



# **Terason t3000/Echo™ Ultrasound System User Guide**



## **Terason Ultrasound System User Guide**

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## Preface Before You Begin

Before you start using the Terason Ultrasound System, you should review this preface, which includes the following topics:

- [Links](#) on page 16
- [Prerequisites](#) on page 16
- [Cautions](#) on page 16
- [Terason Transducer](#) on page 17
- [System Labels](#) on page 22
- [Shipping Label Icons](#) on page 23
- [Printing the User Guide](#) on page 24
- [Getting Help](#) on page 25

For an introduction to the Terason Ultrasound System, see Chapter 1, [About the Terason Ultrasound System](#), on page 27.

### About this Guide

This guide describes how to use the Terason software to conduct an ultrasound exam using a Terason transducer, and defines how to use the software to control and capture the ultrasound image. This guide **does not**:

- Teach how to perform an ultrasound exam or any other medical procedures
- Present medical protocols for ultrasound exams or medical procedures
- Discuss interpretation of acquired scans

You must follow the required clinical procedure for the specific exam you need to conduct.

The figures in this guide that show scanned images were captured using a variety of transducers. Depending on the transducer you use, the images on your computer may differ from the ones in this book.

This guide uses the menus, windows, and dialog boxes of the Terason software version 4.0. If your application is a later version, the menus and windows may include additional features. Refer to the release notes that came with the software for the most up-to-date information.

This guide applies to both the Terason t3000 and Terason Echo families of ultrasound systems and accessories. Where a section refers to the t3000, the feature discussed does not apply to Echo systems. Where a section refers to the Echo, the feature discussed does not apply to t3000 systems.

The Terason software runs on both the Windows 2000 and the Windows XP operating systems. In this book, “Windows” refers to both of these operating systems.

In this manual, the name for two-dimensional imaging is 2D; the term “B-Mode” is not used.

## Warnings, Cautions, and Notes

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



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

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

---



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**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.

## 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 laptop or desktop computer. If you are new to the Windows 2000 or XP operating system, Appendix A, “Working with Microsoft Windows,” on page 279 describes the Windows features used with the Terason software.

## Cautions and Warnings

### Cautions

Closely review the following cautions before using the Terason Ultrasound System for the first time.



## Sale and Use

The Terason Ultrasound System is designed for medical ultrasound imaging. 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.



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

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## Terason Transducer

Each transducer model has indications for use (see [Indications For Use](#) on page 251) concerning specific applications.

## Laptop

Always position the laptop on a stable surface where it cannot fall on the patient.



---

**Caution:** Do not lift the laptop by the power cable or transducer. If either disconnects, the laptop could fall on the patient.

---

## Allergies

Metals used in some of the decorative exterior plates may contain nickel. If persons using the system are allergic to nickel, avoid handling the exterior decorative metal.

## System Covers

Do not remove any system covers or cables. Only qualified Terason personnel should service the Terason Ultrasound System.

## Electrical Shock Hazard

Transducer cables have strain relief at terminations. Inspect cables regularly, to detect damaged, frayed, or broken cables that might contact a patient.



---

**Caution:** Do not use a transducer if the transducer or cable is damaged. Return damaged equipment to Terason for replacement. See [Contacting Terason](#) on page 26 for instructions on contacting Terason Support.

---

Shock hazards exist if the AC power adapter is damaged or is not properly grounded. Use only the supplied medical grade power cord and power adapter, and connect the adapter only to a receptacle marked “Hospital Only”, “Hospital Grade,” or equivalent.



---

**Caution:** Do not remove or try to circumvent the grounding wire. If the protective grounding of the system is questionable, disconnect the laptop from the power source and run it on its internal battery.

---

Before cleaning the system, always disconnect the AC power adapter from the system.

The Terason Ultrasound System is a Type BF Class I product suitable for continuous operation when connected as a system to the Medical Grade Isolation Transformer or Medical Grade AC/DC Power Adapter if operated from the isolation transformer or the laptop battery.



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**Caution:** Use only Medical-Grade peripherals in the patient environment. See [Intended Use](#) on page 19 for a diagram of the patient environment.

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**Caution:** Never plug the medical-grade isolation transformer into a multiple position strip outlet (power strip).

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**Caution:** Only plug components of the Terason Ultrasound System into the isolation transformer. Failure to follow the warnings in this guide may cause the system to no longer comply with regulatory requirements.

---

### **Electrical Fast Transients (EFT)**

The FireWire components used to connect the Terason ultrasound transducer to the computer are susceptible to electrical fast transients on the power line. If these components are subjected to transients, it may cause the FireWire hub and repeaters to lock up and no longer operate as specified. If that happens, communications between the computer and the transducer will fail. To remedy this situation, remove power from the FireWire hub by unplugging the medical-grade power adaptor for a few seconds. When the power supply is plugged back in, the FireWire components reset and begin to function normally. You must also exit the Terason software and restart it.

### **Surges to AC Power Mains**

If the system is powered from AC mains that could experience surges above 1 Kv (for example, from extreme lightning conditions), additional surge suppression is recommended.

### **RF Interference**

The unit should be operated in a location that is no closer than listed in [Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Terason Ultrasound System and Systems that Are Not Life-Supporting](#) on page 318 to any part of RF communications equipment that may disturb its functions. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the equipment. The Terason Ultrasound System should be separated by at least the distances specified in the table referenced above.

The Terason Ultrasound System is intended for use in an electromagnetic environment where radiated RF disturbances are controlled. The customer or the user of the Terason Ultrasound System can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Terason Ultrasound System according to the maximum output power of the communications equipment. See Appendix E, “Electromagnetic Compatibility Tables,” on page 316 for recommended separation distances.

## Explosive

This equipment is not suitable for use in the presence of FLAMMABLE ANESTHETIC MIXTURE WITH AIR OR WITH OXYGEN OR NITROUS OXIDE.

## Battery Pack Usage/Disposal

Lithium-ion battery packs are labeled with cautions indicating that the device could present a fire or chemical burn hazard if mistreated.



---

**Caution:** Do not disassemble, heat above 60°C (140°F), crush, puncture, short external contacts, or incinerate the battery pack.

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**Caution:** Keep the battery pack away from children. Dispose of used battery packs according to the manufacturer's instructions. For safety information, refer to the user guide that was shipped with your computer.

---

## Recycling/Disposal After Useful Life

This equipment can contain environmentally hazardous materials such as, but not limited to: heavy metals, general recyclable metals, and plastics. This product should be recycled according to local and national guidelines for recycling electronic equipment.

## Warnings

Observe the following safety precautions when using the Terason Ultrasound System.

### Intended Use

The Terason Ultrasound System is designed for use as a diagnostic tool and should only be operated by someone who has received proper training in the use and operation of an ultrasound system. This system produces images derived from sound echoes; those images must be interpreted by a qualified medical professional. This system in no way interprets these images or provides a medical diagnosis of the patient being examined.

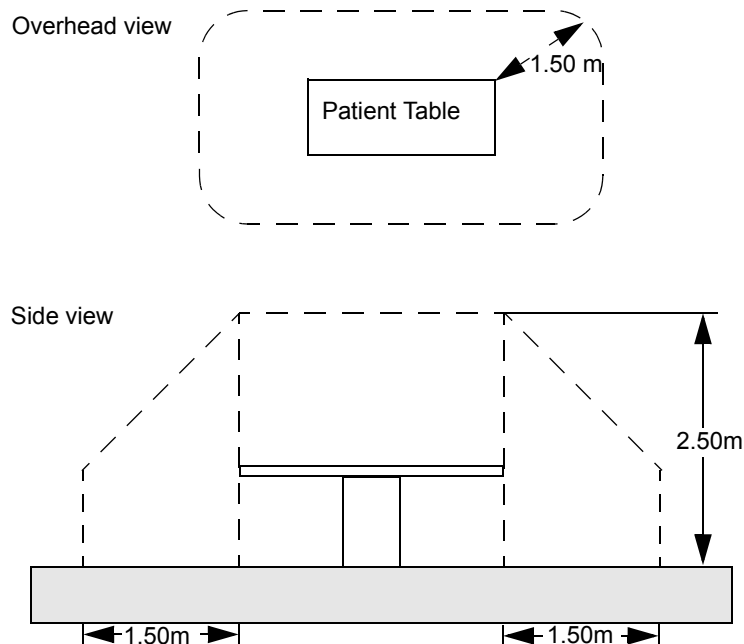
The Terason Ultrasound System has successfully completed compliance tests for IEC 60601-1, IEC 60601-1-1 2nd edition, IEC 60601-1-2, and IEC 60601-2-37 medical standards for the configuration as originally installed. To maintain compliance with the stated safety and EMI standards, Terason recommends use of MEDICAL GRADE PERIPHERALS ONLY. Use of non-medical grade peripherals will result in non-compliance of safety and EMI standards. Non-conformance to these standards can produce risks to the patient and operator of this equipment. Terason cannot be held liable for changes to the system topology that no longer conform to the stated safety and EMI standards. Changes to the system topology may make it necessary to retest the complete system for compliance to these standards. The *Terason Ultrasound System User Guide* refers to the potential for connecting the Terason Ultrasound System to peripherals such as VCRs, TVs, and printers. Note that Terason has not performed compliance tests to the stated standards with these types of devices connected to the system. Any peripheral device, such as a network connection, etc. connected to the Terason Ultrasound System must conform to the IEC standards outlined above (i.e., IEC 60601-1, IEC 60601-1-1 2nd edition, IEC 60601-1-2, and IEC 60601-2-37).

The Terason Ultrasound System (without peripherals) is suitable for use within the patient environment, as defined by the following:



**Warning:** The user should never simultaneously make contact with the patient and the inside of any equipment where a protective cover of any kind is removed. This includes the protective covers for the probe holders containing the ultrasound probe and power modules located at the patient table.

The patient environment is defined as shown in the following figure.



#### Patient Environment

Portable and mobile RF communications equipment can affect medical electrical equipment such as the Terason Ultrasound System and should not be used in the patient environment.



**Caution:** The Terason Ultrasound System should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the system should be observed to verify normal operation in the configuration in which it will be used.

### Electromagnetic Interference (EMI)

Medical electrical equipment such as the Terason Ultrasound System requires special precautions regarding electromagnetic compatibility, and must be installed and put into service according to the information provided in the accompanying Configuration Guide.

To limit exposure to electromagnetic interference from nearby equipment that can degrade image quality, you should operate the Terason Ultrasound System under EMI conditions that minimize power supply transients, mechanical interactions, vibration, and thermal, optical, and ionizing radiation.

## Electrostatic Discharge (ESD)

ESD, or static shock, is caused by rapid discharge of electrical energy from one body to another. ESD is common in conditions of low humidity, such as those resulting from heating or air conditioning. To avoid damage to transducers, electronics or system, use anti-static spray on carpets and linoleum, and anti-static mats.

The Terason Ultrasound System complies to a level of  $\pm 2\text{kV}$  ESD. The latch for locking the ultrasound transducer and the FireWire port is sensitive to ESD and should not be touched when operating the system. In cases where an ESD shock discharges to one of these points, the computer program may freeze or windows may open unexpectedly. In these cases, the Terason software may require restarting, and you may have to close extra windows. In extreme cases, the computer may require restarting. These events are not dangerous to the patient or to the operator.

## Liquids

The Terason transducer, electronics envelope, and computer are not protected from spilled liquids. The transducer array is watertight up to the strain relief, as specified in [Pre-Cleaning](#) on page 274. If the computer is exposed to liquids or moisture, purchase a keyboard drape. In addition, the Terason Ultrasound System electronics must be draped if exposed to liquids or moisture.

## Couplants

Use only couplants specifically designed for ultrasound examinations. Do not use mineral-oil or vegetable-based couplants, which can damage transducers.

## Heat

Do not expose transducers to direct heat such as strong sunlight or local heat sources. Heat ages the crystal and causes loss of sensitivity.

## Latex

Terason strongly recommends that health-care professionals identify their latex-sensitive patients, and refer to the FDA's March 29, 1991 Medical Alert on Latex products. Be prepared to treat allergic reactions promptly.

## Care

Ultrasound transducers and your Terason Ultrasound System are fragile. Handle with care. If the transducer appears damaged, or misuse of the electronics envelope causes a malfunction, please return the equipment to Terason for service or replacement.



---

**Warning:** Do not drop the ultrasound transducer! If you accidentally drop the transducer, check it carefully for damage. Perform a sample scan to make sure it operates correctly. If not, contact Terason for service or replacement.

---

## Immersion

Do not immerse the transducer connector. If the cable connector is immersed, **do not** plug the connector into the system. Rinse the connector under running water and dry it thoroughly. If necessary, contact Terason for service.

## System Labels

Several labels are attached to the Terason electronics envelope. The following sections describe what each label means.

Refer to the laptop user guide for information about its labels and regulatory compliance. Refer to the isolation transformer guide for information about its labels and regulatory compliance.

### Type BF Equipment Applied Part



The Terason Ultrasound System provides protection against electric shock. It is a Type BF applied part that has a lower leakage current than for non-BF applied parts.

### Terason Ultrasound System Emits Ultrasound Energy



This device complies with FDA Track 3 guidelines on acoustic output labeling for the intended uses of the transducers.

### Indoor Use Only



This device is intended for indoor use only.

### CE Mark



The Terason Ultrasound System conforms to all applicable European Directives - specifically, the Council Directive Concerning Medical Devices 93/42/EEC. The number adjacent to the CE marking (0413) is the number of the EU-notified body that certified meeting the requirements of Annex II of the Directive.

### U.S. and Canada Safety Standards



This certification mark indicates that the Terason Ultrasound System has been tested to and meets the minimum requirements of widely recognized U.S. and Canadian product safety standards. It also means that the manufacturing site has been audited, and that Terason has agreed to a program of periodic factory follow-up inspections to verify continued conformance.

## See User Guide



This label indicates that the user should refer to the User Guide for information on using this equipment.

## On/Off Indicator (Isolation Transformer)



The power switch on the Isolation Transformer shows these symbols. The | symbol represents on (power connected to the power mains), and the ○ symbol represents off (power is disconnected from the power mains).

