.

A softkey labeled Needle Lt/Rt toggles between lines angled from upper left to lower right and lines angled from upper right to lower left.

When needle enhancement is active, the legend ENV (for Enhanced Needle Visualization) appears in the scan information area at the right side of the imaging window.



Scanned Image With Needle Enhancement

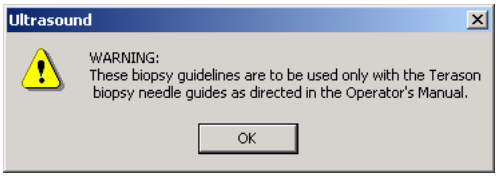
To activate needle image enhancement, press the N key on the console.

Using In-Plane Needle Guides

To perform a biopsy using the in-plane needle guides, complete these steps:

1. Start **live imaging**.
2. Press the **Needle Guide** softkey.

   The needle guide lines show in the Imaging window, along with a warning message.

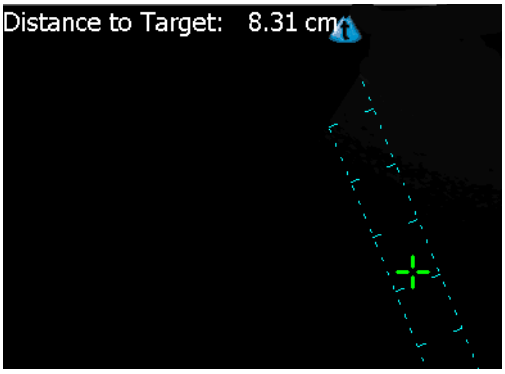


Biopsy Warning

WARNING: These biopsy guidelines should only be used with the Terason biopsy needle guides, as directed in the Operator's Manual.

3. Click **OK**.

   The warning closes and the Terason software displays the needle guides and target indicator. The guide lines show you where the needle should be inserted into the patient. The green target indicator can be moved within the guidelines to the exact location of the biopsy target. The Distance to Target: value then shows exactly how deep the needle must be inserted to reach that target.



Needle Guides and Target Indicator

The large tick marks on the guide lines are at 1 cm intervals, and the distance between the guide lines is fixed at 1 cm.

4. If the green Target Indicator does not show within the guides, press the **Target softkey**.

   The Terason software adds the "Distance to Target" value at the top of the image.

Warning: If the message "Uncalibrated" displays next to the "Distance to Target" text, the probe may be uncalibrated, or your calibration file may be missing or corrupted. Uncalibrated probes can apply harmful levels of energy to the patient. Contact your Terason representative.

5. Use the **trackball** to move the target indicator to the correct depth.

   You cannot move the target outside of the guide lines.

6. Follow the **proper medical protocol** to complete the biopsy.

The target distance is measured in centimeters and is calculated as the distance from the bottom of the clip to the patients' skin (as indicated by the top of the needle guide lines) plus the distance from the skin line to the target as indicated by the location of the green target indicator.

When you insert the needle, it should be located near the center of the guidelines. If the needle appears outside of the lines, verify that you have selected the appropriate needle guide. If you have, stop the procedure immediately and contact a Terason representative.

Using Transverse Needle Guides

To perform a biopsy using the transverse needle guides, complete these steps:

1. Start **live imaging**.
2. Press the **Needle Guide softkey**.

   The needle guide lines show in the Imaging window, along with the warning message. (See Biopsy Warning on page 136.)

   WARNING: These biopsy guidelines should only be used with the Terason biopsy needle guides, as directed in the Operator's Manual.
3. Click **OK**.
4. Press the **Guide Type softkey.**

   A transverse needle guide circle replaces the in-plane needle guides on the Imaging window, and the Needle Guide softkey displays the identification of the guide.

Transverse Needle Guide and Softkey

5. If the guide is not the correct one for the clip you have attached to the hardware guide, press the **Guide Type softkey** until the correct guide displays.
6. Follow the **proper medical protocol** to complete the biopsy.

Verifying the Alignment

To ensure that the probe and biopsy attachment are accurately aligned, and that the needle path is within the stated specification, Terason strongly recommends that you periodically conduct a simulation test. To conduct this test, you must have an assembled biopsy bracket, needle guide, and a water tank.

Use 2D to verify the alignment, and do not use the Zoom tool. The needle guides do not show in zoomed displays.

To verify the alignment of the probe and biopsy attachment, complete these steps:

1. If the needle guides are not visible, press the **Needle Guide** softkey. The biopsy guides appear in the Imaging window.
2. Press the **Guide Type** softkey to select the needle guide to use for the test.

   There may be only one guide available for the installed probe.
3. Assemble the **bracket, needle guide clip, and gauge insert pin** as described in Assembling the Bracket and Guide on page 133
4. Insert the needle into the **gauge insert pin**.
5. Place the needle in a **water tank**, ensuring that you do not touch the side or bottom of the water tank (which can bend the needle and produce an inaccurate reading).
6. Verify that the **needle** appears clearly between the two guidelines.
7. Remove the **needle** from the biopsy bracket and safely dispose of the needle.
8. Detach the **biopsy bracket** from the probe.

Calibrating Needle Guide Positioning for Biopsies

The Terason software lets you make small adjustments to the positioning of the needle guides (used in biopsies) and the insertion grid (used for cryoablation or brachytherapy).

When you receive needle guides, they are already configured and tested for angle and depth. The angle is the number of degrees between the X-axis and the Y-axis (the needle axis). The depth, shown in millimeters, is the point at which the biopsy needle and guide lines intersect the vertical center line of the 2D image.

You can make marginal changes to the upper and lower limits for angle and depth on the Needle Guide Error Correction dialog box. Your changes to these settings are visible in the needle guidelines, and are saved by the system and used for all biopsies until you change them again.

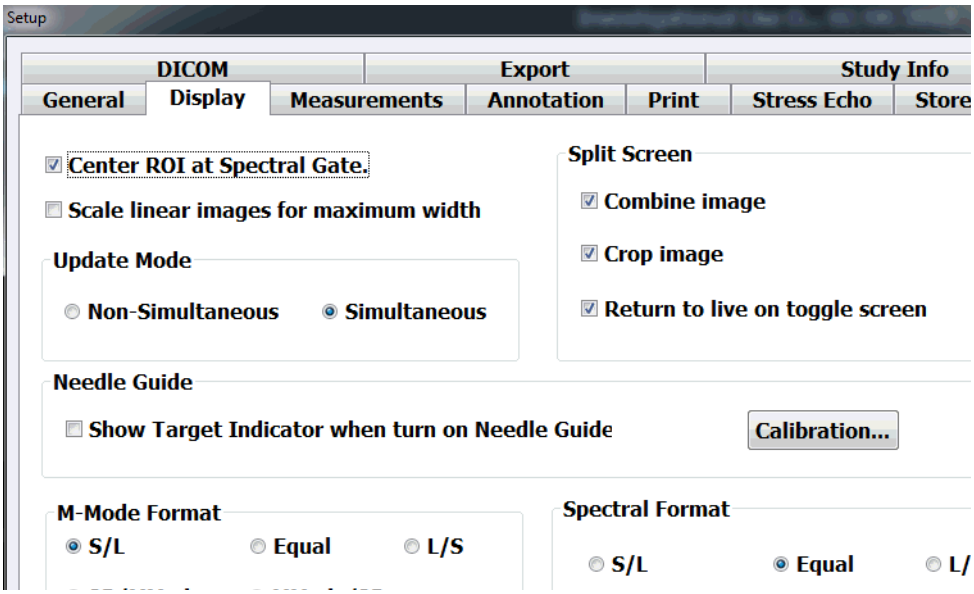
You can change the value within these ranges:

- Angle: –2° to 2°
- Depth: –1 mm to 1 mm

To change the needle guide error correction values for any probe except the biplanar probe, complete these steps:

1. Press the **Setup key**.
2. Click the **Display** tab.

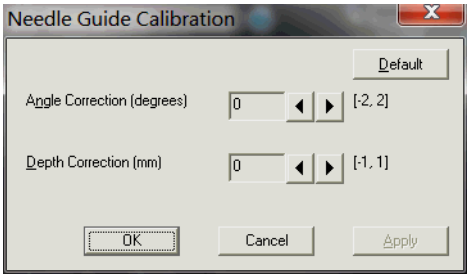
   The Setup Display window opens.



Setup Display Window

3. In the Needle Guide section, click the **Calibration...** button.

   The Needle Guide Calibration dialog box opens.



Needle Guide Calibration Dialog Box

   You can click the **Apply** button to see the effects of your choices without closing the dialog box. click the **Default** button to reset the values to the factory-set values.

4. Next to the **Angle Correction** field, click the left and right arrows to correct the angle by one or two degrees.
5. Next to the **Depth Correction** field, click the left and right arrows to correct the depth by plus or minus one millimeter.
6. Click **OK** to save your entries and close the dialog box.

Cleaning Probes and Disposing of Brackets

The probe must be cleaned and high-level disinfected between patients. For instructions, refer to “Processing Terason Probes Between Uses” in Volume 2 of the *User Guide*.

Needle guides used with the 5C2A and 15L4 probes are single-use disposables. See the manufacturer instructions included in the guide package for disposal procedures.

9 Working With DICOM

DICOM (Digital Imaging and Communications in Medicine) is a format created by NEMA (National Electrical Manufacturers Association) to aid in the distribution and viewing of medical images such as ultrasound scans.

If you have the DICOM option installed on your Terason Ultrasound System, you can:

- Send studies to a DICOM server where they can be used by other applications that support DICOM files
- Use DICOM Worklist to search the archive of patient studies on the DICOM server, and copy patient info sets to the Terason Ultrasound system so that exams on the system are identified with the correct patients.

Before you can use the Terason DICOM option, you must purchase and configure the DICOM option. If the DICOM option is not installed, the DICOM menu items are not accessible.