## Shipping Label Icons

The following symbols appear on the shipping label.

### Environmental



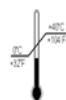
The Terason Ultrasound System must be stored in the original shipping container in environments with 15% to 90% relative humidity and non-condensing.

### Air Pressure



The Terason Ultrasound System must be stored in the original shipping container in environments between 63 kPa (472.5 mmHg) and 101.3 kPa (759.8 mmHg) air pressure.

### Temperature



The Terason Ultrasound System must be stored in the original shipping container in environments between 0° and 40° C (32° and 104°F).


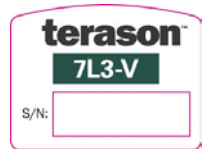


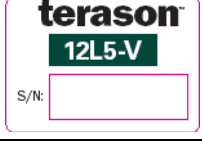
## Terason Transducers

Each Terason transducer has a label that indicates its model and serial numbers:

### Terason Transducer Models

Label	Description
	Phased-linear array transducer with a maximum depth of 240 mm and a user-controllable field-of-view

Terason Transducer Models (Continued)

Label	Description
 <p>terason™ 5C2-A S/N: <input type="text"/></p>	Curved linear array transducer with a maximum depth of 200 mm and a user-controllable field-of-view
 <p>terason™ 7L3-V S/N: <input type="text"/></p>	Linear wideband array transducer with a maximum depth of 130 mm and a user-controllable field-of-view used for veterinary applications
 <p>terason™ 8EC4 S/N: <input type="text"/></p>	Convex-linear endocavity array transducer with a maximum depth of 140 mm and a 130° field-of-view
 <p>terason™ 12HL7 S/N: <input type="text"/></p>	Angled-head linear wideband array transducer with a maximum depth of 70 mm and a user-controllable field of view
 <p>terason™ 12L5-V S/N: <input type="text"/></p>	Linear wideband array transducer with a maximum depth of 80 mm and a user-controllable field of view

## 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 on a black-and-white printer.

To print the User Guide, you must connect your laptop to a printer, or to a network that connects to 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. 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.

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**.

## Getting Help

To help you get the most out of the Terason Ultrasound System, Terason provides several resources in addition to this user guide.

### Terason Online Help

To access the help, select the **Help > Help Topics** menu. The Help window has three tabs on the left used to view information on the right:

- |                 |  |
|-----------------|--|
| <b>Contents</b> | Double-click a book (  ) to open it. Click on a topic (  ) to view it. |
| <b>Index</b>    | Enter the entry you want, or scroll to find a topic, then double-click a selection.  |
| <b>Search</b>   | Enter the word to search for, press <b>Enter</b> , and double-click a topic.   |

### Terason Ultrasound System User Guide

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

To read the Terason Ultrasound User Guide online, complete these steps:

1. Click the **Start** button in the lower left of the screen.
2. Select **Programs > Terason > Terason User Guide**.  
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 Guide** (for Acrobat Reader 4.0) or **Help > Reader Help** (for Acrobat Reader 5.0) from the menu bar.

### Windows Online Help

For help with the Windows operating system, click the **Start** button in the lower left of the screen, and click **Help**. The Windows Help system opens. This help works the same as the [Terason Online Help](#); see page 25.

### Your Laptop or Desktop Computer

If you have questions or need more information about the computer itself, refer to the user guide that came with your specific system.

## Contacting Terason

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

### By Mail

Terason™, a 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](mailto:techsupport@terason.com)

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

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

[www.terason.com](http://www.terason.com)

# 1 About the Terason Ultrasound System

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. The Terason software can run on a desktop or laptop computer. You can also connect the computer to a VCR or a printer for image output.

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

- [About Ultrasound Modes](#) on page 27
- [Support for Medical Procedures](#) on page 34
- [Terason Transducers](#) on page 35

## 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**

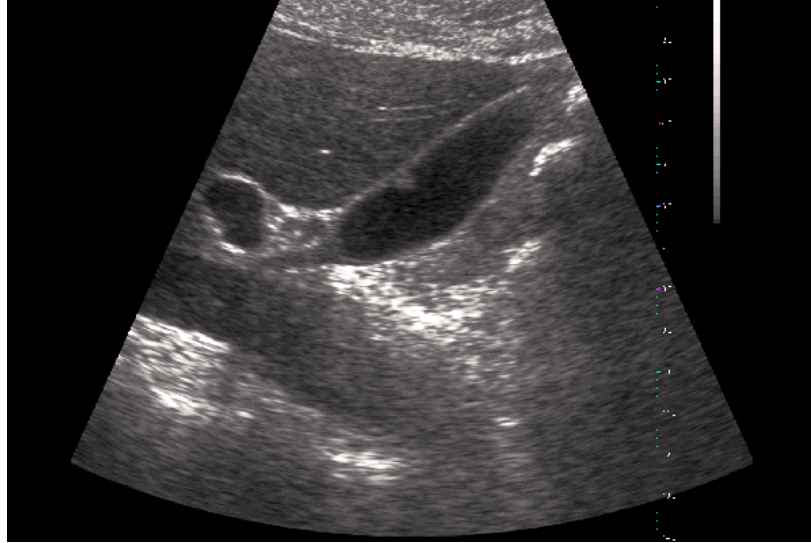
Mode	Standard	Advanced	Optional
2D	X	X	
M-Mode	X	X	
Directional Power Doppler	X	X	
Power Doppler	X	X	
Color Doppler		X	
Pulsed Wave Spectral Doppler		X	
Triplex			X

Triplex scan mode is available only with the AD version. Triplex provides both simultaneous and non-simultaneous scanning of Pulsed-Wave Doppler with either Power Doppler, Color Doppler, or Directional Power Doppler in the same Image Display window.

## 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 transducers.

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



**Example 2D Scan**

To use 2D, see:

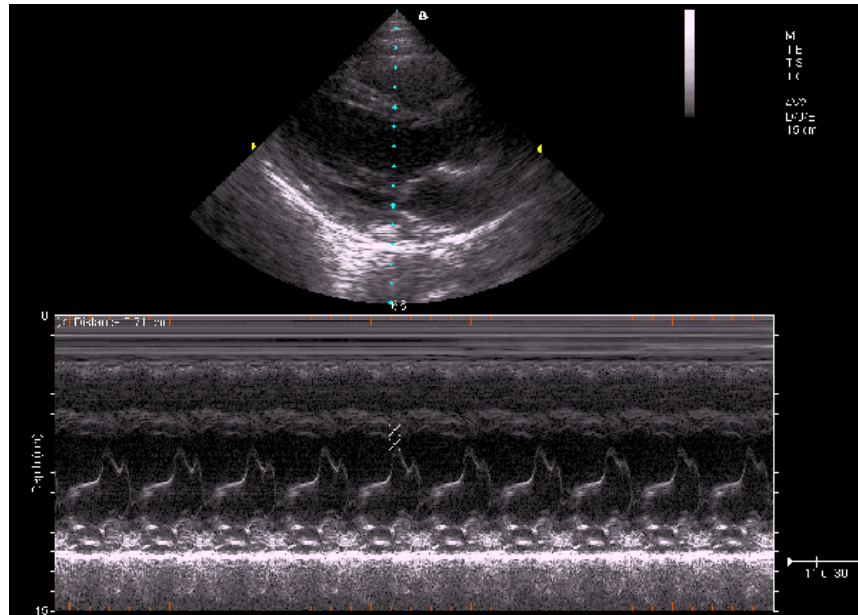
- [Acquiring Images](#) on page 67
- [Using 2D and I.Q. Controls](#) on page 91
- [Controls on the I.Q. Image Control Window](#) on page 99

## M-Mode (Motion Mode)

The Terason Ultrasound System provides simultaneous 2-dimensional (B-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 Image Display 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 67
- [Using M-Mode Image Controls](#) on page 105
- [Measuring in the M-Mode Window](#) on page 184

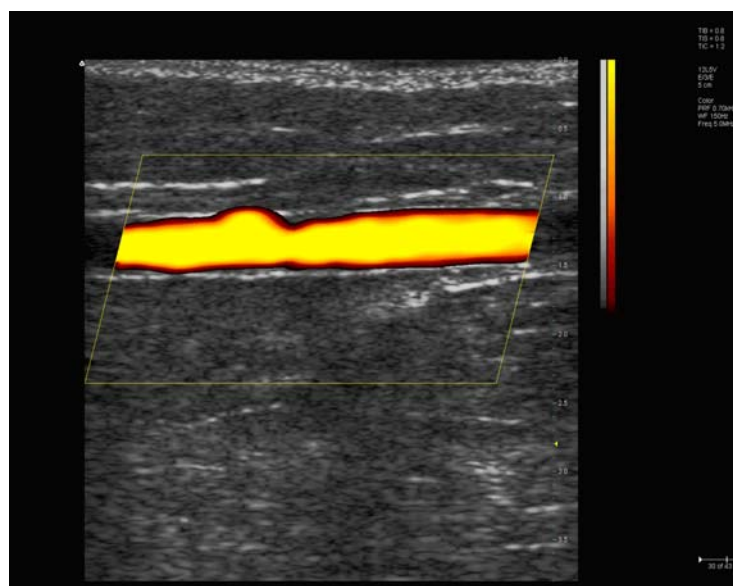
## Power Doppler

Conventional Power Doppler shows blood flow by displaying the density of red blood cells, as opposed to their velocity. Large amplitude signals are assigned a bright hue, and weak signals are assigned a dim hue. For example, the jugular vein is shown in brighter colors than the carotid artery because the jugular vein contains more red blood cells at any given time than does the carotid artery. All flows display in shades of the same color; no directional information is provided. You also can choose to apply a high frame rate or high resolution to control the quality of the scan.

In general, Power Doppler is more sensitive than Color Doppler. Amplitude estimation is less noisy than a mean frequency estimate. Therefore, Power Doppler detects and displays more real signal. Power Doppler is more sensitive to low flow than Color or Directional Power Doppler. The increased sensitivity means that Power Doppler is less angle-dependent than Color Doppler, and does not alias.

Power Doppler is the preferred mode to show perfusion and contour of vessel lumen.

The Power Doppler scan data displays in the 2D Image Display window as shown in the following figure.



### Example Power Doppler Scan

For more information on using Power Doppler mode, see:

- [Acquiring Images](#) on page 67
- [All image control settings on the PWD tab remain available.](#) on page 116

## 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 transducer is assigned shades of red, and flow away from the transducer 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 transducer – flow towards the transducer produces a higher-frequency signal than flow away from the transducer. 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 transducer, 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 transducer.

The Color Doppler scan data displays in the 2D Image Display 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 67
- [All image control settings on the PWD tab remain available.](#) on page 116

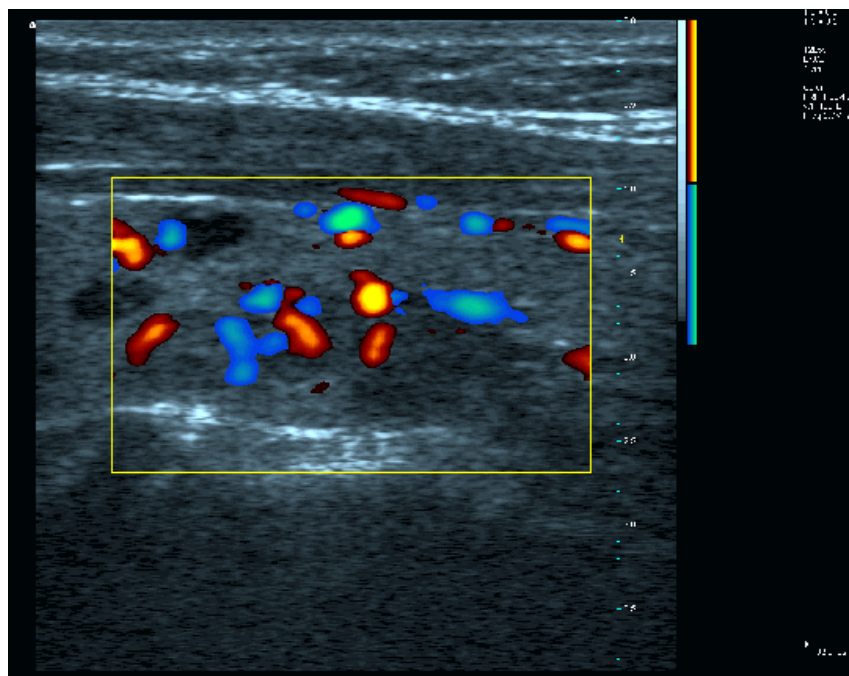
## Directional Power Doppler

Directional Power Doppler (DirPwr) is a combination of some features of conventional Power Doppler and of Color Doppler. It provides the increased sensitivity of conventional Power Doppler, plus the directional information derived from Color Doppler.

Directional Power Doppler does not provide an estimate of the velocity of blood flow. The color palette is proportional to the strength of the Doppler signal. This mode allows you to obtain good-quality images of deep arteries and other tissue. You also can choose to apply a high frame rate or high resolution to control the quality of the scan.

The Directional Power Doppler scan data displays in the 2D Image Display window.