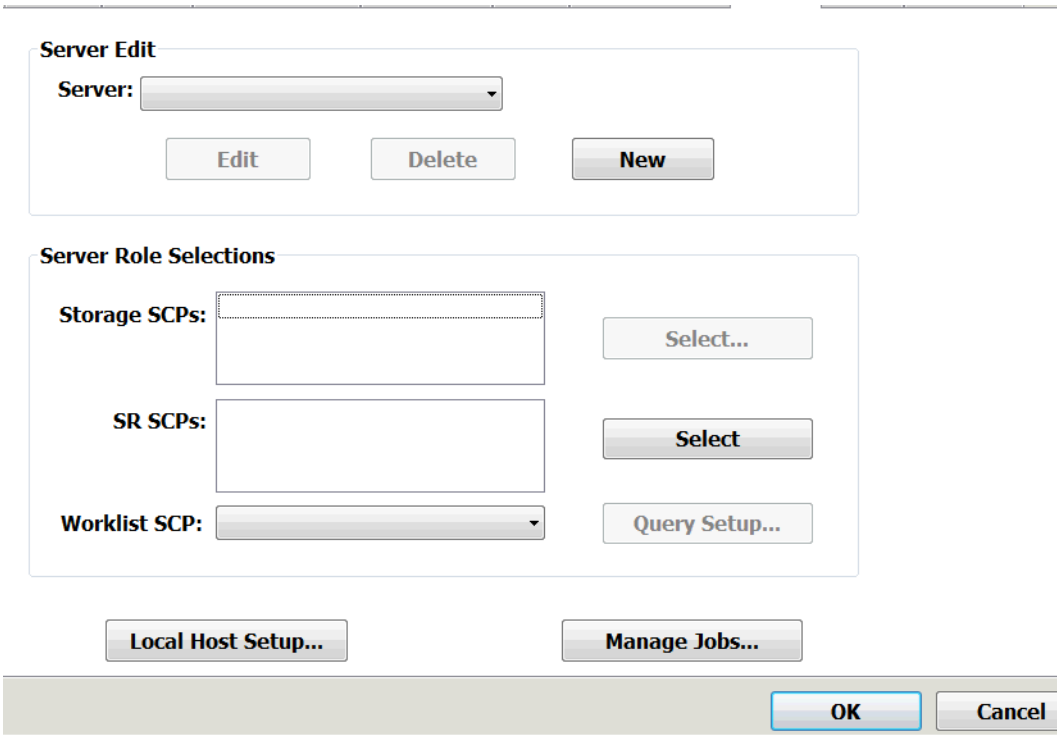
Configuring the DICOM Option

Your facility's DICOM Administrator has the information required to configure the DICOM option. Either obtain the information from the administrator, or ask the administrator to do the configuration.

To configure the DICOM utility, complete these steps:

1. Press the **Setup key**.
2. Click the **DICOM** tab.

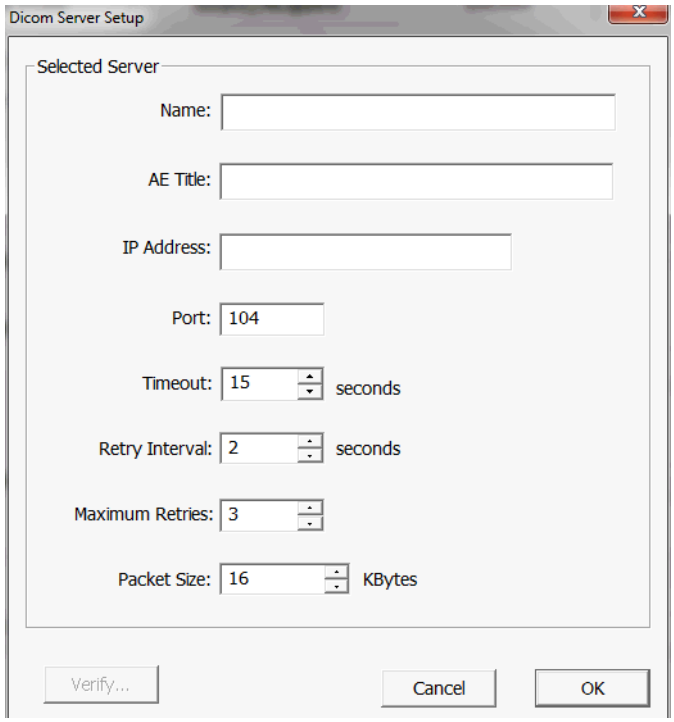
   The Setup DICOM window opens.



Setup DICOM Window

3. Click the **New** button in the Server Edit section.

   The DICOM Server Setup window opens.



DICOM Server Setup Window

4. Enter the **server name, AE title, and IP address** in the appropriate fields.

5. Make any required **changes** to the other fields.
6. Click **Verify...**.

   The software tests the connection to the DICOM server. If the connection is good, a message box that says Connect Valid appears
7. Click **OK** in the message box.
8. Click **OK** in the DICOM Server Setup window.
9. Enter any **Storage SCPs** in that field.
10. Enter the **DICOM Worklist SCP** in that field.
11. Click **OK**.

To see the ultrasound system's Host Name, AE title, SCP IP address, or SCP port, click Local Host Setup... on the Setup DICOM window.

Using Studies with a DICOM Server

When you send a study to a DICOM server, the Terason software saves the study in a temporary location on your computer. The studies are then sent to the server. To configure the system for sending to DICOM servers, see Setting DICOM Defaults on page 167.

To view log messages about studies exported to a DICOM server, open the DICOM utility (select Start > Programs > TerasonDICOM >Terason) and click the Communications Log tab.

DICOM Structured Reporting

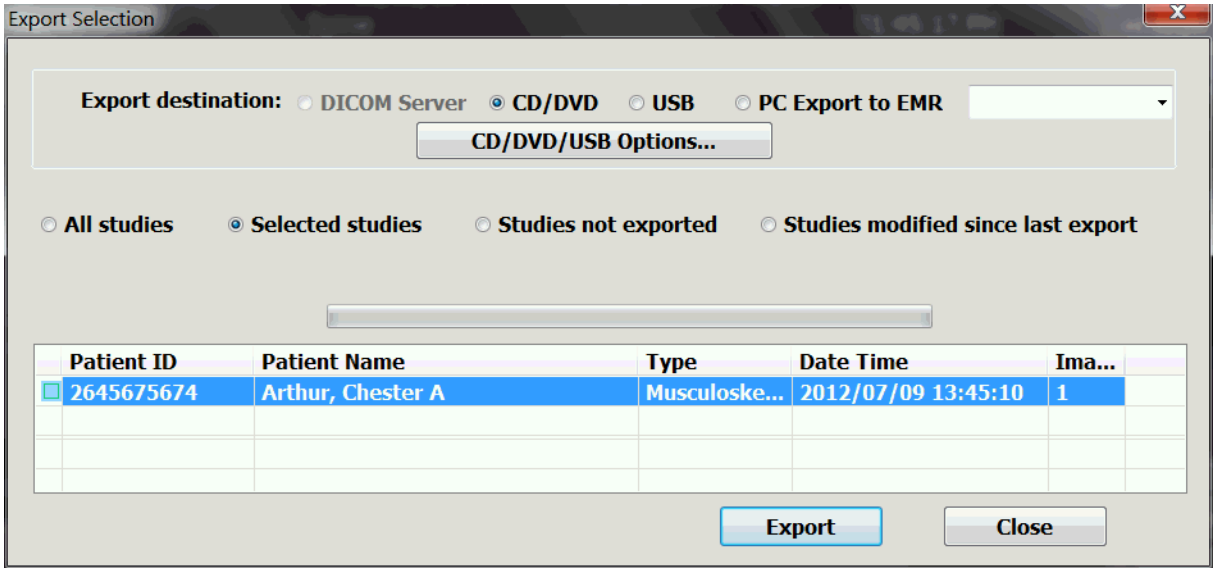
Structured reports include a study's measurements and calculations. The Terason uSmart3300 supports structured reports for vascular and adult echocardiac studies. If the system is configured to send reports to DICOM SR SCPs (structured-reporting service class providers; see DICOM Server Export Options on page 159), exported vascular and echocardiac studies are sent to those SCPs. Multiple SCPs can be designated recipients for exported reports, and all such SCPs will receive any exported reports.

Sending Studies to a DICOM Server

To send a study to a DICOM server, complete these steps:

1. Load the **study** (if it was previously saved) or obtain and save a new scan.
2. Press the **Export** softkey.

   The Export Selection window opens.



Export Selection Window

3. In the Export destination: section, make sure the **DICOM Server** radio button is selected.
4. Click the **name of the study** you want to send.
5. Click **Export**.

   The Terason application sends the study to the configured DICOM server.

Study Status Indicator

In the Study List and Export Selection windows, the color of a small square to the left of the Patient ID for each study indicates the status of that study:

- An **empty** square indicates that no export of that study was attempted.
- A **yellow** square indicates that export of the study is pending.
- A **black** square indicates that the study was modified after it was sent to the DICOM server.
- A **red** square indicates that export of the study failed.

DICOM Status Indicator

The DICOM option starts when the computer is powered on, and an icon is added to the Status bar. The icon color indicates one of three conditions:

- **Green** indicates that the system is connected to the DICOM server, and that any studies sent to the server have reached it successfully.
- **Red** indicates that the system is not connected to the DICOM server.
- **Yellow** indicates that there has been a failure sending to the DICOM server.

To identify the failure that caused a yellow indicator, complete these steps:

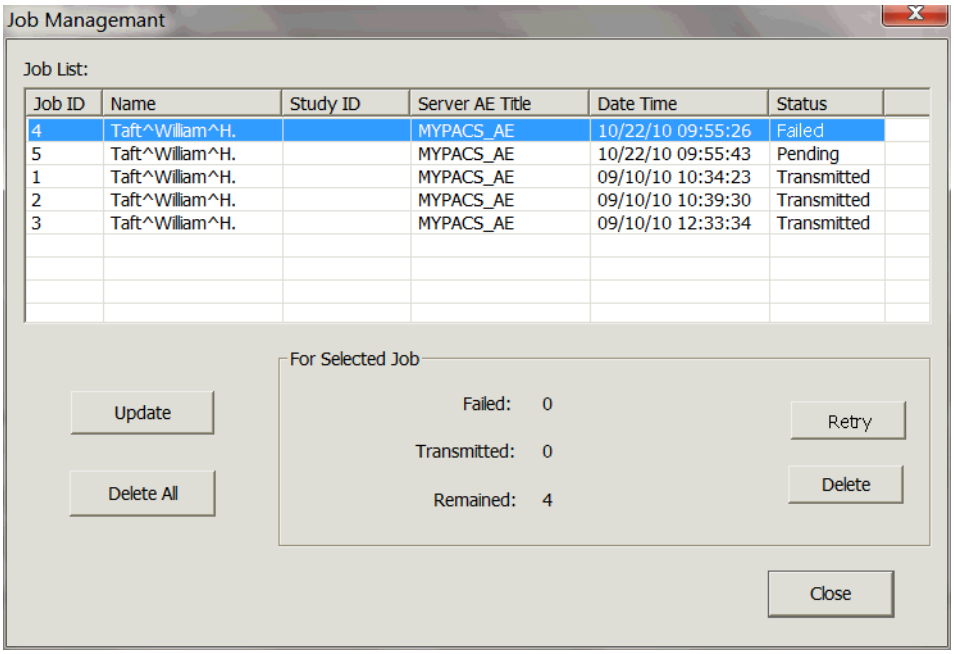
1. Press the **Setup key**.