### Example Directional Power Doppler Scan

For more information on using Directional Power Doppler, see:

- [Acquiring Images](#) on page 67
- [All image control settings on the PWD tab remain available.](#) on page 116

## Pulsed-Wave Doppler

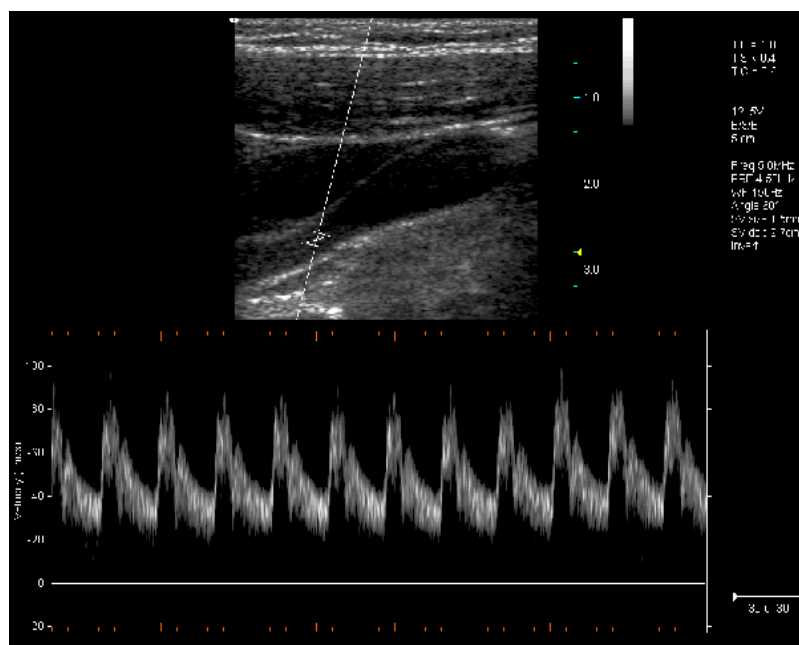
A Pulsed-Wave Doppler (PWD) scan produces a series of pulses used to study the motion of blood flow at a small region along a desired scan line, called the sample volume or sample gate.

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 Image Display 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 scan line 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.

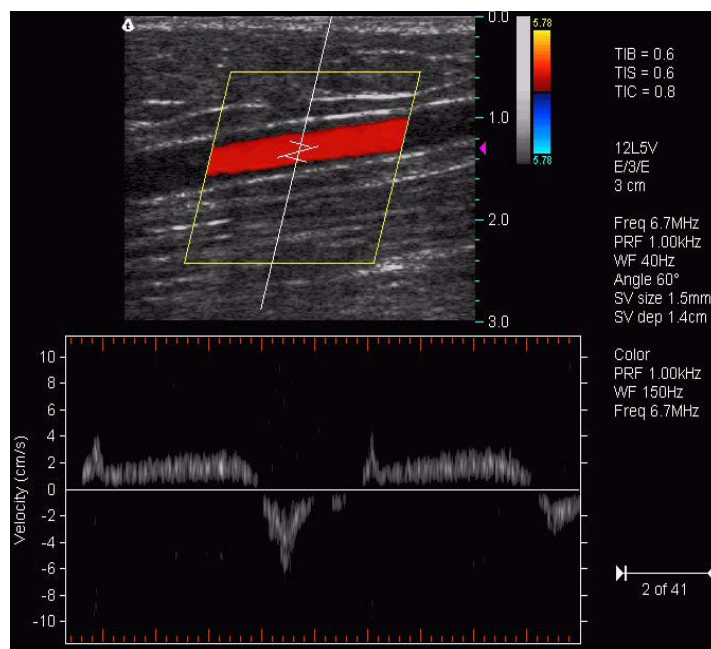
For more information on using Pulsed Wave Spectral Doppler, see:

- [Acquiring Images](#) on page 67
- [Using the PWD Image Controls](#) on page 108
- [Measuring in the PWD Window](#) on page 185

## Triplex

Triplex scan mode combines simultaneous or non-simultaneous Doppler imaging (Color Doppler, Directional Power Doppler, or Power 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 67
- [Using Continuous Wave Doppler Image Controls](#) on page 126

## Support for Medical Procedures

The Terason Ultrasound System can be configured with needle guides used for tissue biopsy, fluid aspiration, amniocentesis, and catheter placement. The Terason Ultrasound 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 the system. 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 28
- [Color Doppler](#), see page 30
- [Directional Power Doppler](#), see page 31
- [Power Doppler](#), see page 29

See [Performing Medical Procedures](#) on page 135 for information on using the Terason Ultrasound System to perform biopsies.

## Terason Transducers

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

The following table describes the supported transducers.

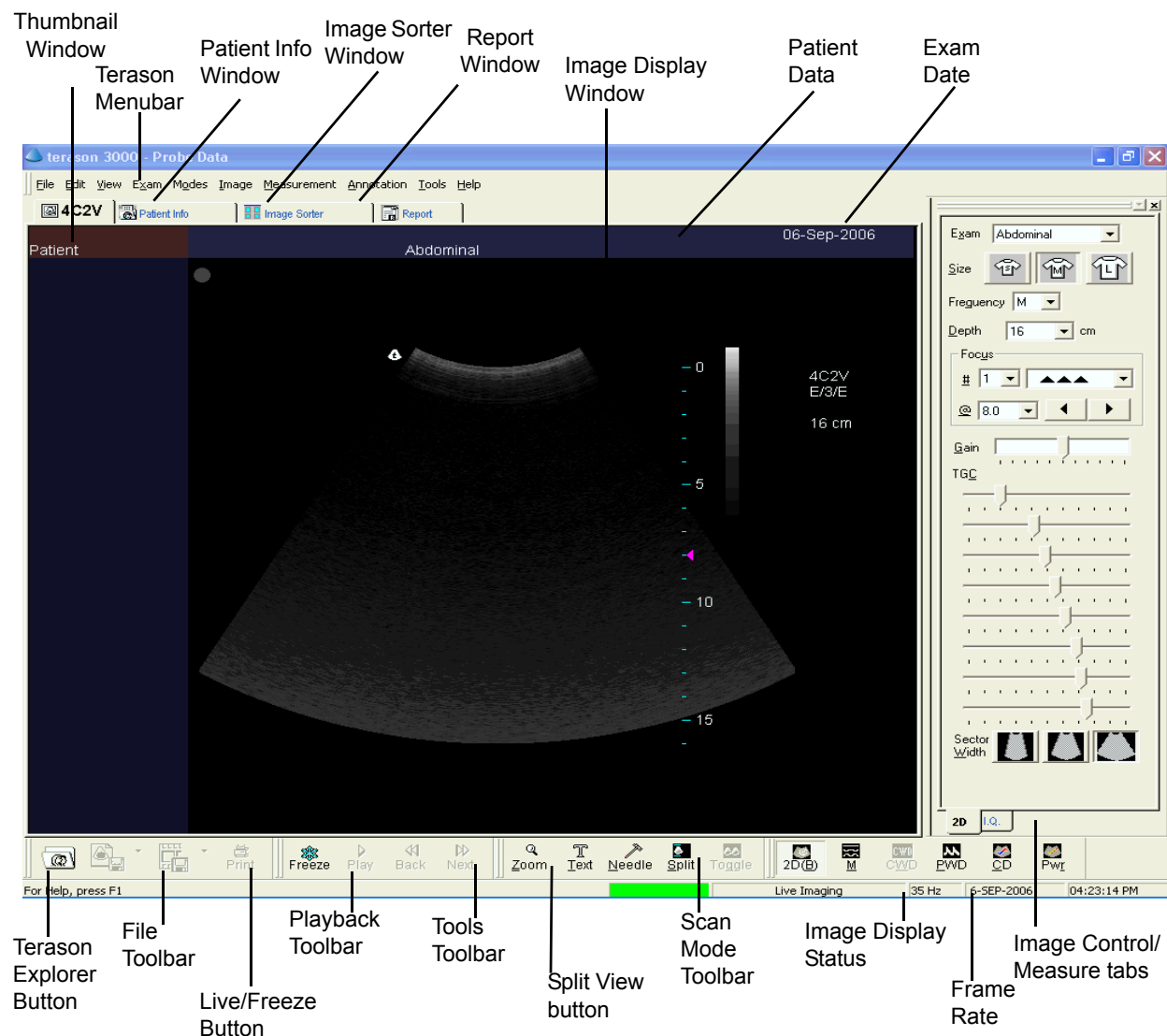
**Terason Transducer Specifications**

Transducer	Elements	Array Type	Applications	
4V2	64	Phased	Adult abdominal OB/GYN Cardiac	Abdominal vascular Fetal heart Renal
5C2A	128	Curved Linear	Adult abdominal OB/GYN Fetal heart	Abdominal vascular Renal
7L3	128	Linear	Dialysis access Small parts Musculoskeletal Peripheral vascular	Cerebrovascular Medium depth arterial and venous studies Breast
8EC4 (t3000 only)	128	Tightly curved	Endovaginal Infertility Early OB	General GYN Prostate
12HL7	128	Linear	Intra-operative Vascular Intra-operative (Neuro) Laparoscopic	Pediatric Small Organ
12L5V	128	Linear	Dialysis access Small parts Musculoskeletal Peripheral vascular	Extracranial vascular Medium depth arterial and venous studies Breast

The Terason Ultrasound System also allows you to connect more than one transducer to a hub, and then connect the hub to a laptop or desktop computer. This configuration lets you switch transducers without having to disconnect any cables. Refer to the Configuration Guide that came with your system for instructions.

## About the Terason Main Screen

When you start the Terason software, the main screen displays.



### Terason Main Screen

If a control, button, or menu shows in gray, it usually means that the function is not available for the current circumstances. For example, you cannot use the save, print, or playback tools with a live image, so those items are gray. You can add additional toolbars to the window using View on the Toolbars menu.




**Note:** The gray-unavailable condition does not apply to the tabs at the bottom of the Image Control window; visible tabs are always available. The tabs are gray when they are not selected.

The location of the toolbars and relative positioning of the windows may appear different on your computer. You can move many of these items to different locations, and you can hide them to make more room for the Image Display window. See [Moving Windows and Toolbars](#) on page 285 for instructions on moving toolbars and windows to different locations.

For complete descriptions of the menus and toolbars available in the Terason software, see Appendix B - [Menu and Toolbar Reference](#).

## Terason Explorer Window

The **Terason Explorer** window lets you find patient or image files. This window shows the directory structure of the Patient and Image folders that store all patient information files and saved images and image loops.

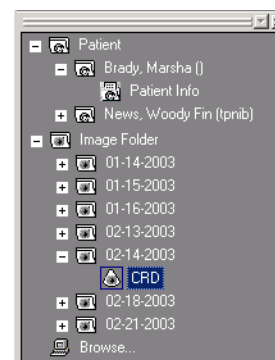
To open the Terason Explorer window, click the Explorer button .





The files listed in Terason Explorer window are stored at the following default location on your computer's hard disk:

C:\Program Files\Teratech\Terason 3000

This directory includes the following folders:

- Patient
- Image



To expand a folder and view its contents, click the . The  changes to a  and shows a list of files. To hide the contents of a folder, click the . You can also double-click a folder name to open or close it. For information on using the Terason Explorer window to locate patient and image files, see [Finding Files in the Terason Explorer](#) on page 151.

## Image Display, Patient Info, and Image Sorter Windows

These windows use the same space on the computer screen. Click a tab to open that window. The tab for the Image Display window shows the name of the connected transducer (4V2 in the example). You might see any Terason transducer model as the name of this tab (if that transducer is connected). If you have more than one transducer connected to the computer, there is a tab for each transducer.

The Image Display 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.

To use these windows, see:

- [Working with Scan Modes](#) on page 90
- [Setting Up Patient Information](#) on page 60
- [Finding Stored Images and Loops](#) on page 151
- [Finding Files in the Image Sorter Window](#) on page 154

## Toolbars

The toolbars provide quick access to menu items. For example, the Scan Mode toolbar contains buttons that correspond to the menu items in the Modes menu. [Terason Main Screen](#) on page 36 shows the default set of toolbars. You can also show the Exit, Full, and Transducer toolbars.

You can hide or show any toolbar using View in the Toolbars menu or by right-clicking in the toolbar area and selecting the needed toolbar. If you hide a toolbar, you can still access those functions by using the menu bar or a shortcut key. See [Toolbar Reference](#) on page 299 for a description of the available toolbars, and [Shortcut Keys](#) on page 287 for a list of the shortcut keys.

## Image Control Bar/Measure Tabs

The Image Control bar shows tabs that let you configure settings to adjust the scanned image and make measurements on frozen images.

### Live Imaging Control Tabs

For live imaging, the Image Control bar shows the following tabs:

- 2D and I.Q. tabs for 2D imaging
- Additional tab for the selected scan mode

### Frozen Image Control Tabs

When the image is frozen or when a ULT file is loaded, following the Image Control bar tabs are available:

**Tabs Displayed When Image Frozen or ULT File Loaded**

Mode	Tabs Available	
2D	I.Q.	2D Measure
M-Mode	I.Q.	M Measure
	2D Measure	
CWD	I.Q.	CWD
	2D Measure	CWD... (CWD Measure)
PWD	I.Q.	PWD
	2D Measure	PWD... (PWD Measure)
CD	I.Q.	CD
	2D Measure	

**Tabs Displayed When Image Frozen or ULT File Loaded (Continued)**

Mode	Tabs Available
Pwr	I.Q. Pwr 2D Measure

For a loaded file in a format other than ULT, this window shows an Info tab. See [Storing Images and Loops](#) on page 146 for information about viewing saved files.

For information about how the image controls for the scan modes work, see Chapter 5, [Working with Scan Modes](#), on page 90.

For information about using the Measure tabs, see Chapter 8, [Working with Measurements](#), on page 169.

## 2 Installing Software

When you purchase the Terason Ultrasound System, it comes with all the required software already installed on the laptop. You may never need the information in this chapter unless you upgrade your system, or if you want to install the Terason Ultrasound System on a computer that was not provided by Terason.

If you must install, uninstall, or configure part of the Terason Ultrasound System, instructions for the following operations are included in this chapter:

- [Installing Terason Software](#) on page 40
- [Upgrading Terason Software](#) on page 42
- [Uninstalling Terason Software](#) on page 44
- [Installing the FireWire Terason Transducer Driver](#) on page 45
- [Installing the Terason DICOM Utility](#) on page 47
- [Licensing the Terason Software](#) on page 54

For information on connecting hardware components, or if you must reinstall the computer's operating system, refer to the Configuration Guide that came with your system.