2. Click the **DICOM** tab.

   The Setup DICOM window opens.

3. Click the **Manage Jobs** button.

   The Job Management window opens, showing a list of studies sent to the DICOM server. The Status column shows whether each job was transmitted or if the sending failed.



Job Management Window

4. To clear the yellow failure notification, click either **Retry** to send the study again, or **Delete**, to cancel sending of the study.

   You may have to correct the reason for the failure before resending the study.

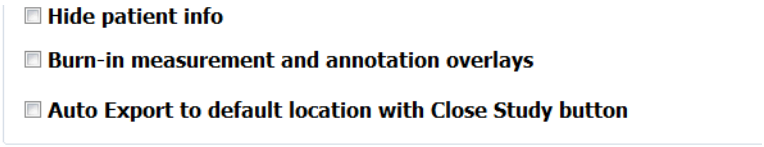
5. Click **Close**.

Using the DICOM Image Viewer on a CD or DVD

When you export studies to a CD or DVD (see Exporting Studies on page 119), you have the option to include a viewer for DICOM files on the disc.

To include the DICOM image viewer on a CD or DVD:

1. Press the **Setup key**.
2. Click the **Export** tab.



Include Viewer Button on Export Window

The Setup Export window opens.

3. Make sure the **Include Viewer on CD/DVD** checkbox is checked.
4. Click **OK**.

When you export studies to a CD or DVD with the Include Viewer on CD/DVD checkbox checked, the viewer is also included on the disc.

When the disc is inserted in a computer, the image viewer may launch automatically, or Windows may display a menu of choices. If the menu appears, the user should select Run Show.Studies.exe.

The viewer includes a Help file that explains how to use it. To access the viewer Help file, click Help on the viewer window.

Using DICOM Worklist

DICOM Worklist is a function of the Terason Ultrasound software that connects to a DICOM server using a network service, and generates a list of patient information sets that meet chosen criteria. Worklist finds patient records based on parameters set in the Setup > DICOM > Query window.

To prepare for an ultrasound exam, the ultrasound technician queries Worklist using parameters that include the patient's information. The query reruns a worklist of all the patient information sets that meet the criteria. The ultrasound technician selects a patient's record on the worklist, and the exam is automatically attached to that patient's information (the Patient Info window is populated with the selected patient's information.) The technician can also use Worklist to obtain the patient information from the DICOM server and apply the information to a current exam.

To use DICOM Worklist, see:

- Worklist Queries; see page 145
- Configuring Worklist; see page 146
- Configuring Broad Queries; see page 147
- Making a Query; see page 148
- Applying a Patient Info Set; see page 150
- Customizing the Worklist; see page 151
- DICOM Network Service; see page 152

Worklist Queries

There are two available types of Worklist queries: *auto* queries and *manual* queries.

Auto queries run periodically when the ultrasound system is on, and return a list of patient info sets that match the criteria set in the Query window as a broad query (see Configuring Broad Queries on page 147.) For example, an auto query can be set up to return a list of ultrasound exams that are scheduled on the current date. The facility's scheduling administrator enters an ultrasound exam for a patient into DICOM, and when the scheduled date arrives, the Worklist auto query collects the patient info and adds it to the worklist.

Manual queries can take two forms: *broad* queries, and *patient-based* queries.

Broad queries search all records on the DICOM server, using the parameters chosen in the Options window. Broad queries are preset groups of parameters. They can be used as they are, or modified with different parameters, or applied to patient-based queries. See Configuring Broad Queries on page 147, and Making a Broad Query on page 148.

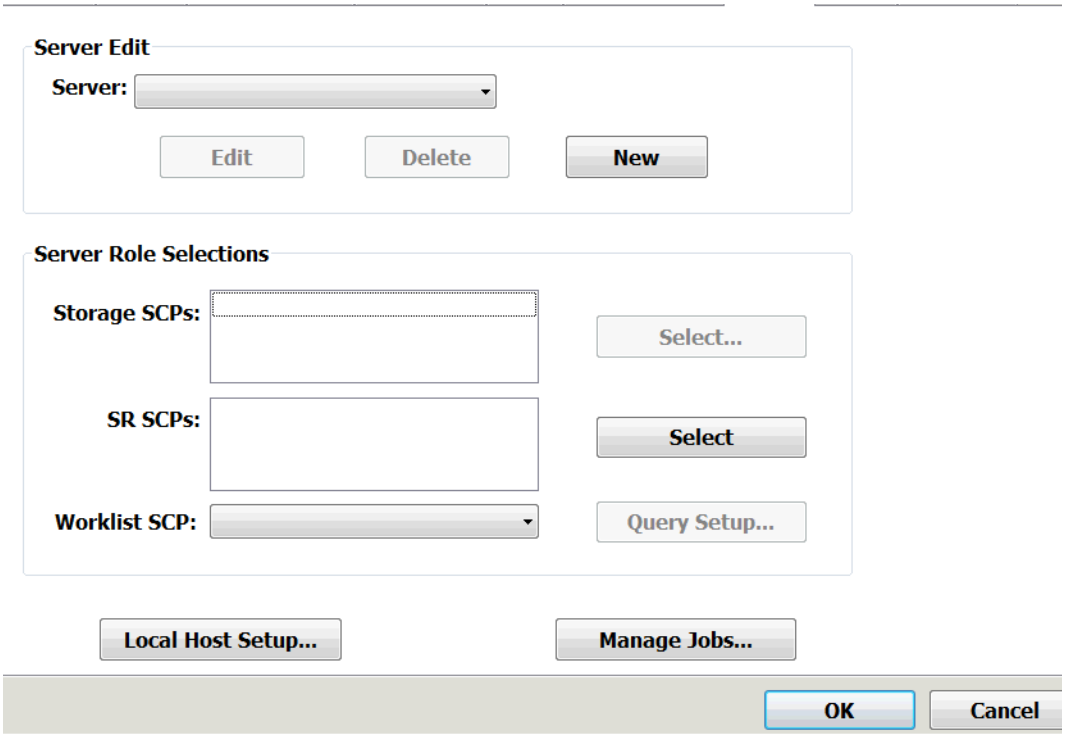
Patient-based queries search the records using a patient name, accession number, or Patient ID.They can be further limited to the parameters in a broad query. See Making a Patient-Specific Query on page 150.

Configuring Worklist

To configure Worklist to communicate with a DICOM server:

1. With the Terason software running, press the **Setup key**.
2. Click the **DICOM** tab.

   The Setup/DICOM window opens.



Setup/DICOM Window

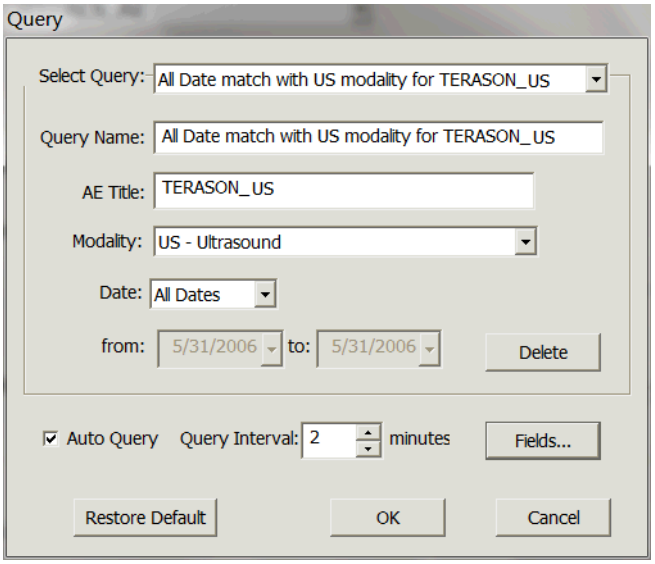
3. Click **Select...**, and make sure the Storage SCP is in the right-hand pane of the DICOM Server Selection window. If it is in the left-hand pane, click it, then click the right arrow > and click OK.
4. Click **Worklist SCP:**, and select the worklist SCP designated by your site administrator.
5. Click **OK.**

Configuring Broad Queries

To configure a query so that it is available in the Broad Query menu on the Worklist window:

1. In the Setup/DICOM window, click **Query Setup...**.

   The Query window opens.

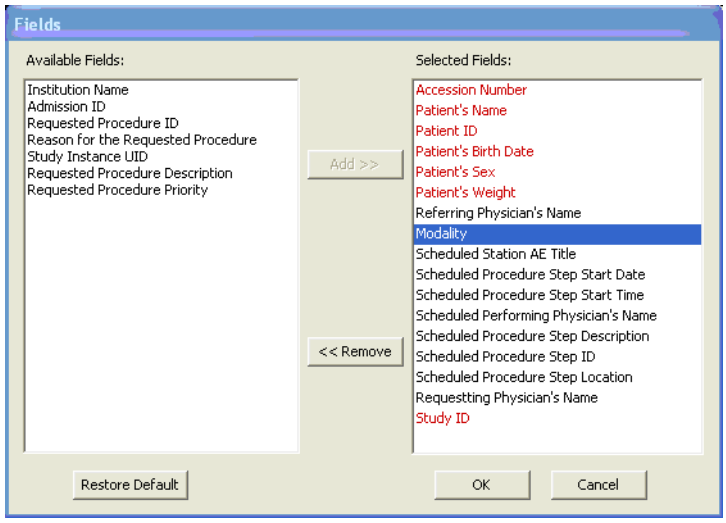


Query Window

2. Select one of the preconfigured queries in the **Select Query:** menu, or if you want to create a new query, select New Query Item.
3. Enter the **AE Title:**.
4. Choose the **Modality:**.
5. Choose the **Date:** - either All Dates, Today or Date Range. If you chose Date Range, choose the start and end dates in the from: and to: fields.
6. To change the parameters that are selectable for queries:

   a. Click Fields....

   The Fields window opens.