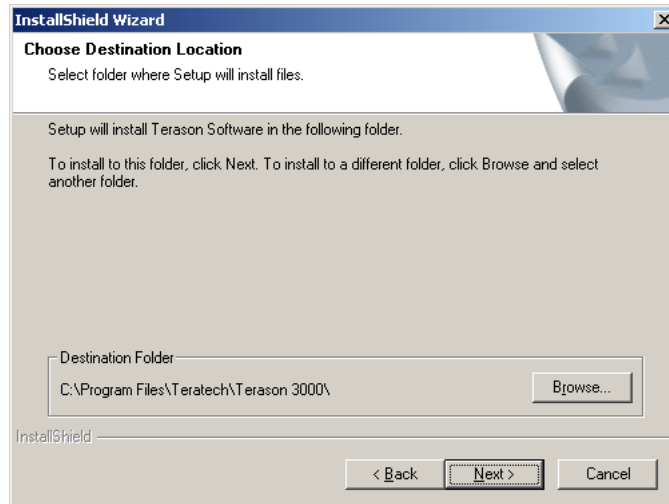
### Installing Terason Software

Terason Ultrasound System are shipped with all required software installed on the laptop. You do not need to complete the following procedure unless you want to install the Terason Ultrasound System on a computer that was not provided by Terason.

When ready, complete these steps:

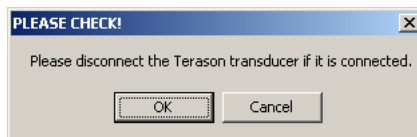
1. Exit all applications including email, and **unplug** the Terason engine from the laptop if it has already been installed.
2. Insert the **Terason CD** into the CD-RW drive. An InstallShield message displays as it prepares to install the software, then the Welcome dialog box opens.
3. Click **Next>**. The License Agreement dialog box appears. Read the License Information carefully.
4. Click **Yes**. The Choose Destination Location dialog box opens.





#### InstallShield Wizard for Choosing the Destination

5. Click **Next>** to install the application in the default location. To select a different location, click Browse and navigate to a different directory (not recommended). The wizard reminds you to unplug the Terason Transducer.



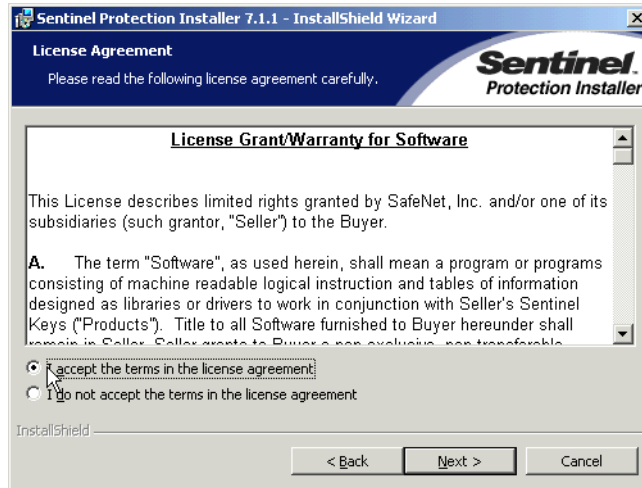
#### Reminder to Unplug the Transducer

6. Click **OK**. The installer copies files from the CD to the computer.
7. The Install shield opens again, to install the Sentinel Protection Installer. When the Welcome dialog box opens, click **Next >**.



#### Sentinel Installer Welcome

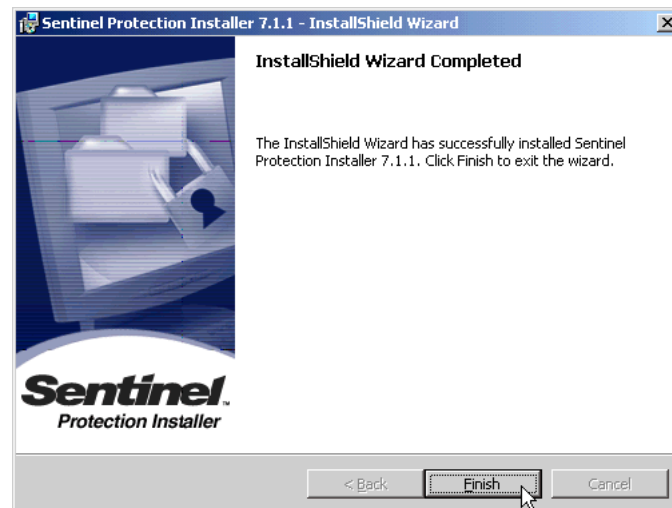
8. On the License dialog box, read the license agreement, then click the **I accept . . .** radio button and Next >.



9. On the Setup Type dialog box, click **Next >**.

10. On the Ready to Install dialog box, click **Install**.

When finished, the installer displays a setup complete message.



#### Installation Complete Message

If you see “Rebooting is required,” you must restart your computer before you use the Terason software.

11. Click **Finish**.

## Upgrading Terason Software

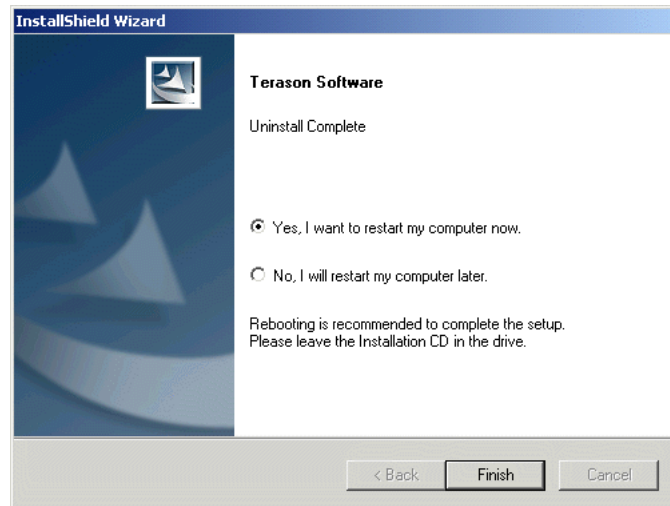
When upgrading software, the Terason installer first removes the existing version, and then installs the new version.

To upgrade to a newer version of the Terason software, complete these steps:

1. Exit all applications and **unplug** the Terason transducer from the engine.
2. Insert the **Terason CD** into the CD-RW drive. The Uninstall dialog opens.

3. Click **Next>**. The Confirm Uninstall dialog box opens.
4. Click **OK** to confirm. If you see a dialog box that includes a check box, select the Don't display this message again check box and click **Yes**.

The installer removes all of the previous Terason software and displays a completion message, recommending that you reboot.



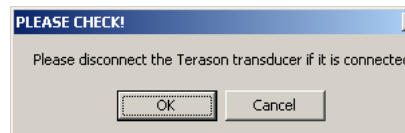
#### Uninstall Complete Dialog Box

5. Click **Finish**. Keep the Terason CD in the drive and wait while the computer reboots (restarts).

After the computer finishes starting up, you may have to log on before proceeding.

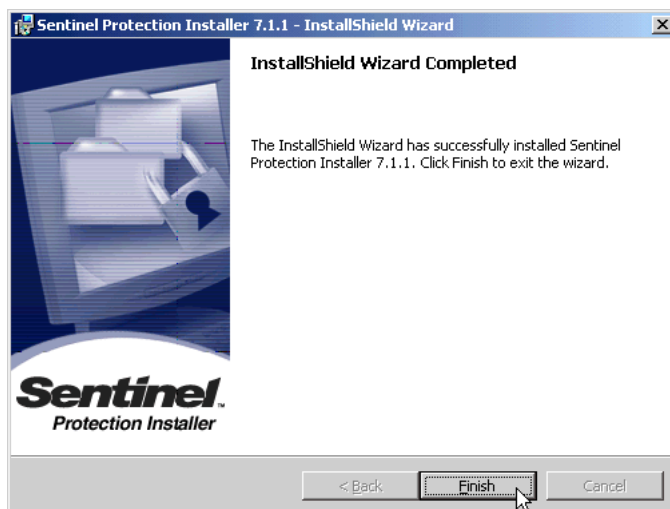
When you are logged in, the Welcome dialog for the new Terason application opens.

6. Click **Next>**. The License Agreement dialog appears. Read the License Information carefully.
7. Click **Yes**. The Choose Destination Location dialog box opens.
8. Click **Next>** to install the application in the default location. You can click Browse to select a different location (not recommended). The wizard reminds you to unplug the Terason Transducer.



#### Reminder to Unplug the Transducer

9. Click **OK**. The installer copies the files to the selected location. When finished, the installer displays a setup complete message.



#### Installation Complete Message

If you see “Rebooting is required,” you must restart your computer before you use the Terason software.

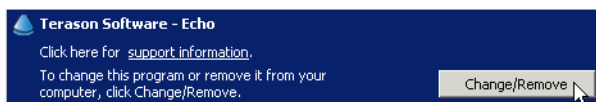
#### 10. Click **Finish**.

Remember to connect the transducer.

## Uninstalling Terason Software

You do not need to manually uninstall the current version of software when you upgrade software. To permanently remove the Terason application, complete these steps:

1. Click **Start** in the Windows task bar.
2. Select **Settings > Control Panel**. The Control Panel window opens.
3. Double-click **Add/Remove Programs**
4. Scroll down the list of programs and click to select **Terason Software - Echo**.



#### Uninstalling the Terason Software

When you select an application, the listing expands to show the size of the files, frequency of use and the date the program was last used.

5. Click **Change/Remove**.
6. Click **Next>** to proceed with the uninstall.
7. Click **OK** to confirm.
8. Click **Finish** to complete the uninstall process.

## Installing the FireWire Terason Transducer Driver

If you purchased the laptop from Terason, all the required drivers are already installed and you need not perform the procedure in this section. If you installed the Terason software on a computer or laptop purchased from another source, the steps you must take vary, depending on the system configuration of the specific computer.

If you start the Terason software and do not see any messages about the Terason transducer, the driver software is already installed and you need not perform this procedure. Complete this procedure only if you see a “Digital Signature Not Found” or “New Hardware Found” message.

When the Terason transducer is connected to your PC, you may have to install the device driver for the operating system to recognize the new hardware. After you plug in the Terason transducer for the first time, make sure your computer is turned on, and wait approximately one minute.

Use these guidelines to determine how to install the driver:

- If you do not see any messages about the Terason transducer, the driver is already installed, and you can skip this procedure
- If you see a Found New Hardware message box, start with Step 1, below.

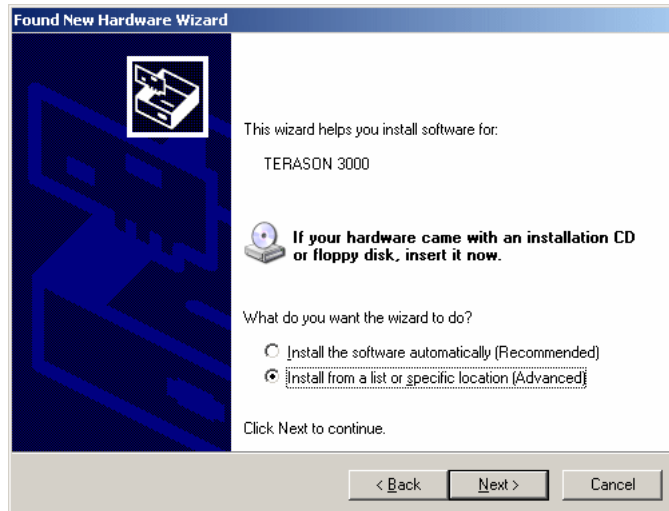


### Found New Hardware Wizard

Complete these steps to install the driver (starting from the Found New Hardware window):

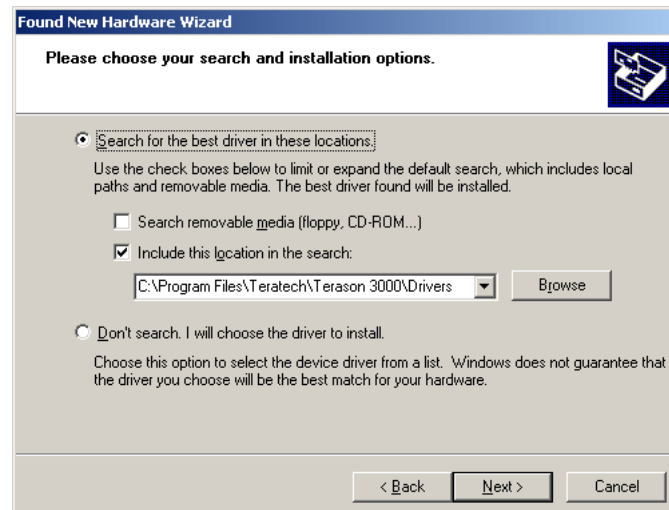
1. Click **Next>**.

The New Hardware Wizard window changes to allow you to install hardware device drivers.



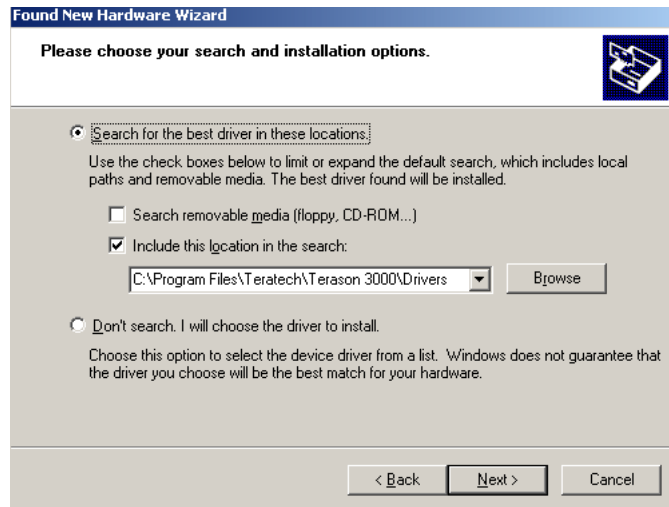
### Selecting From a List or Location

2. Select **Install from a list or specific location (Advanced)** and click **Next>**.



### Including a Location

3. Clear the **Search removable media (floppy, CD-ROM...)** check box.
4. Select the **Include this location in the search:** check box.
5. Click **Browse**.
6. Navigate to the **Program Files** folder on the C:\ drive.
7. Double-click the **Teratech** folder, then double-click the Terason 3000 folder. The complete path to the required folder is:  
C:\Program Files\Teratech\Terason 3000\Drivers
8. Click the Drivers folder to select it, then click **Open**.