Fields Window

b. To add a search parameter to the Selected Fields: list, click its name in the Available Fields: list, then click **Add > >**.

c. To remove a search parameter from the Selected Fields: list, click its name in the Available Fields: list, then click **< < Remove**.

Note: Parameters in red are defaults that cannot be removed from the Selected Fields: list.

d. Click **OK**.

7. Choose whether you want Worklist to run **auto queries**, by checking or unchecking the Auto Query checkbox. If you do want auto queries to run, choose the frequency for auto queries from the Query Interval menu.
8. When all the values are entered, click **OK**.

   The new or modified query is saved, and is available in the Broad Query: menu of the Worklist window.

Making a Query

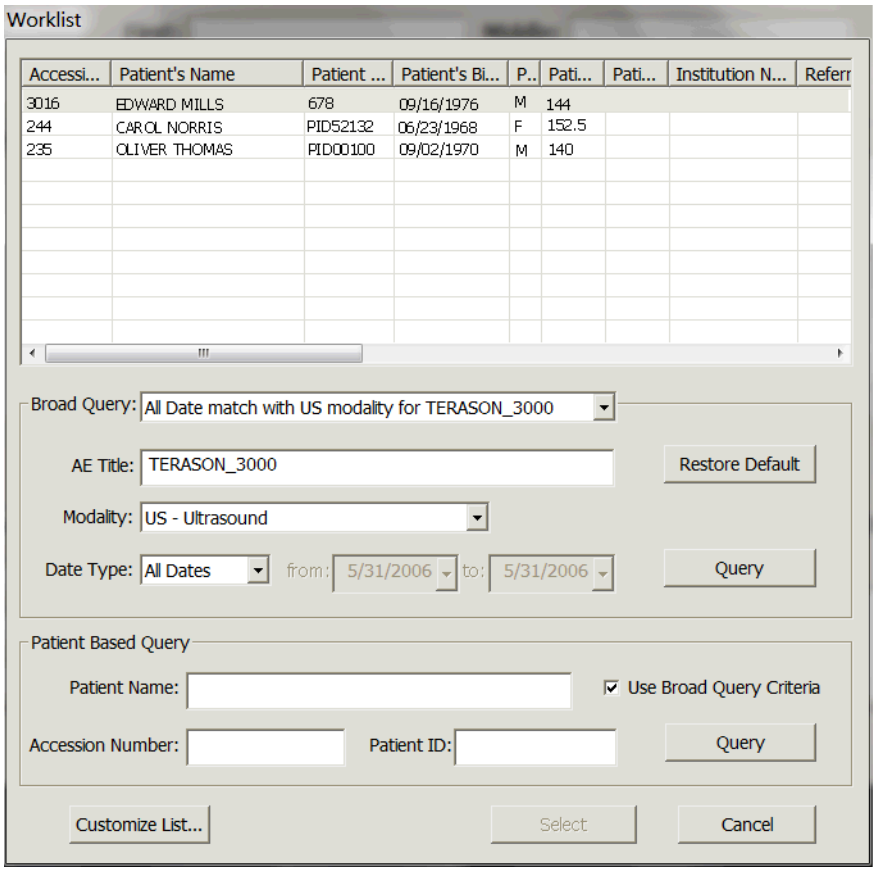
You can make a broad query that searches all the patient records and returns all the patient info sets that match the criteria, or a patient-specific query that searches for a specific patient's info set. A patient-specific query can use the same criteria as a broad query, returning only those info sets that match both the criteria in the broad query and some data specific to the patient.

Making a Broad Query

To make a broad Worklist query:

1. Press the **Patient key**.
2. Click **Worklist**.

The Worklist window opens.



Worklist Window

3. Pull down the **Broad Query:** menu, and select the query that uses the parameters you want.

   If there is no appropriate query in the menu, create one, using the procedure described in Configuring Broad Queries on page 147.

4. To search for info sets of patients who have not had an ultrasound exam before, pull down the **Modality:** menu and choose an exam type.

5. If the patient you are searching for has not had an ultrasound exam before, pull down the **Modality:** menu and select All.

   If the patient's information was saved to the DICOM server during a previous exam of any type, the query will return that information.

6. To limit the search to specific dates, pull down the **Date:** menu, and choose All Dates, Today, or Date Range to search.

7. In the Broad Query section, click **Query**.

   Worklist searches the DICOM server, and lists the results in the top part of the Worklist window.

Making a Patient-Specific Query

To make a patient-specific query:

1. In the Patient window, click **Worklist**.

   The Worklist window opens.

2. Enter the patient's name, Patient ID, or accession number in the **appropriate field**.

3. To apply the parameters in a broad query to the patient-specific query (this further narrows the query results):

   a. Click **Use Broad Query Criteria** so the box is checked.

   b. Pull down the **Broad Query:** menu, and select the query that uses the parameters you want.

   If there is no appropriate query in the menu, create one, using the procedure described in Configuring Broad Queries on page 147.

   c. You can also search using different **modality and date** parameters, using those functions in the Broad Query section.

4. In the Patient Based Query section, click **Query**.

   Worklist searches the DICOM server, and lists the results in the top part of the Worklist window.

Applying a Patient Info Set

Worklist makes it easy to apply a patient info set to an exam.

To apply a patient info set to a new exam:

1. Press the **Patient key**.
2. Click the **Worklist** tab.
3. Either click **Query** in the Broad Query section, or enter the patient name in the Patient Based Query section, and click Query in that section.
4. Click the appropriate **patient info set** to select it.
5. Click **Select**.

   Worklist populates the Patient Info window fields with the data in the selected info set. The current exam is associated with that patient.

Note: When a patient info set is applied to an exam, and the exam is saved, that exam is permanently associated with that patient. If the wrong patient info set was selected, a new exam is required for the correct patient association.

Customizing the Worklist

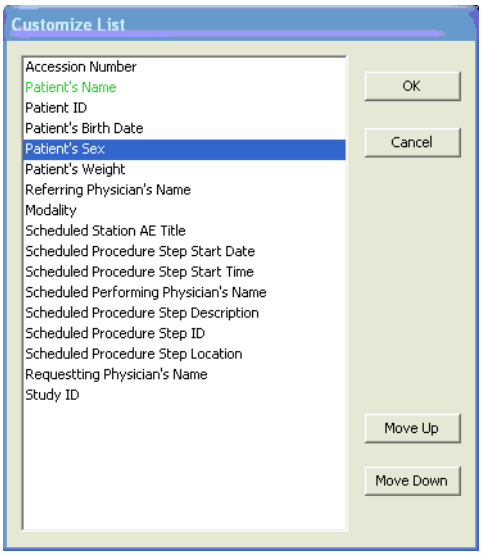
The categories-of-patient-information header on the worklist is wider than the Worklist window. To see all the categories, you must use the scroll bar at the bottom of the list area. You can set the left-to-right listing order of the patient info values, to reduce the amount of left-to-right scrolling required to read information you commonly use. See Setting the Value List Order, below.

Setting the Value List Order

To set the left-to-right listing order of the patient info values:

1. On the Worklist window, click **Customize List...**.

   The Customize List window opens.



Customize List Window

2. To move a value type to the left on the worklist, select the name of the field in the list and click **Move Up** until the name is in the desired place on the vertical list in the Customize List window.

   The top of the list in the Customize List window corresponds to the left side of the patient-information header on the Worklist window. The bottom of the list in the Customize List window corresponds to the right side of the patient-information header on the Worklist window.

3. To move a value type to the right on the worklist, select the name of the field in the list and click **Move Down** until the name is in the desired place.

4. **Repeat** with any other fields you want to move.

5. Click **OK**.

   Worklist displays the values in the patient info sets in the order you specified. When you make a new query, the worklist displays the values in the order you set with this procedure.

DICOM Network Service

When the computer starts, a network service called DcmNetService.exe runs automatically. This service allows automatic worklist queries to execute on schedule, even if the Terason software is stopped. If the service stops or does not start automatically, you can launch it manually. You can also stop the network service manually.

Starting the Network Service Manually

To start the network service manually:

1. Press **alt-tab** to change to the Windows screen.
2. Open Windows Explorer and navigate to the **Teratech directory**.
3. Double-click **DcmNetService.exe**.

   The network service launches and connects to the DICOM server.

Note: Only one instance of the network service can run at a time.

Stopping the Network Service

To stop the network service:

1. Press **alt-tab** to change to the Windows screen.
2. If necessary, press **tab** again to show the Windows taskbar.
3. Right-click the **network service icon**  on the Windows status bar at the lower right corner of the screen. If the icon is not visible, click the up arrow at the left end of the right-hand group of icons in the taskbar.

   A dialog box opens.
4. Click **Exit** in the dialog box.

   The network service stops.

Checking the Connection Status

When you hover the Windows pointer over the network service icon, a tooltip appears that describes the network connection status. There are six possible messages:

- **Connect Valid** - Successfully connected to the server
- **Connect Failed** - Did not connect to the server
- **Query Error** - Error in query and retrieve
- **Verify Failed** - Failed to verify the connection to the server (for manual query only)
- **Timeout** - Communication timeout
- **Undefined** - There is no server defined

If the icon is red, not blue, there is no connection to the DICOM server.