#### Insert Disk With Path to Drivers

9. Click **Next>**. The drivers install.
10. Click **Finish**.



## Installing the Terason DICOM Utility

The Terason software must be installed before you can install the DICOM Send/Print utility or use the DICOM Worklist utility. See [Installing Terason Software](#) on page 40 for instructions on installing the Terason software.

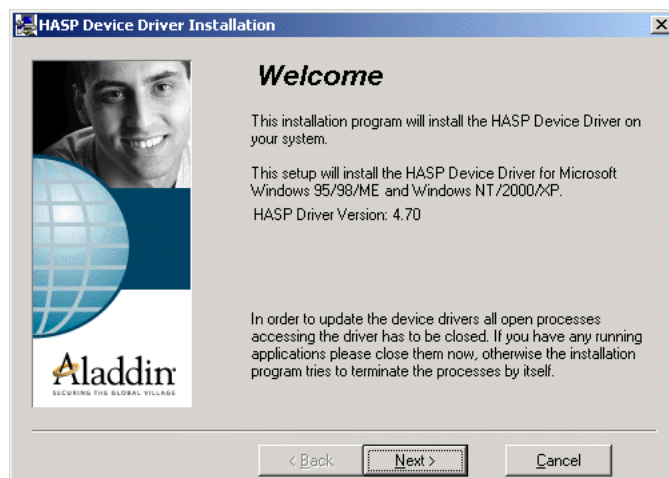
After installing the driver, you must configure it to set up the destination DICOM server and printer. After the utility is configured, follow the instructions in [Printing Files to a DICOM Printer](#) on page 225 or [Sending Files to a DICOM Server](#) on page 225 to use the DICOM print and export functions. See [Using DICOM Worklist](#) on page 225 for instruction on using Worklist to retrieve patient information.

## Installing the DICOM Utility

To install the DICOM utility, complete these steps:

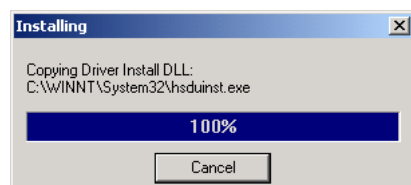
1. If necessary, **save** the active image or image loop. See [Saving Images and Loops](#) on page 148 for instructions.
2. **Exit** the Terason software using one of these methods:
  - Click  on the toolbar at the bottom of the window
  - Click  in the upper right corner of the window
  - Select **File > Exit**
3. Install the HASP Dongle Driver:
  - a. Insert the **installation disk** into the CD drive.
  - b. Open the HASP Dongle **Driver folder**.

- c. Double-click the **hdd32.exe** file. The Welcome box opens.



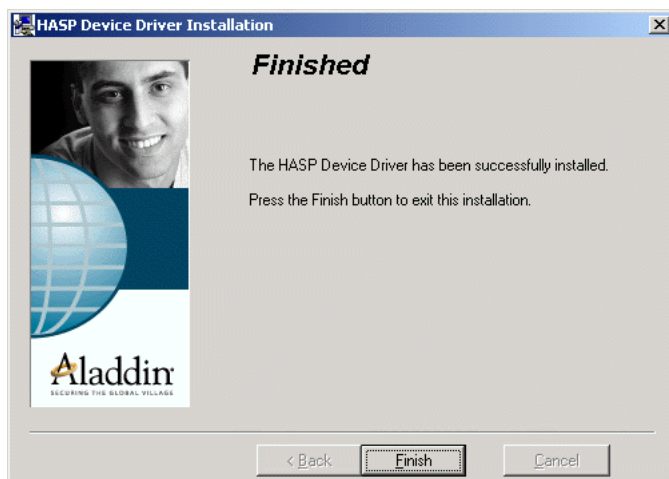
**HASP Welcome**

- d. Click **Next>**. The installation program installs the driver and displays a status message.



**HASP Installing Message**

When complete, the installation program displays the Finished message.

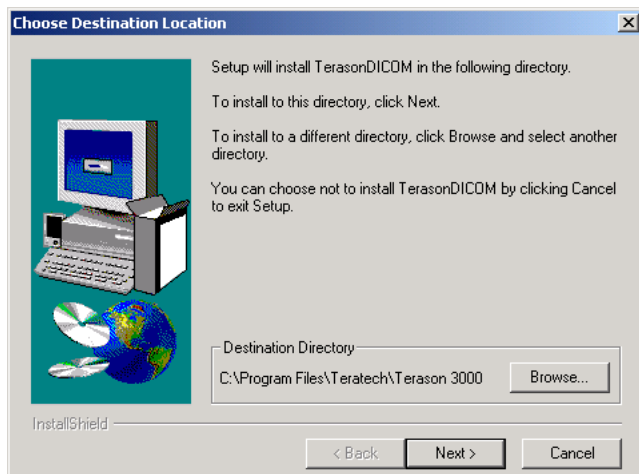


**HASP Installation Finished Screen**

- e. Click **Finish**.
4. Plug the dongle into one of the computer's **USB ports**.
  5. Install the DICOM Utility:
    - a. With the same installation disk in the CD drive, change to the **Install Disk** folder.

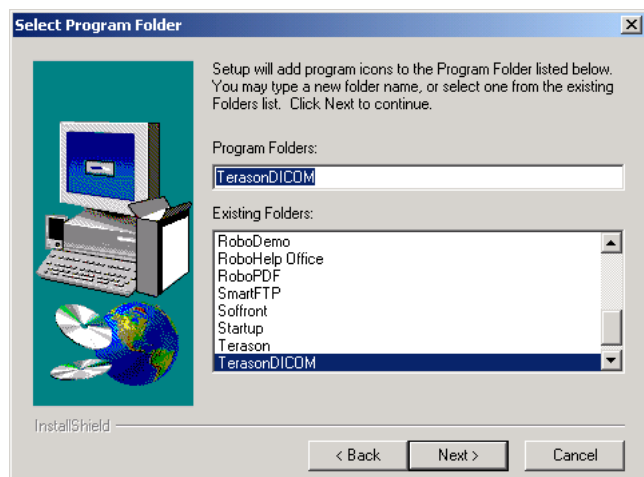


- b. Double-click the **Setup.exe** file. The installation program prompts you to choose where to install the utility.



#### Choosing Directory for Installation

- c. Click **Next>**. The installation program prompts you to select a program folder (for using the Start button to access the application).



#### Selecting Program Folder (Accessed from the Start Button)

- d. Click **Next>**. The installation program prompts you to confirm your choices.



#### Confirm Choices and Start Installation

e. Click **Next>**. The installation program copies all required files, then exits.

#### 6. Restart the computer.

When configuring the DICOM utility, you must enter network names, addresses, and other network details. Contact your network system administrator to get the needed information.

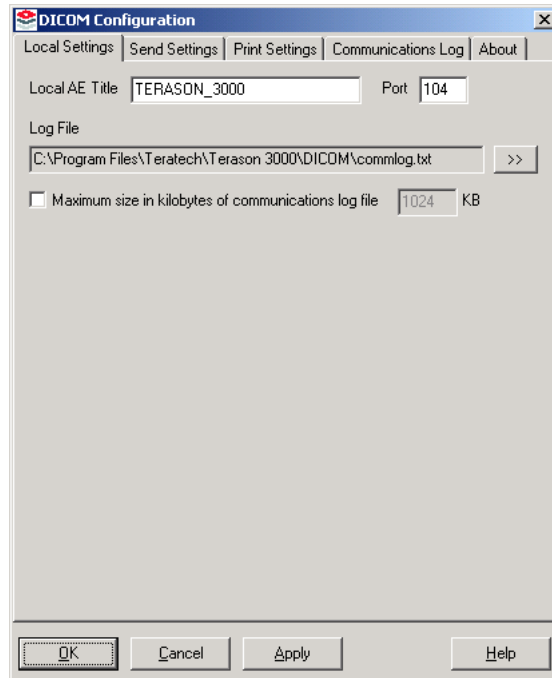
## Configuring the DICOM Utility

To configure the DICOM utility, complete these steps:

#### 1. Start the **configuration utility** using one of these methods:

- Double-click the DICOM icon  in the taskbar
- Select **Start > Programs > TerasonDICOM > Terason**.

The system opens the DICOM Configuration Window.



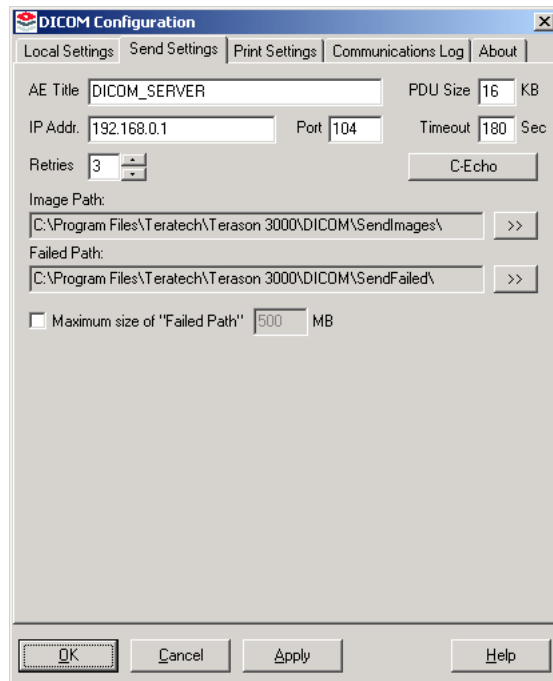
**DICOM Configuration Window / Local Settings Tab**

**2. Configure the **Local Settings** tab:**

- a. Verify that the Local AE Title and port number are correct for your DICOM server. The default values are TERASON\_3000 and 104, respectively. Your server or network configuration may require different values, especially if your facility has more than one Terason Ultrasound System.
- b. If necessary, select a different path and file name for the communication log by clicking the >> button and using the Windows dialog boxes to select a different location.
- c. To limit the size of the communications log file, select the check box and enter a value in the KB text box. When the maximum size is reached, the system overwrites the oldest entries.
- d. Click **Apply**.

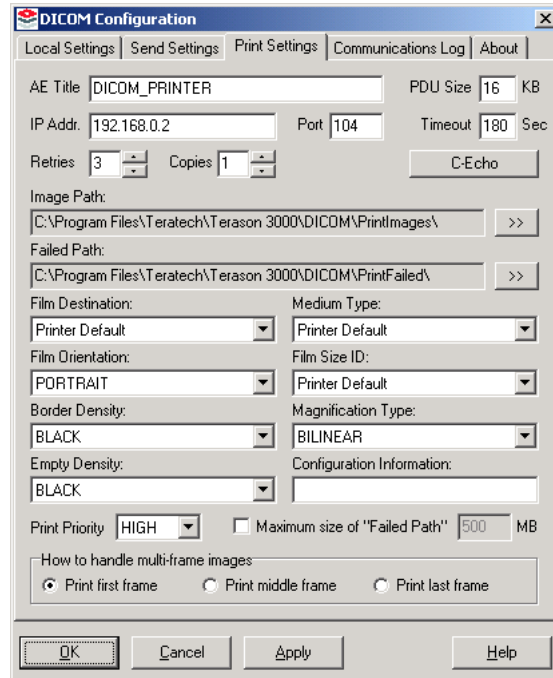
**3. Configure the **Send Settings** tab (settings apply to a server where DICOM files are stored):**

- a. Click the **Send Settings** tab to bring it to the front.



**DICOM Configuration Window / Send Settings Tab**

- b. Enter the name of your DICOM server in the **AE Title** field.
  - c. Enter the IP address or DNS node name of the DICOM server in the **IP Addr.** field.
  - d. Enter the DICOM server's port number in the **Port** field.
  - e. If your DICOM server requires different values, **edit** the PDU size, Timeout, and Number of Retries boxes as necessary.
  - f. Click the **C-Echo button** to test whether or not the server is active on the network.
  - g. If necessary, you can change the **image path** (where the computer temporarily stores DICOM files) by clicking the **>>** button and browsing to a different location.
  - h. If necessary you can change the **failed path** (where the DICOM files are moved if they cannot be successfully sent after the indicated number of retries) by clicking the **>>** button and browsing to a different location.
  - i. To limit the disk space consumed by DICOM files in the Failed Path, you can select the check box and enter a **MB value**. If you do, the system overwrites oldest files first when the maximum size is reached.
  - j. Click **Apply**.
4. Configure the **Print Settings tab** (settings apply to a printer that will print DICOM files):
  - a. Click the **Print Settings** tab to bring it to the front.

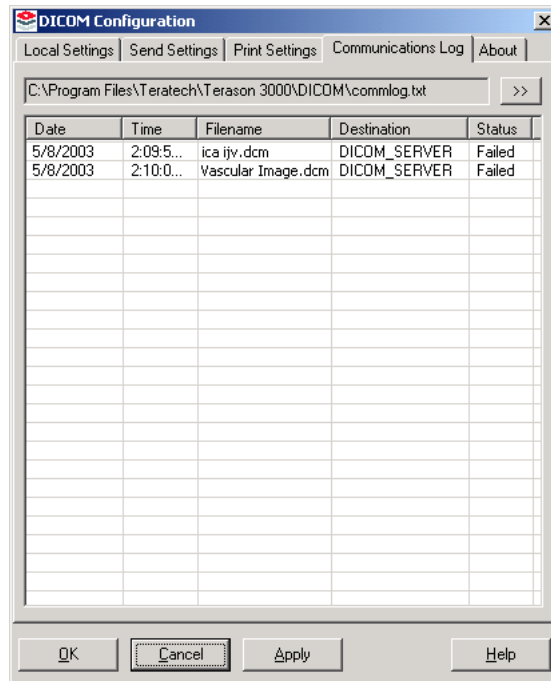


**DICOM Configuration Window / Print Settings Tab**

- b. Enter the name of your DICOM printer in the **AE Title** text box.
- c. Enter the IP address or DNS node name of the DICOM printer in the **IP Address** text box.
- d. Enter the DICOM printer's port number in the **Port** field.
- e. If your DICOM printer requires different values, edit the PDU size, Timeout, and Number of Retries boxes as necessary.
- f. Click the **C-Echo button** to test whether or not the printer is active on the network.
- g. If necessary, edit the number of copies to print (default value is 1).
- h. If necessary, change the image path (where the computer temporarily stores DICOM files) by clicking the **>>** button and browsing to a different location.
- i. If necessary, change the failed path (where DICOM files are moved if they cannot be successfully sent after the number of retries) by clicking the **>>** button and browsing to a different location.
- j. To limit the disk space consumed by DICOM files in the Failed Path, select the check box and enter a MB value. If you do, the system overwrites oldest files first when the maximum size is reached.
- k. Change the default values for the Film Destination, Medium Type, Film Orientation, File Size ID, Border Density, Empty Density, Magnification Type, Configuration Information, and Print Priority to meet your requirements or if needed by the DICOM printer.
- l. Do not change the "How to handle multi-frame images" setting (the Terason software does not print multi-frame images).
- m. Click **Apply**.