10 Working With Setup Tools

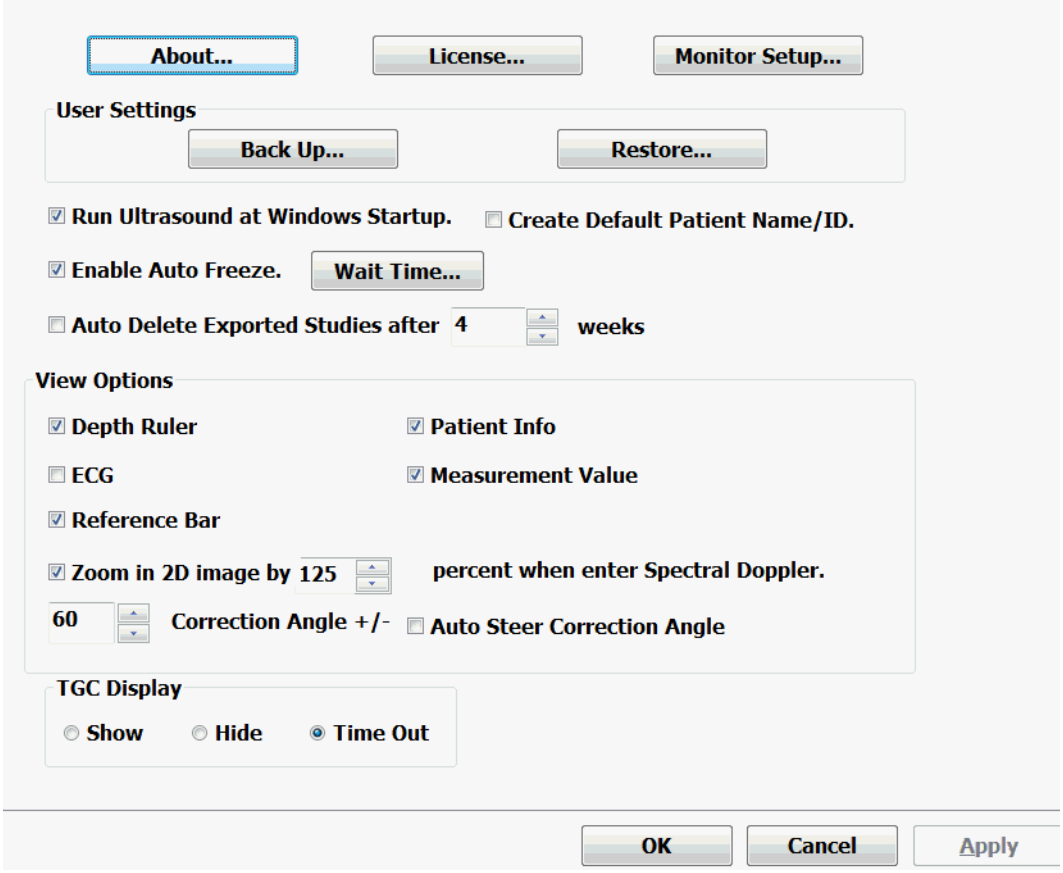
Setup Tools Overview

The **Setup** window allows you to set defaults and control various functions of the Terason software. The Setup window tabs display sets of controls for defaults and other settings.

The controls are described in these sections:

Using General Setup Controls

When you press the Setup key, then click the **General** tab, the Setup window offers several controls for different actions and defaults.



Setup General Window

About

The About button opens a message box that includes the version number of the Terason Ultrasound software.

License

The License button opens the Ultrasound License Registration window, where you can enable optional features you have purchased.

Monitor Setup

The Monitor Setup button opens a window where you can change the default monitor profile (useful if you're using a separate monitor), and run different tests on the selected monitor.

Startup

The Run Ultrasound at Windows Startup box is checked by default. This makes the ultrasound system start automatically when the computer is started. Unchecking the box means you have to manually start the Terason Ultrasound software.

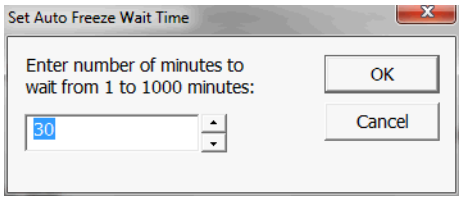
Auto Freeze

The Terason software lets you set a time value that shuts off power to the probe and freezes the scan if the system has been inactive for the specified period. This feature is especially useful when you run an ultrasound system on battery power.

To set the Auto Freeze time, complete these steps:

1. Press the **Setup key.**
2. On the Setup/General window, make sure the **On** box under Auto Freeze is checked.
3. Click the **Wait Time...** button.

   The Set Auto Freeze Wait Time window appears.



Setting the Auto Freeze Time

4. Either type the **number of minutes** you want to specify as the time-out value, or click the up and down arrows to select a different value.
5. Click **OK**.

When the specified number of minutes elapses, the computer shuts off power to the probe and displays the following message:

Program has automatically suspended. Hit any key or move mouse to resume.

The Terason title bar changes to Terason - Suspended, to indicate that probe power is shut down. When you move the mouse or press any key on the keyboard, the Terason software sends power to the probe and removes the message box.

Auto Delete Exported Studies

When you check this box, exported studies are automatically deleted from the ultrasound system when the selected number of weeks have passed since the study was created. If a study was created at a time that is further in the past than the number of weeks selected, it is immediately deleted when it is exported. You can select any number of weeks from 0 to 99.

Studies that have not been exported are not automatically deleted.

View Options

Several checkboxes that toggle different features of the Imaging window on and off are offered in the View Options area. Click the check boxes to enable or disable the feature. When the box has a checkmark, the feature is enabled.

Depth Ruler sets whether or not to show the depth ruler.

ECG sets whether output from ECG leads is displayed.

Reference Bar sets whether the color doppler reference bar displays.

Patient Info sets whether the patient information is shown at the top of the Imaging window.

Measurement Value sets whether the values of measurements on the Imaging window are displayed.

TGC Display

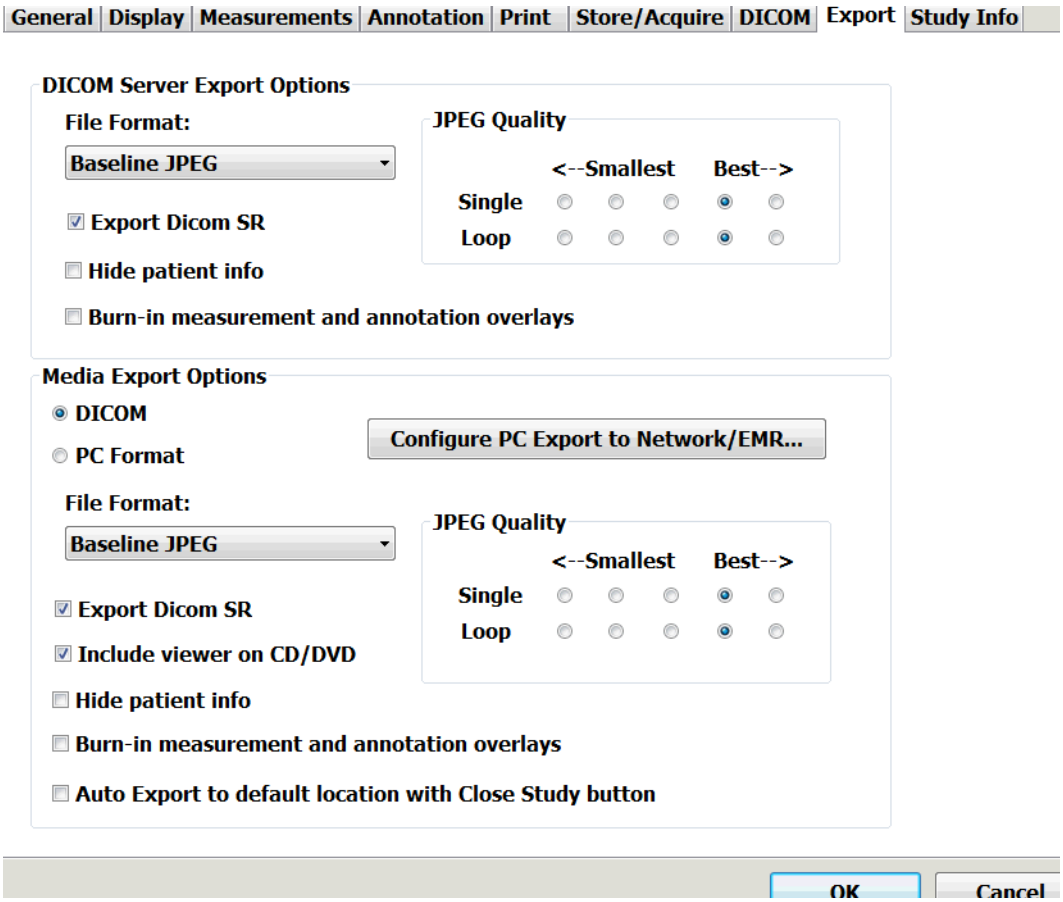
You can choose whether and for how long the Time Gain Compensation display appears on the Imaging window.

- **Show** sets the TGC display to always show.
- **Hide** sets the TGC display to never show.
- **Time Out** sets the TGC display to show for a few seconds after an adjustment is made to the TGC sliders or the Gain knob.

Setting Export Defaults

When you press the Setup key, then click the **Export** tab, the Setup window offers several controls for different actions and defaults.

By default, the Terason software uses the DICOM file format when saving image files and loops. You can choose a different format for exporting images or loops to a CD, DVD, USB, DICOM server, or other network location.



Setup Export Window

Media Export Options

Choices in this section affect the format of files exported to a CD, DVD, or USB drive.

Selecting the **DICOM** radio button exports files in the standard DICOM format.

Selecting the **PC Format** radio button lets you choose a different format for export. You can choose any of the following formats:

- Palette Color (8-bit color)
- RGB (24-bit color)
- Palette Color RLE (Palette Color with run-length encoding applied)
- RGB, RLE (RGB with run-length encoding applied)
- Baseline JPEG

Selecting the **Include viewer on CD/DVD** checkbox includes a DICOM image viewer on CDs and DVDs burned with the Terason Ultrasound software. This lets DICOM loops play on systems that do not have the Terason software installed. See Using the DICOM Image Viewer on a CD or DVD on page 144.

DICOM Server Export Options

You can choose the color format used for sending a DICOM image. You can choose any of the following formats:

- Palette Color (8-bit color)
- RGB (24-bit color)
- Palette Color RLE (Palette Color with run-length encoding applied)
- RGB, RLE (RGB with run-length encoding applied)
- Baseline JPEG

This setting only affects files sent to a DICOM server. DICOM files saved in the Terason Image or Patient folders always use the Palette color format.

Baseline JPEG enables the JPEG Quality controls. Selecting a radio button toward the Best--> end of the table produces a higher-quality image with fewer artifacts, and a larger file. Selecting a radio button toward the <--Smallest end of the table produces a lower-quality image and a smaller file.

By default, DICOM files are compressed using the DICOM RLE syntax, and then uncompressed and converted to the chosen Send format when exported or sent to a DICOM server.

PC Export Options

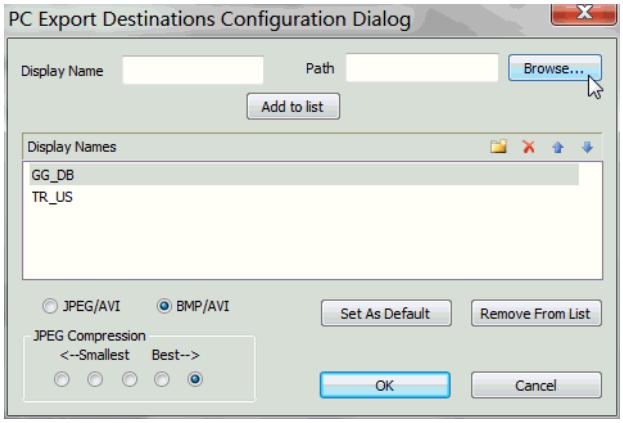
The PC Export button on the Setup/Export window opens a dialog box that lets you set defaults for exporting to other locations on a network. PC Export does not work with DICOM.