5. Click **OK**.

You need not configure the Communications log. You can click the Communications Log tab to review the contents of the log file:



**DICOM Configuration Window / Communications Log Tab**

Each line in log file contains this information about a file sent to a DICOM server or printer:

- Date
- Time
- File name
- Destination
- Status

If you see Failed images in the Status column, you should use the Terason software to resend those files to the server or printer, as appropriate. See [Sending Files to a DICOM Server](#) on page 225 for instructions.

## Licensing the Terason Software


When installed, the Terason software can be used for a 30-day evaluation period without entering a license number. You can obtain the license number by phone or email. While waiting for the number, you can use the Terason software, however, you must enter the license number before the evaluation period expires.

This section explains the following operations:

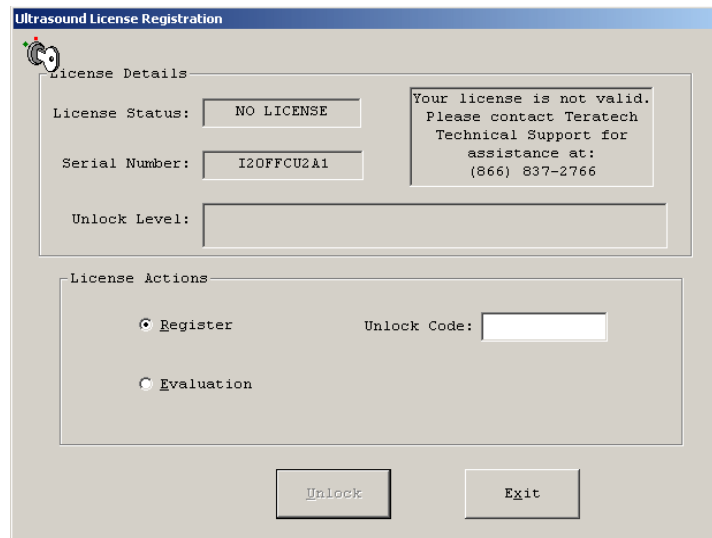
- [Entering the License or Evaluation Unlock Code](#) on page 55
- [Extending the Evaluation Period](#) on page 56
- [Transferring the License](#) on page 56
- [Upgrading the License](#) on page 58

## Entering the License or Evaluation Unlock Code

To license the Terason software, complete these steps:

1. Start up the Terason software using either of these methods:
  - Double-click the shortcut **icon**, , on your computer desktop
  - Click the **Start** button, and select **Programs > Terason > Terason**.

The Ultrasound License dialog box opens.



The dialog box is titled "Ultrasound License Registration". It contains two main sections: "License Details" and "License Actions".

**License Details:**

- License Status:** A dropdown menu showing "NO LICENSE".
- Serial Number:** A text field containing "I2OFFCU2A1".
- Unlock Level:** An empty text field.
- Message:** A text box stating: "Your license is not valid. Please contact Teratech Technical Support for assistance at: (866) 837-2766".

**License Actions:**

- Register:** A radio button that is selected.
- Evaluation:** A radio button that is not selected.
- Unlock Code:** An empty text field.

At the bottom, there are two buttons: "Unlock" and "Exit".

**Ultrasound License Dialog Box**

2. To register by **phone**, call Terason at 1-866-TERASON (1-866-837-2766) and give the Terason Support Representative the Serial Number shown in the dialog box.
3. To register by email, send an **email** message to **techsupport@Terason.com** and provide these details:
  - Serial number (see the Terason Ultrasound License Registration dialog box)
  - Computer serial number (on a label on the bottom of the laptop)
  - Company nameYou will receive, by phone or return email, a 10-digit unlock code.
4. To use the software without entering the code, click **Continue Ultrasound**.
5. To enter the code, type the unlock code into the text field and click **Unlock**. The Terason software updates the status to Licensed.
6. Click **Continue Ultrasound**. The Terason software starts up.

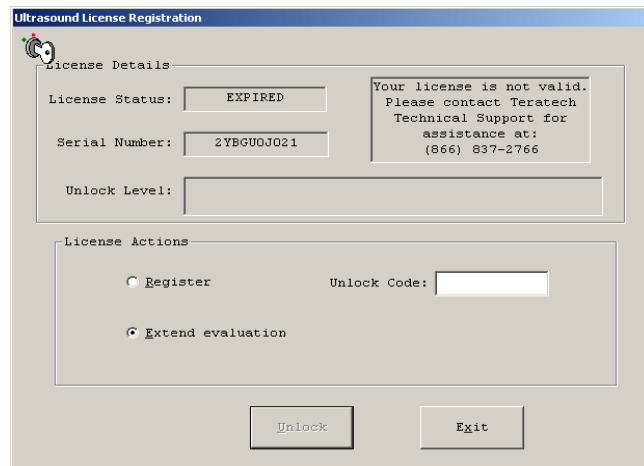
## Extending the Evaluation Period

If your evaluation period expires and Terason has agreed to extend the evaluation period, you must enter a new unlock code. To do so, complete these steps:

1. Contact Terason **Technical Support** at 1-866-837-2766. During this procedure, you must give a serial number to Technical Support and receive a new unlock code.
2. Start up the Terason software using either of these methods:

- Double-click the shortcut icon, , on your computer desktop
- Click the **Start** button, highlight **Programs > Terason > Terason**.

The Ultrasound License dialog opens.



**Ultrasound License Dialog Box**

3. Click in the option box for **Extend Evaluation**.
4. Read the new **Serial Number** to Terason Technical Support. Technical Support will give you a new 10-digit unlock code.
5. Type the unlock code into the text field and click **Unlock**. The Terason software updates the status to Evaluation.
6. Click **Continue Ultrasound**. The Terason software starts up.

## Transferring the License

You can transfer the Terason software license from one computer to a second computer. In this section, “first” refers to the computer where the software was initially installed and “second” refers to the computer to which you will transfer the license.

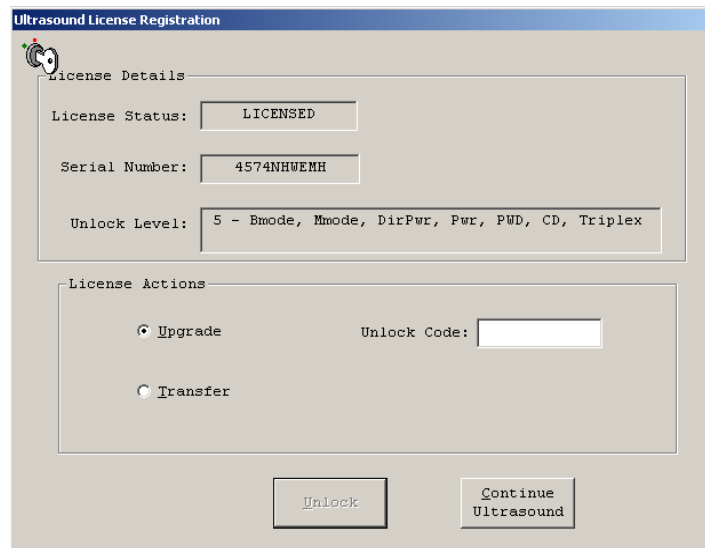
Before you start this procedure, you must determine the serial number of the destination PC. This number is not the serial number on the PC, but an application serial number assigned by Terason.

To transfer the license, complete these steps:

1. On the second computer, install the Terason **software** as described in [Installing Terason Software](#) on page 40.



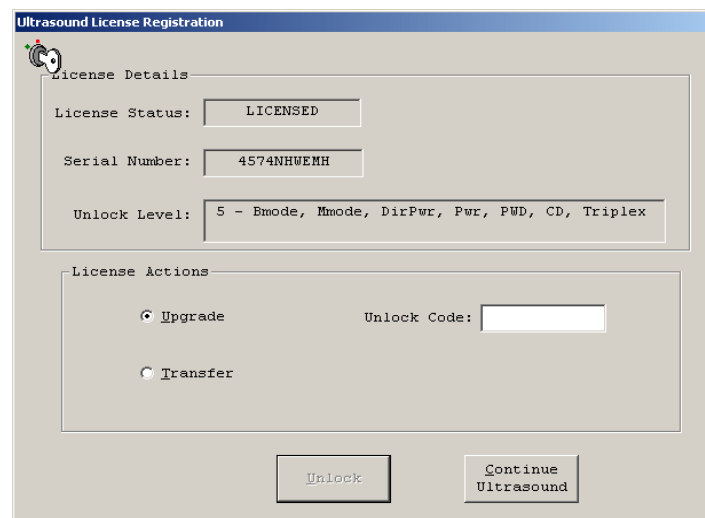
2. Double-click the Terason **shortcut**  on the second computer's desktop. The Ultrasound License Registration window opens.



**Ultrasound License Registration Window**

3. Write down the **Serial Number**. Do *not* close the window.
4. On the first computer, start the Terason software.
5. Select **Help > License**.

The Ultrasound License Registration window opens.



**License Registration Window**

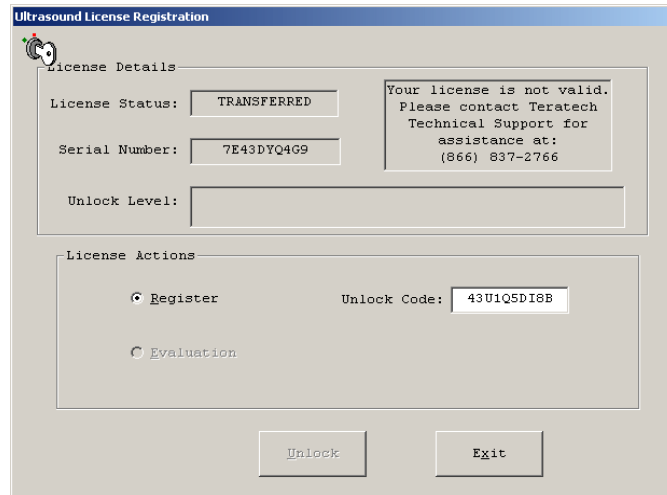
6. Click the **Transfer** radio button.
7. Enter the **number** you wrote down in step 3 in the Transfer PC Serial Number field. The Transfer button remains gray until you enter the correct number of digits in the field.
8. Click **Transfer**. The Terason software displays this warning message:

Transferring the license to another computer will remove the license from this computer. Ultrasound will no longer be able to run on this computer until the license is transferred back or another license is purchased. Do you want to continue?

9. Click **Yes**. The Terason software displays this instruction:

Enter the unlock code on the transferred computer.

10. Click **OK**. The Terason software displays the unlock code you must enter on the second computer.



#### Unlock Code to Transfer to a Second Computer

11. Write down the **Unlock Code**.
12. Click **Exit**. The Terason software quits.

If you start the Terason software on the first computer again, you will see the License dialog shown here. Note that the unlock code shown above will not enable the software on this computer. You must contact Terason for a different unlock code.

13. On the second computer, enter the **unlock code** you wrote down in Step 11. The Unlock button remains gray until you type the correct number of characters.
14. Click **Unlock**.


You can no longer use the Terason software on the first computer. If you try to start it, you will see the License Registration dialog box showing the License Status as transferred, and you cannot run the software.

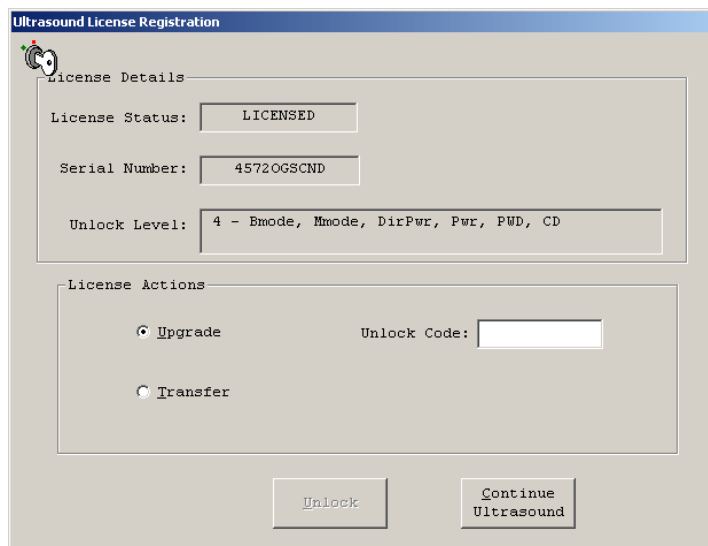
See [Uninstalling Terason Software](#) on page 44 for instructions on removing the Terason software from the first computer.

## Upgrading the License

You can purchase additional options for the Terason Ultrasound System. For example, if you originally bought the ST (standard) version of the system, you can later upgrade to the AD (advanced) version. To upgrade the software, you must contact Terason Technical Support to obtain a new unlock code.

To upgrade the Terason Ultrasound System, complete these steps:

1. Double-click the short-cut **icon**, , on your computer desktop to start the application.
2. Select **Help > License**. The software shows the license dialog box.