Locations added as export destinations appear in a drop-down menu on the Export Selection window. If more than one destination is added to the menu, you can select one as a default. If only one destination is added, or if a destination is designated the default, the Export button on the Export Selection window immediately sends the image to that destination. If more than one destination is added, and no destination is designated the default, clicking the Export button on the Export Selection window opens a notification box with a message saying you must choose a destination EMR.

To add a destination EMR:

1. Press the **Setup key**.
2. In the Setup window, click the **Export tab**.
3. On the Setup/Export window, click the **Configure PC Export to Network/EMR** button.

   The PC Export Destinations Configuration Dialog box opens.



PC Export Destinations Configuration Dialog Box

4. Click **Browse...** .

   The system searches the network, and displays a list of possible destinations in a Select Path window.

5. Select the **export destination** from the Current Path list on the Select Path window.

6. Click **OK**.

7. On the PC Export Destinations Configuration Dialog box, click in the **Display Name** field, and enter a name for the destination.

8. Click Add to list.

   The destination is added to the Display Names list, and will appear in the drop-down menu on the Export Selection window.

To set defaults for PC Export:

1. To set a destination as the default, select it in the Display Names list, then click **Set As Default**.

2. Select either **JPEG/AVI** or **BMP/AVI**.

3. Select the **JPEG Compression** level.

4. Click **OK**.

   The selected defaults are set.

Burning Measurements and Annotations for Export

Some servers do not allow overlays on images. If the images you export are stripped of measurements and annotations, you must burn those into the images when exporting.

To configure export to burn measurements and annotations into images:

1. Press the **Setup key**.

   The Setup window opens.

2. Click the **Export tab**.

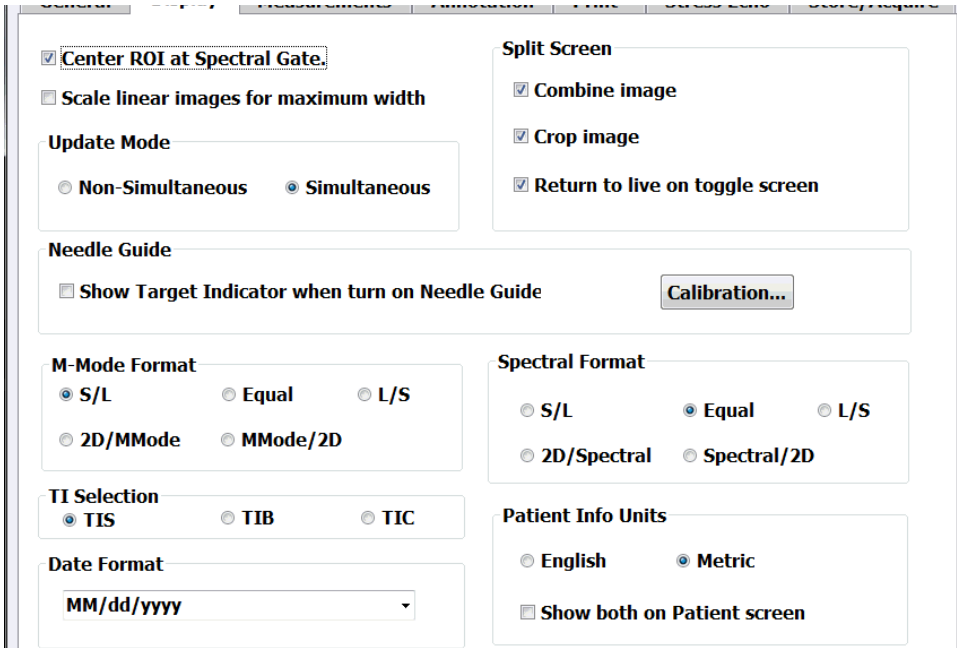
   The Setup/Export window opens. (See Setup Export Window on page 158.)

3. Click the **Burn-in measurement and annotation overlays** checkboxes.

Setting Display Defaults

When you press the Setup key, then click the **Display** tab, the Setup window offers several controls for different actions and defaults.

The Display tab on the Setup window controls how certain features of the Imaging window are displayed.



Setup Display Window

Return to live imaging on toggle active screen

The checkbox controls whether toggling between split screens makes the active screen live or not.

When the box is **unchecked**, toggling between the screens leaves them both frozen. Pressing the Freeze key makes the active window live. Toggling to the other screen and back freezes both screens again.

When the box is **checked**, toggling between windows makes the active window live, even if it was previously frozen using the Freeze key.

Center ROI at Spectral Gate

When this box is checked, the feature centers the region of interest around the spectral gate.

Scale linear images for maximum width

when this box is checked, the feature widens the display for shallow scans.

Patient Info Units

You can choose to have the height and weight values in patient information sets display as either Metric or English units. When you change from one to the other, the software automatically calculates the equivalent value in the new units. For example, if the patient's height was entered as 2 meters, when you change to English units, that value is changed to 6 feet 7 inches.

Update Mode

When they are selected, Spectral Doppler modes normally open updating both the Time Series display and the 2D display simultaneously. This is the default, and is the Simultaneous selection on the Setup Display window. Selecting Non-Simultaneous causes Spectral Doppler modes to open with the 2D display frozen.

Whichever radio button is selected, pressing the Update key toggles the 2D display between live and frozen.

Needle Guide

This section includes a checkbox that shows or hides the Target Indicator and a button that opens the Needle Guide Calibration window.

Needle guide calibration is used exclusively with the biopsy/medical procedures options. See Calibrating Needle Guide Positioning for Biopsies on page 138 for information on correcting the needle guide position.

M-Mode Format and Spectral Format

These radio buttons set the relative sizes of the 2D display and the Time-Series display on the Imaging window.

- **S/L** makes the 2D display half the height of the Time-Series display
- **Equal** makes the 2D display the same height as the Time-Series display
- **L/S** makes the 2D display twice the height of the Time-Series display

See Resizing the 2D and Time-series Displays on page 52.

TI Selection

This chooses the thermal index that is displayed on the scanning window. Refer to "General Description of Indices" in Volume 2 of the *User Guide* for more information about thermal indices.

- TIS is the Soft Tissue index.
- TIB is the Bone index.
- TIC is the Cranial index.

Combine Image

Allows measurement across both images in split-screen mode.

Crop Image

When checked, this cuts the edges of trapezoidal or sector images in split-screen mode to increase the image size.

Return to live on toggle screen

When this box is checked, toggling from one split-screen view to the other makes the selected view live.

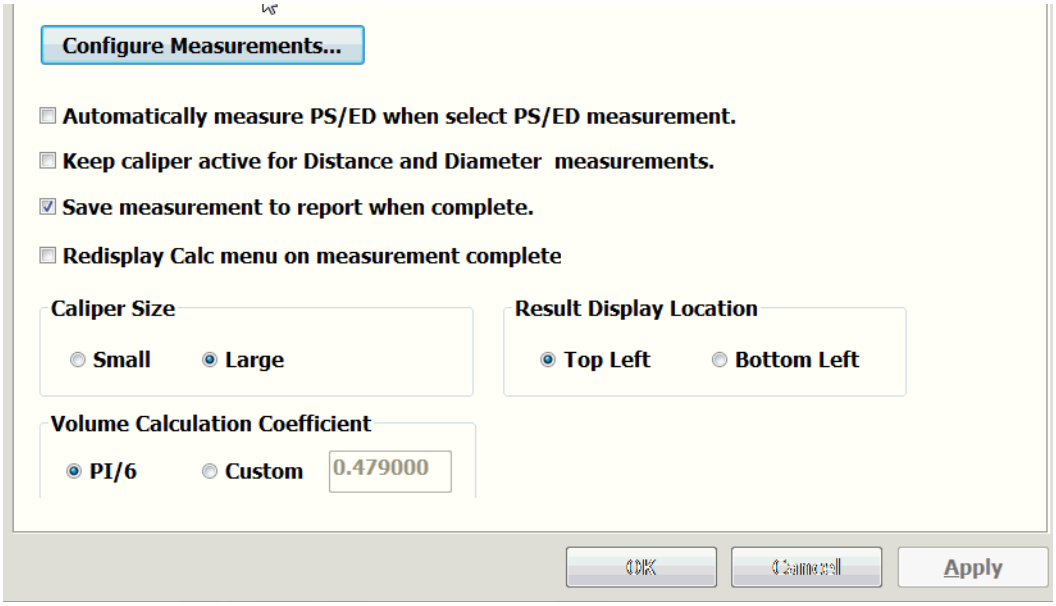
When the box is not checked, both views remain frozen when toggling from one to the other, until the Freeze key is pressed.

Setting Measurement Defaults

When you press the Setup key, then click the **Measurement** tab, the Setup window lets you choose which measurements appear on the menu accessed by the Calcs key on frozen images. See Measurement Sets on page 89 for instructions on how to do that.

The Setup Measurement window also includes controls for choosing the size of the measurement cursor, the tables used in calculating obstetric measurements, and the port used to send measurements to another location.

The Volume Calculation Coefficient selection chooses either the standard PI/6 ellipsoid coefficient, or a custom value. The default for the Custom selection is 0.479, another commonly used value, but you can enter any value.



Setup Measurements Window

Caliper Size

To change the size of the measurement cursor, click the Small or Large radio button.

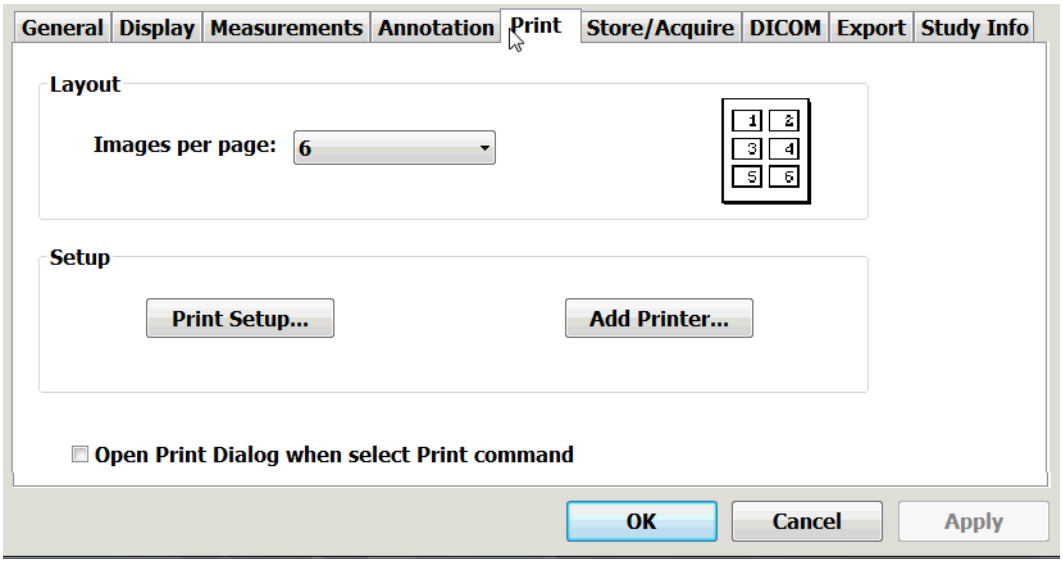
Using Annotation Setup Controls

When you press the Setup key, then click the **Annotation** tab, the Setup window offers several controls for different actions and defaults. The Setup Annotation window lets you control which anatomy labels are available when you press the Text key. This is explained in detail in Predefined Text on page 56 and Custom Predefined Text on page 56.

The Setup Annotation window also lets you control which body markers are available when you press the Body Marker softkey. This is explained in detail in Using Body Markers on page 61.

Setting Print Defaults

When you press the Setup key, then click the **Print** tab, the Setup window lets you add and configure printers and choose how many images will print on a page.



Setup Print window

To set the number of images that print on a page, click the triangle next to the Images per page: field, the select a number from the menu.

To add a printer:

1. Click the **Add Printer...** button.

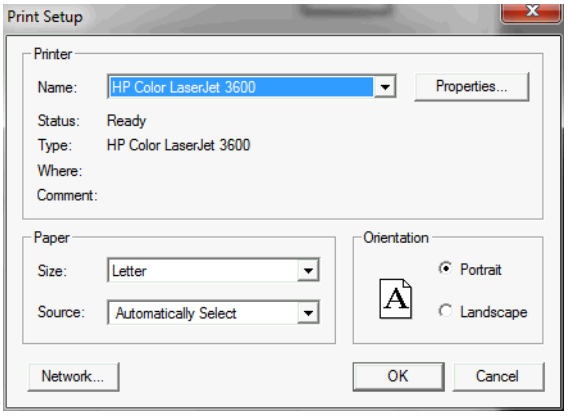
   The Windows Add printer window opens.

2. Select the printer you want to use, then click **Add**.

To Set the printing defaults:

1. Click the **Print Setup...** button.

   The Print Setup window opens.



Print Setup Window

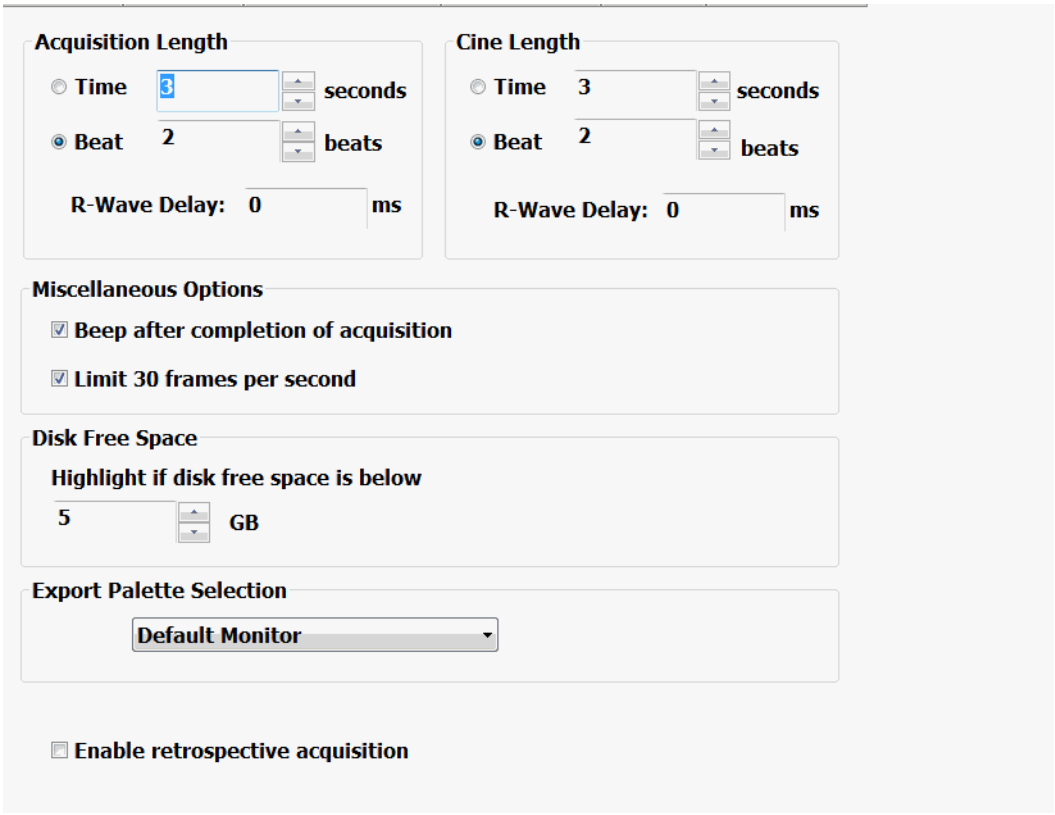
(This illustration is an example; the details of the window depend on the printer you have selected.)

2. Select the **paper size**, orientation, etc.

   For detailed instructions, refer to the printer manufacturer's documentation.

Setting Storage and Acquisition Defaults

When you press the Setup key, then click the **Store/Acquire** tab, the Setup window offers several controls for different actions and defaults.



Setup Store/Acquire Window

Acquisition Length

This lets you set the length for prospective loops. See Saving Prospective Loops on page 50.

Cine Length

This lets you set the length for retrospective loops. See Saving Retrospective Loops on page 51

Disk Free Space Warning

When the unused space on the computer hard disk becomes less than the value set with this control, the Disk free space indicator on the Imaging window turns yellow. You should delete unneeded files to make more room on the disk for new studies.

To set the disk free space warning threshold, click the up or down arrow next to the GB field until the desired value displays, then click OK or Apply.

Export Palette

You can choose the export palette to match the computer, but this is seldom necessary. The correct palette is set at the factory.

Miscellaneous Options

Acquisition Beep

You can enable and disable a beep sound triggered by the completion of an image or loop acquisition.

To enable or disable the acquisition-complete beep, click the Beep after completion of acquisition checkbox.

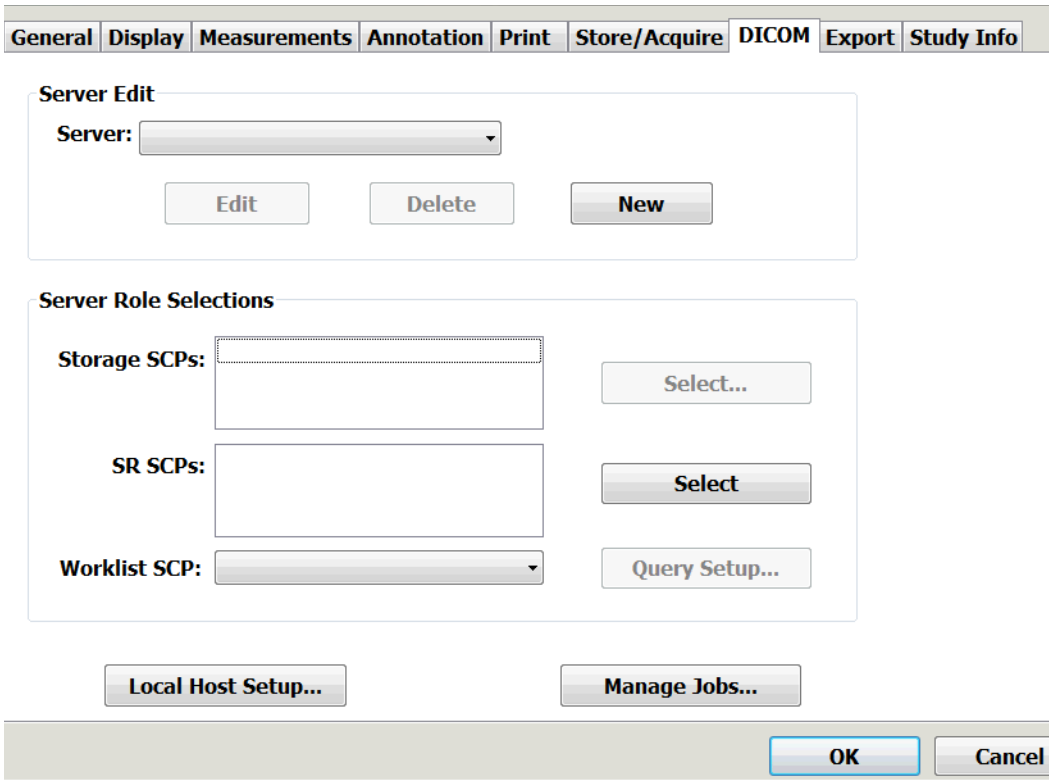
Frame-Rate Limit

This control toggles a 30 frames per second limit on the frame rate. Enabling the limit results in smaller study files.

Setting DICOM Defaults

When you press the Setup key, then click the **DICOM** tab, the Setup window offers controls for connecting to and using DICOM networks.

Connecting and configuring DICOM networks requires the involvement of your System Administrator.



Setup DICOM Window

Server Edit

This set of controls lets you define DICOM server identities. Click New and enter the name, AE title, and IP address of any DICOM servers you want to export to.