#### Evaluation Period Dialog Box

3. Click the **Upgrade** radio button.
4. Contact Terason **Technical Support** and read the serial number to the Support Representative. The Representative will give you an unlock level number and an 10-digit unlock code.
5. Enter the **Unlock Code**.
6. Click **Unlock**. The Terason software upgrades the features of your Terason Ultrasound System.
7. Click **Continue Ultrasound**.

### 3 Setting Up Patient Information

Although you can scan a patient without entering any information about that patient, 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 folder for the specific patient, along with a patient information file. If you do not enter patient details, the image is stored in a folder with other images and is not associated with a specific patient.

To work with patient information, you should understand:

- [Using the Patient Info Window](#), see page 61
- [Adding a New Patient](#), see page 61
- [Preparing Patient Info for an Exam](#), see page 64
- [Updating Patient Information](#), see page 65
- [Deleting a Patient Folder](#), see page 66

To view the Patient Info window, click the Patient Info tab.

**Patient Info Window**

These examples show loaded information. Double-click the Patient Info file in any patient's folder to load existing data.

Patient information remains loaded until one of these events occurs:

- You load a different patient's information
- You open an image or loop in the Image Display window for a different patient
- You click the **New Patient** button or select **File > New Patient**

## Using the Patient Info Window

When entering text in this window, you can use these **Edit** menu items:

### Edit Menu Items for the Patient Info Window


Menu Name	What it Does
Undo	Undoes the most recent cut, text typing, or deletion
Cut	Removes the selected text from the field and stores it in a system clipboard. Clipboard text can be pasted into any field in this window, or as text into another document
Copy	Copies the selected text without removing it and stores it in a system clipboard. Clipboard text can be pasted into any field in this window, or as text into another document
Paste	At the location of the cursor, inserts the last text cut or copied
Delete	Removes the highlighted text

The buttons at the bottom of the window provide these functions:

### Description of Buttons in the Patient Info Window

Button	What It Does
Save	Saves new or modified patient information
New Patient	Clears the Patient Info window so you can add a new patient
Cancel	Undoes any edits or entries you made
Help	Provides access to the online Terason Help system

You can also use the **File** menu to access the Save Patient and New Patient functions.

You can print the contents of the Patient Info window by clicking  or selecting **File > Print**.

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 225.

## Adding a New Patient

If you need to start the ultrasound exam immediately, the Terason software lets you skip entering patient information. However, if you save the image it will not be associated with this patient, and no patient information will be saved with or displayed on the scan. You can enter patient information after starting such an exam (by clicking the Patient Info tab),

and saved images will then be associated with the patient info file. You can also enter the patient info later, then open the saved image. When you save the image again, it is associated with the patient info file.

When you add a new patient, the Terason software creates a folder in the Patient folder with the patient's name. In that folder, the Terason software stores the Patient Info file and all saved scans for that patient.



#### Patient Info File in the Terason Explorer Window

The folder in the Patient list for John Adams contains the Patient Info file and two dated folders, each containing one or more scans that were saved on the indicated date. Starting an exam after creating or opening a patient info file creates a new date folder and a report file. The report file and any saved images are saved in the date folder.

The Terason software uses the Image folder to store all images that were saved without entering patient information. Each folder in the Image folder contains all images that were saved without patient information on the indicated date.

When you enter a patient name, the total number of characters of the first, last, and middle name is limited to 64 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 64 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. Click the **Patient Info** tab.
2. Click **New Patient**. If unsaved data is entered, the Terason software prompts you to save your changes.



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

3. Enter the **last name**.

4. Enter the **first name**.
5. Enter the **middle name**.
6. Enter a **patient ID** (sometimes called a Medical Record Number).  
You can enter up to 64 alphanumeric or special characters. You can *not* use any of the following characters in the Patient ID field:  
\* \ | : " < > / ?
7. If appropriate, enter a **study ID** number using up to 16 alphanumeric characters.
8. 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.
9. Enter the patient's **date of birth** in this format: MM-DD-YYYY.  
You can use the calendar tool to enter the date by following these steps:
  - a. Click the down-arrow to view the calendar.



#### Calendar Tool

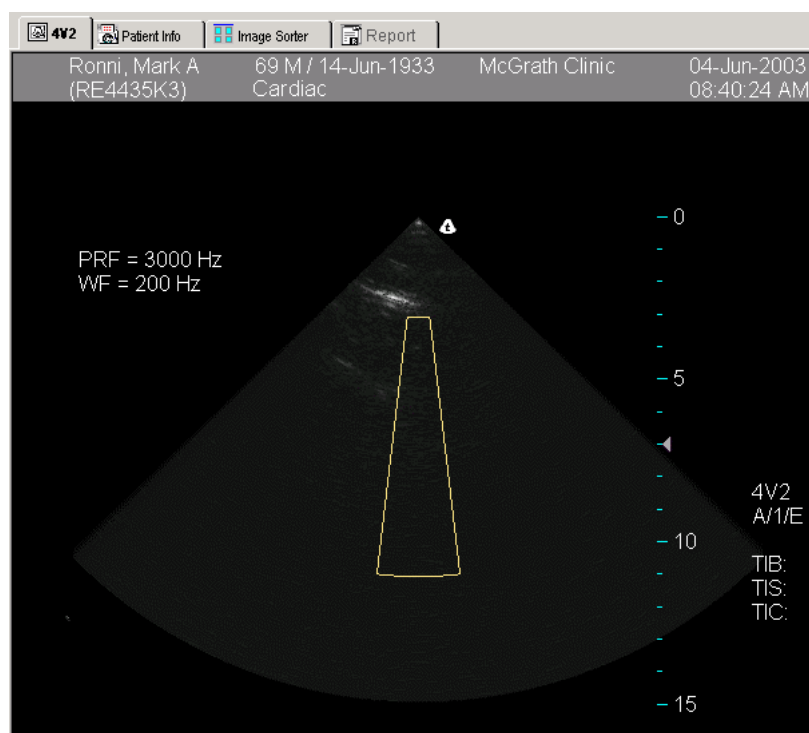
- b. Click the left or right double arrows to choose a different year.
  - c. Click the left or right single arrows to choose a different month.
  - d. Click the day.
10. Click in the check box for the patient's **gender**: M for male or F for female.
11. Enter the patient's **height and weight**. To change the units of measurements used, see [Setting the Units for Patient Measurements](#) on page 247.
12. Enter any **comments**. You can type directly in the field, or click Extended Comment to type a longer comment.
13. In the **Location**: field, enter where the exam is taking place. You can enter up to 46 alphanumeric characters.
14. In the **Clinician**: field, enter the name of the clinician performing the exam. You can enter up to 46 alphanumeric characters.
15. Use one of these methods to save your entries:

- Click the **Save** button
- Click the Image Display tab
- Select **File > Save Patient**

The patient information is saved in a Patient Info file and displays in the Terason Explorer window in a folder with that patient's name. The Image Display window is ready for you to conduct the exam.

The Terason software displays the patient information in the Image Display 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.

If you do not see the patient information, select **View > Image Display Properties > Patient Information**.



**Patient Information at the Top of the Image Display Window**

This scan shows an empty scan in Power Doppler mode. You are now ready to conduct the ultrasound exam.


## Preparing Patient Info for an Exam

Before you perform an ultrasound exam, you should load the patient information, and enter details about the exam.

To prepare the Patient Info window for an exam, complete these steps:

1. Find the **patient** in the Terason Explorer window.



- Click the  in front of the patient's name. The folder expands and you can see the Patient Info file, and any image folders for that patient.



#### Patient Info File

- Double-click the **Patient Info** file. The Terason software loads the saved patient information into the Patient Info window and at the top of the Image Display window.




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

- If necessary, click the **Patient Info** tab to make it active.
- Optional: In the **Location:** field, enter where the exam is taking place. You can enter up to 46 alphanumeric characters. If you previously entered a location for this patient, you can click the down-arrow and choose an existing location (by default, the site for the most recent exam displays in the field).
- Optional: In the **Clinician:** field, enter the name of the clinician performing the exam. You can enter up to 46 alphanumeric characters. If you previously entered a clinician for this patient, you can click the down-arrow and choose an existing clinician (by default, the clinician for the most recent exam displays in the field).
- Enter any needed **comments**.
- Click **Save**.

You are now ready to scan the patient.

## Updating Patient Information

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

- Click  in front of the patient's name in the Patient folder in the Terason Explorer window.
- Double-click the **Patient Info** file.
- If necessary, click the **Patient Info** tab to make it active.
- Enter the **new information** in the appropriate fields.
- To edit the comment, click **Extended Comment** and make any needed changes.
- Click **Save**.

## Deleting a Patient Folder

You cannot directly delete a Patient Info file, however, you can delete a patient's folder and the Terason software will delete all Patient Info files within that folder. If the folders contain any saved images, those files are also deleted.

To archive the patient information file and its associated images before you delete them, see [Backing Up Files on a CD](#) on page 157.



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**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 folder, including saved scans, before you perform this procedure.

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To delete a patient folder, complete these steps:

1. In the Terason Explorer window, locate the **patient's name**.
2. Right-click the patient's folder and select **Delete**.

The Terason software prompts you to verify that you really want to delete the Patient Info file.

3. Click **Yes**.

The Terason software prompts you to verify that you really want to delete the folder and all its contents.

4. Click **Yes**.

## 4 Acquiring Images


To support image acquisition, you must understand:

- [Starting and Exiting the Software](#) on page 67
- [Conducting an Ultrasound Exam](#) on page 67
- [Freezing Images](#) on page 72
- [Working with Image Loops](#) on page 72
- [Determining Image Status](#) on page 73
- [Adjusting the Displayed Image](#) on page 74
- [Adding Guides to the Image Display](#) on page 78
- [Changing the Text Size](#) on page 79
- [Using Split Screen Mode](#) on page 80
- [Working with Annotations](#) on page 82
- [Switching Transducers](#) on page 89

To adjust the acquired scan data, see [Chapter 5 - Working with Scan Modes](#).

### Starting and Exiting the Software

You can use either of these methods to start up the Terason software:

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





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**Note:** When running a laptop on battery power, always check the amount of power left. The system beeps when the battery is getting very low. For information on checking the battery power status for your computer, refer to the computer manual

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Make sure you save or print any images or loops before exiting the software. You can use any of these methods to exit the Terason software:

- Click the  button at the bottom of the Terason window
- Click the  icon at the top right of the menu bar
- Select **File > Exit** from the menu bar

### Conducting an Ultrasound Exam

In general, complete these steps to conduct an exam:

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

2. Start **live imaging**.
3. Select an **exam type**.
4. Select a **scan mode** and adjust image controls.
5. **Freeze** the image.
6. Add **annotations** or measurements.
7. **Save** or print the image.







For more detailed instructions, complete the steps for the type of exam you must conduct. See the following sections:

- [Conducting a 2D or M-Mode Exam](#) on page 68
- [Conducting a PWD Exam](#) on page 70
- [Conducting a CWD Exam](#) on page 71
- [Conducting a Triplex Exam](#) on page 71

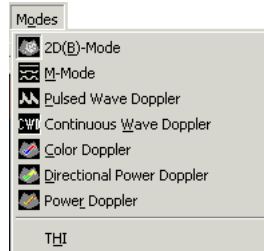
## Conducting a 2D or M-Mode Exam

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

1. If you use more than one Terason transducer, click the Image Display tab for the needed transducer.
2. Load or create the patient information. See Chapter 3, [Setting Up Patient Information](#), on page 60 for instructions.
3. Click the icon for the needed scan mode:

- For 2D, click 
- For M-Mode, click 
- For Color Doppler, click 
- For Pulsed-Wave Doppler, click 
- For Continuous-Wave Doppler, click 
- For Power Doppler, Click 

If you hid the Modes toolbar, you can also select a scan mode from the **Modes** menu.

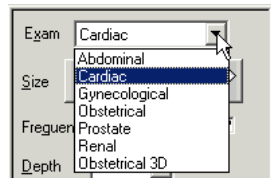


#### Scan Modes in the Modes Menu

You can also use shortcut keys to start scanning:

- **B** for 2D
- **M** for M-Mode
- **C** for Color Doppler
- **P** for Pulsed-Wave Doppler
- **W** for Continuous-Wave Doppler
- **D** for Directional Power Doppler
- **R** for Power Doppler

4. In the 2D Image Control tab, select an exam type from the Exam menu.




#### Choosing an Exam Type

The Terason software loads preset image control settings that are optimized for the selected exam and the connected transducer. See Chapter 9, [Working with Exams](#), on page 218 for information about exam types and defining your own exams.

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

5. If necessary, adjust the **2D image controls**. See [Using 2D and I.Q. Controls](#) on page 91 for instructions.
6. If necessary, adjust the **I.Q. image controls**. See [Controls on the I.Q. Image Control Window](#) on page 99 for instructions.
7. If necessary, adjust the **image controls** for the selected scan mode:


- For M-Mode, see [Using M-Mode Image Controls](#) on page 105.
  - For Color Doppler and Power Doppler scan modes, see [Using Color and Power Doppler Image Controls](#) on page 117.
  - For Pulsed-Wave Doppler scan mode, see [Using the PWD Image Controls](#) on page 108.
  - For Continuous-Wave Doppler scan mode, see [Using Continuous Wave Doppler Image Controls](#) on page 126.
8. Click . The Terason software automatically adds measure tabs to the Image Control window. The measure tabs include measuring tools for the selected scan mode (see Chapter 8, [Working with Measurements](#), on page 169 for instructions on using the measurement tools).
  9. Add **annotations** (see [Working with Annotations](#) on page 82) as needed.
  10. Save or print the ultrasound image. See [Saving Images and Loops](#) on page 148 and [Printing Images](#) on page 165.

## Conducting a PWD Exam


To conduct a Pulsed-Wave Doppler exam, complete these steps:

1. Conduct a 2D exam as described in [Conducting an Ultrasound Exam](#) on page 67 (do not freeze the scan).
2. Position the cursor in the 2D image where you want to set the range gate, then double-click.