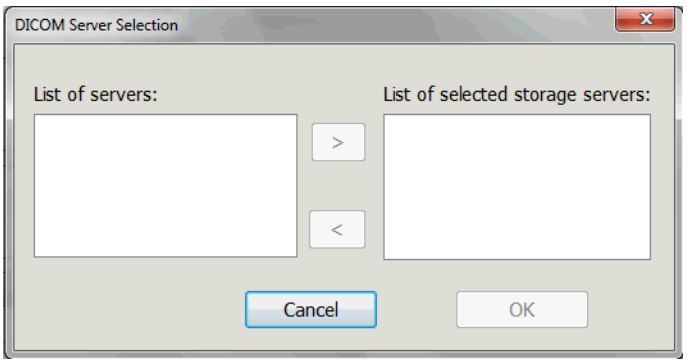
Server Role Selections

This section is where you define SCPs and set up Worklist Query defaults.

To configure storage SCPs:

1. Click **Select** next to the Storage SCPs: field.

   The DICOM Server Selection window opens.



DICOM Server Selection Window

2. Click a desired target SCP from the **List of Servers** to select it, then click the right arrow to add it to the List of selected storage servers.
3. Click **OK**.

To configure SR SCPs:

1. Click **Select** next to the SR SCPs: field

   The DICOM Server Selection window opens.
2. Click a desired target SCP from the **List of Servers** to select it, then click the right arrow to add it to the List of selected SR servers.
3. Click **OK**.

Local Host Setup

This button opens a dialog box where you can enter data required for communication with a DICOM server.

Manage Jobs

This button opens a window where you can monitor the status of items sent to the DICOM network.

11 Solving Problems

You can resolve many Terason Ultrasound System problems yourself. Use these guidelines to help you determine what the problem is, and how to fix it. Refer to the section for your specific problem:

If you complete the procedures and the problem persists, contact Terason as described in Contacting Terason Technical Support on page 174.

Installation Problems

When installing the Terason software, you cannot have any other applications open on the ultrasound system, especially Microsoft Outlook. A conflict exists in the InstallShield software (the installation utility that installs the Terason software) with the Microsoft Outlook application. Make sure you exit from all applications before you start installing the Terason software.

Startup Self-Test

When the Terason ultrasound system powers up, the software runs the following tests to assure proper operation:

- Verifies communication between the computer and the ultrasound engine
- Verifies that external electronic noise is below the specified limits
- Verifies that the probe is within specifications for sensitivity and signal-to-noise ratio

If any of the tested conditions are outside specifications, the system displays an error message that indicates which condition is at fault and includes suggestions for remedying the fault. If the suggestions are not effective, contact Terason Technical Support.

The system also monitors electronic noise levels during use, and displays an alert if it detects excessive noise. If this alert appears, remove any noise sources that have been introduced in the examining area or relocate the exam to another area.

Problems with Scanning

If the software does not show a scan image, the problem could be:

- The probe is not plugged in
- The device driver is not installed

To determine how to proceed, check whether the image is frozen, then refer to the following table:

Terason Probe States

If the Image Status is...	Then...
Frozen Image	Either you have frozen an image, or the probe has not been used in several minutes and has shut down to conserve power. Press any key on the keyboard or move the trackball, and the ultrasound system sends power to the probe
Live Imaging	The probe is functioning. Try adjusting the 2D Gain.

Probe Connection

If you have used the probe before, the driver is already installed, so it is probably a connection problem. Make sure all connections between the probe and computer are secure.

Reconnecting Components

If the problem still exists, usually the cause is that a component connection has become loose. You must unplug the component and plug it in again, following these steps:

1. **Quit** the Terason software.
2. Shut down the **computer**.
3. Unplug the **probe**.
4. Start the **computer**.
5. When the hourglass icon is gone, plug in the **probe**.
6. Wait **15 seconds**.
7. If you see a “Digital Signature not Found” or a “Found New Hardware” message, contact **Terason Technical Support**.
8. If no digital signature message displays, start the **Terason software**.

Interference on the Scan

If the probe or the Terason electronics envelope is too close to an electronic device, such as a computer, you may see interference patterns in the scan image.

To resolve this problem, move the probe and electronics away from all power sources.

Printing Problems

The most common printing problems are:

- The printout is too light or too dark
- The printout is too small

Caution: A printer installed within the patient environment may result in non-conformance to safety standards. Use of non-medical grade peripherals will result in non-compliance of safety and EMI standards. Non-conformance to these standards can result in risks to the patient and operator of this equipment.

Print Quality

The default printer settings should be sufficient to print a good image, although the type of paper you put in the printer also affects image quality:

- Photo quality paper produces the best output, but is the most expensive
- Brochure paper produces good output, and costs less than photo quality paper
- Regular laser printer paper is the least expensive, but produces low-quality output

If the printer is low on ink, you may have to change the printer cartridge. refer to the printer user manual for instructions.

If you must adjust the printer controls, refer to the user guide for the printer for instructions on adjusting (usually to lighten) the output.

Printout Too Small

If the printout is too small, use the printer's options to enlarge the printed image. Refer to the printer user manual for instructions.

Display Problems

If you must connect a separate monitor to the ultrasound system, you will need a "Mini Display Adapter," which is available from Apple. Please note that the ultrasound images can only be optimized for display on a single monitor.

CD Writing or Reading Problems

If you get errors when writing to a CD, check these items:

- Filenames for CDs are restricted to 64 characters, however, Windows supports filenames with up to 256 characters. For any files that you want to archive or move to a CD, make sure the filenames do not exceed 64 characters.

- Make sure you do not exceed the available space on the CD. For example, if you choose 100 MB to add to a CD, but the CD only has 80 MB available, the CD writer may let you start the copying process, but will generate an error during the write process.

- If you closed the CD when you created it, you cannot add any more files to that CD. When you copy to a CD, you can close the session, but if you want to write to the CD again, you should not close the CD. See Exporting Studies on page 119 for guidelines.

If you cannot access files on a CD, you may not be able to recover those files. To avoid possible problems reading files from a CD, follow these guidelines:

- Terason recommends that you use only write-once CDs. If you use rewriteable CDs, they may not work on other computers.

- Do not completely fill the CD. If the CD is close to 100% full, the computer may not be able to read from that CD. When adding files to the CD layout, the Status bar displays an Estimated Free Space value. Make sure to leave at least 10% available space on the CD.

- Check for errors when writing a CD. Make sure to choose Test and Create CD and not Create CD only. If you choose Test and Create CD, the Create CD software lets you know immediately if any errors occurred.

- Always use the Terason software after writing to a CD to open an image on that CD. This step lets you know immediately if there is a problem with the CD.

Network Problems

Terason cannot provide network assistance. Only a system administrator at your site can resolve network issues. The ultrasound system comes with a network card and internal modem. However, the required network settings (such as IP address) are determined by your network system administrator.

Contacting Terason Technical Support

If you have followed the suggestions provided and still cannot resolve your problem, contact Terason Technical Support at:

Voice from the U.S.A.: 1-866-TERASON (1-866-837-2766) X 1048
Voice from outside the U.S.A.: 781-270-4143 X 1048

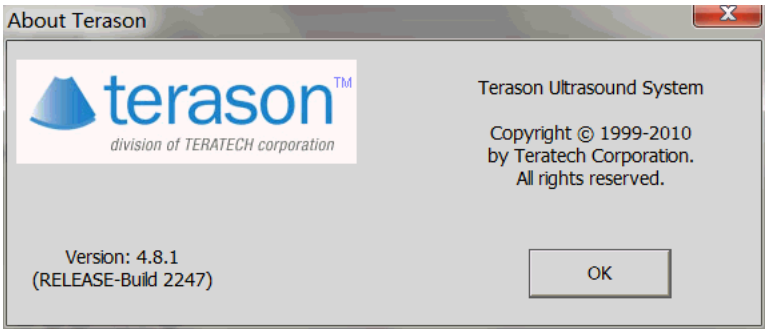
FAX: 1-781-270-4145

Email: techsupport@terason.com

Before you call, make sure you have the following information on hand:

- Serial number of the probe/electronics envelope
- Operating system (Windows 7) service pack number
- Terason software version number*
- If available, sales order number
- Name of the organization that purchased the Terason Ultrasound System

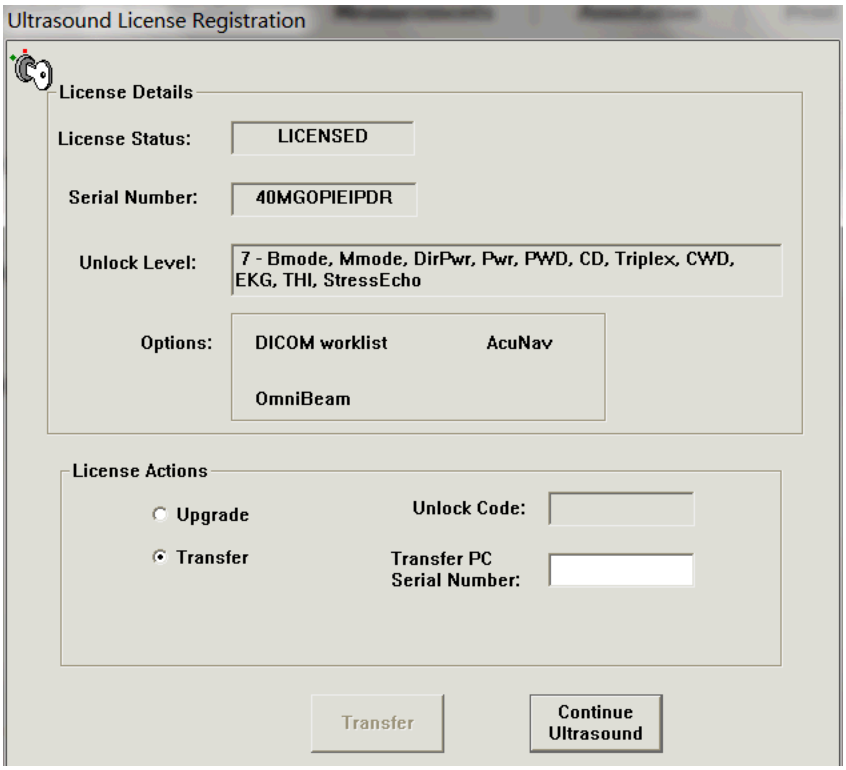
* You can find the Terason software version by clicking the About... button on the Setup/General window.



About Terason Message Box

Click **OK** to close the box.

You can find your system serial number by clicking the License... button on the Setup/ General window.



Ultrasound License Registration Window

Copy the serial number, then click **Continue Ultrasound** to close the message box.

If you call Terason and a support specialist is not available, please leave the following information, and we will return your call as soon as possible:

- Name
- Phone number
- Description of the problem
- Probe serial number
- Terason software version number
- Operating system (Windows 7) and service pack #

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