You can also use any of these methods:


- Click 
- Select **Modes > Pulsed-Wave Doppler**
- Right click and select **Set PWD Gate**
- Type **P** when not in text mode


Click in the range gate and move it to the proper location.

3. Adjust any image control settings on the PWD tab as needed. See [Using the PWD Image Controls](#) on page 108 for instructions.
4. Click . The Terason software automatically adds the 2D Measure and PWD Measure tabs to the Image Control window (see Chapter 8, [Working with Measurements](#), on page 169 for instructions on using the measurement tools).
5. Add annotations (see [Working with Annotations](#) on page 82) as needed.
6. Save and/or print the ultrasound image. See [Saving Images and Loops](#) on page 148 and [Printing Images](#) on page 165.

## Conducting a CWD Exam

To conduct a Continuous-Wave Doppler exam, complete these steps:

1. Conduct a 2D exam as described in [Conducting an Ultrasound Exam](#) on page 67 (do not freeze the scan).
2. Go to CWD mode, using any of these methods:
  - Click 
    - Select **Modes > Continuous Wave Doppler**
    - Type **W** when not in text mode


Click in the range gate and move it to the proper location.
3. Adjust any image control settings on the CWD tab as needed. See [Using Continuous Wave Doppler Image Controls](#) on page 126 for instructions.
4. Click . The Terason software automatically adds the 2D Measure and CWD Measure tabs to the Image Control window (see Chapter 8, [Working with Measurements](#), on page 169 for instructions on using the measurement tools).
5. Add annotations (see [Working with Annotations](#) on page 82) as needed.
6. Save and/or print the ultrasound image. See [Saving Images and Loops](#) on page 148 and [Printing Images](#) on page 165.


## Conducting a Triplex Exam

To conduct a Triplex exam, complete these steps:

1. Conduct a Color Doppler, Directional Power Doppler, or Power Doppler **exam** as described in [Conducting an Ultrasound Exam](#) on page 67 (do not freeze the scan).
2. Position the cursor in the 2D image where you want to set the **range gate**, then double-click.

You can also use one of these methods:

- Click 
  - Select **Modes > Pulsed-Wave Doppler**
  - Type **P** when not in text mode

Click in the range gate and move it to the proper location.
- 3. Adjust any **image control settings** on the PWD tab as needed. See [Using Continuous Wave Doppler Image Controls](#) on page 126 for instructions.
- 4. Click . The Terason software automatically adds the 2D Measure and PWD Measure tabs to the Image Control window (see Chapter 8, [Working with Measurements](#), on page 169 for instructions on using the measurement tools).

5. Add **annotations** (see [Working with Annotations](#) on page 82) as needed.
6. Save or print the ultrasound image. See [Saving Images and Loops](#) on page 148 and [Printing Images](#) on page 165.

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 [Using Continuous Wave Doppler Image Controls](#) on page 126 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 Image Display window. The frozen frame can be saved as a single image file or an image loop. For M-Mode, PWD, CWD, 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 click Live without saving the image or image loop, you lose the temporarily-stored frames.

When performing an ultrasound scan, click  to freeze the displayed image (or select **Image > Freeze** from the menubar). You can then use the Playback toolbar or the arrow keys to move through the frames acquired during the scan (see [Working with Image Loops](#) on page 72).

To start a new scan, you can:

- Click 
- Select **Image > Live**
- Press the space bar



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**Note:** If you do not save the frozen image or loop, the frame data is lost when new data is acquired. When you start live imaging, all previous frames are erased. Make sure you save or print any needed images before you acquire new scan data.

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You can use the spacebar to freeze images and start live scanning when Text mode is not active. See [Typing Text on an Image](#) on page 85 for information on Text mode.





## 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 buttons on the Playback toolbar or the arrow keys to review an entire loop, frame by frame, to find a specific frame. You can also use the Playback buttons when viewing a saved loop.






### Playback Toolbar Buttons

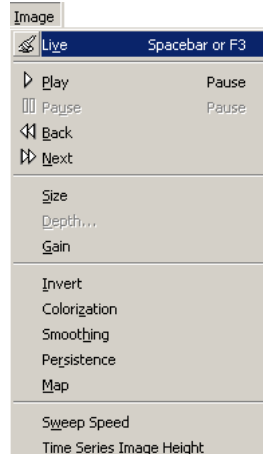
To select a specific frame to save as an image (not as a loop), make sure the image has focus. To do this the image area should have a blue dot in the upper left hand corner of the image area. Click  or  or the left and right arrow keys until the needed frame displays, then click . You need not select a different frame to save the scan as a loop: all acquired frames are saved in the loop when you click .

For 2D images the  and  are both active, and allow you to review the loop both forwards and backwards. For Color Doppler modes, you can only move the image forward.

To view a loop, click . The Play button changes to the Pause button. The loop plays continuously until you click the Live or Pause buttons. You can track the frames and the number of the current frame in the progress bar next to the Next button.

To stop a playing loop, click the Pause button.

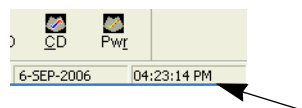
If you have hidden the Playback toolbar, you can use the **Image** menu to implement the Play, Pause, Back, and Next functions.



### Playback Functions on the Image Menu

## Determining Image Status

The Terason software continually displays an image status message at the bottom right of the main window, next to the frame rate (if displayed) for the Image Display window. In the example below, the message shows beneath the Modes toolbar. There is also a bar next to the status message. When this bar is green, the image is live. When the bar is gray, the image is frozen.



### Location of Image Status Message

You could see any of the statuses in the following table:

### Terason Status Messages

Image Display Window Status	Description
Initializing...	Starting up and verifying the connection to the transducer
Live Imaging	Actively acquiring scan data from the transducer
Frozen Image	Stopped acquiring data
Playing Loop	An acquired loop is playing
Paused Loop	An acquired loop was playing and is now paused
Single Image File	A Terason format (ULT) image file has been loaded
Playing Loop File	A loaded ULT file is playing
Paused Loop File	A loaded ULT file was playing and is now paused
BMP Image File	A bitmap file has been loaded
JPEG Image File	A JPEG file has been loaded
TIFF Image File	A TIFF file has been loaded
DICOM Image	A DICOM file (image or loop) has been loaded
Playing DICOM Loop	A loaded DICOM loop is playing
Paused DICOM Loop	A loaded DICOM loop was playing and is now paused
Playing AVI Video Clip	A loaded AVI file is playing
Paused AVI Video Clip	A loaded AVI file is paused

## Adjusting the Displayed Image


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

- [Enlarging an Area of the Image](#) on page 74
- [Resizing the Window](#) on page 75
- [Displaying the Image in Full Screen](#) on page 76
- [Hiding Windows and Toolbars](#) on page 76
- [Enhancing the Image Using TeraVision™ Optimization](#) on page 77

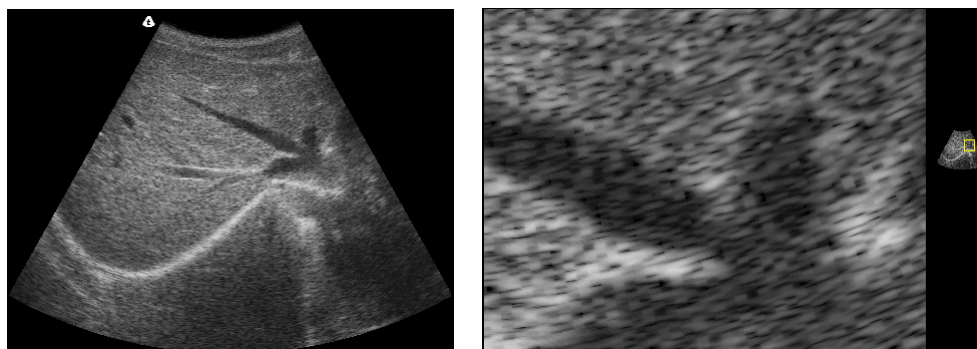
### Enlarging an Area of the Image

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 in on a portion of an image, complete these steps:

1. Click , click Z, or select **View > Zoom**.
2. Move the cursor to a corner of the area you want to magnify, click, move the mouse to the diagonal corner, and click.

The selected area is magnified and a small reference image called a thumbnail appears on the right to show which part of the image is enlarged.



**Normal Image (Left) and Zoomed Image with Thumbnail (Right)**

To return to the original image view, click  again.

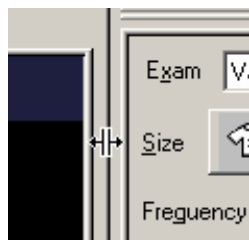
If you do not see the thumbnail or if you want to hide it, select **View > Image Display Properties > Zoom Thumbnail**. Clicking on this menu item toggles between showing and hiding the thumbnail. The Large Thumbnail option in this menu works with the Image Sorter tab, not with the zoom function.

Use the scroll bars if you must view obscured areas of the scan. Click the Zoom button to return the image display to normal view.


## Resizing the Window

You can change the size of the image by changing the size of the Image Display window. You can increase the size of the Image Display window by hiding the Terason Explorer or Image Control windows.

You can also drag the border between the Image Display window and an adjacent window to show less of the other window.




**Changing the Window Size**

When you place the cursor exactly between the two windows, the cursor changes to . You can then click the left mouse button and move that border in either direction to change the relative sizes of the two windows. When you resize a window, the Image Display window expands or contracts to fill the space available.

## Displaying the Image in Full Screen

You can set the Image Display window to encompass the entire display area of your monitor, including the area usually reserved for the menu and Windows task bar. You can use any of these methods:

- Click 
- Press the F11 key
- Select View > Full Screen

To return the Image Display window to its original size, press the F11 key. Alternatively, slide the cursor to the extreme top of the window. The menu display and you can select View > Full Screen to revert the Image Display window to its original size.

## Hiding Windows and Toolbars

When you show all of the Terason windows and toolbars, you have quick access to all of the software's functions. You can quickly locate a patient's information, choose an image mode, save or print images, and all of the other Terason functions.

However, the windows and toolbars take up room. To have more room for the actual scanned image, you can hide any of the windows and toolbars. You do not lose access to those functions; you can use the menus to select them.


For example, if you hide the Terason Explorer window and the File toolbar, you can use **Open** on the File menu to open a saved image. If you hide the Scan Modes toolbar, you can use the Modes menu or a shortcut key to select an image mode for scanning.

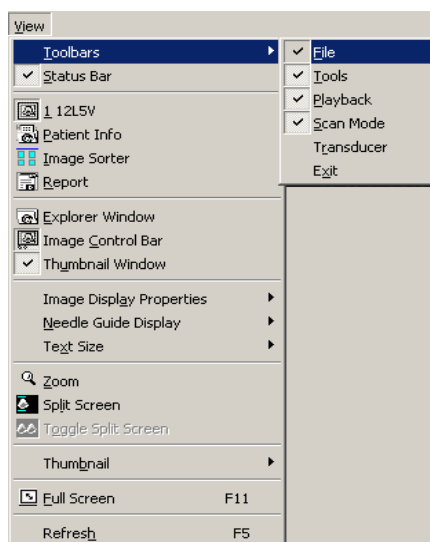
When you hide windows or toolbars, the Image Display window expands to fill the additional area.

You can hide or show toolbars using either of these methods:

- Select **View > Toolbars** and click the toolbar you want to hide or show
- Right-click in the Image Control window or on a toolbar and select the toolbar

You can hide windows using any of these methods:

- Click the  at the top right corner of the window
- From the **View** menu, select **Terason Window**, **Image Control Bar**, or **Thumbnail Window**
- Right-click in the Image Control window or on a toolbar and select Terason Explorer or Image Control



### Showing or Hiding Toolbars and Windows

The menus work as toggles: each time you select or click it, the TeraVision software hides or shows the window depending on its current state.

The **Status Bar** menu item hides or shows the status bar at the bottom of the TeraVision window.

The **Image Display** (indicated by the transducer model number), **Patient Info**, **Image Sorter** and **Report** menu items show the selected window in front of the other two windows; you cannot close these windows.

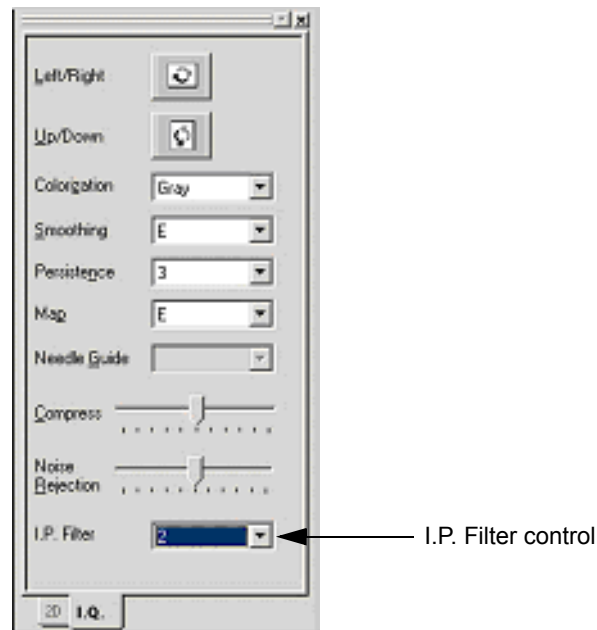
See [Menu and Toolbar Reference](#) on page 287 for a quick description of each toolbar.

## Enhancing the Image Using TeraVision™ Optimization

TeraVision is an optional image-optimization package that sharpens images produced by the TeraVision ultrasound system. TeraVision requires a dedicated license dongle installed in a USB port. See the *TeraVision Image Enhancement Installation Guide* for instructions on installing the TeraVision software and dongle.

The TeraVision software only works if the dongle is connected to a USB port on the computer before the TeraVision Ultrasound program launches. If the dongle is not connected, the image processing control does not appear, and no smoothing can be applied. The following figure shows the Image Control window with TeraVision installed.

The default configuration starts TeraVision when the TeraVision ultrasound system starts. To change this so the TeraVision system starts with TeraVision off, see [Starting the System with TeraVision Off](#) on page 247.



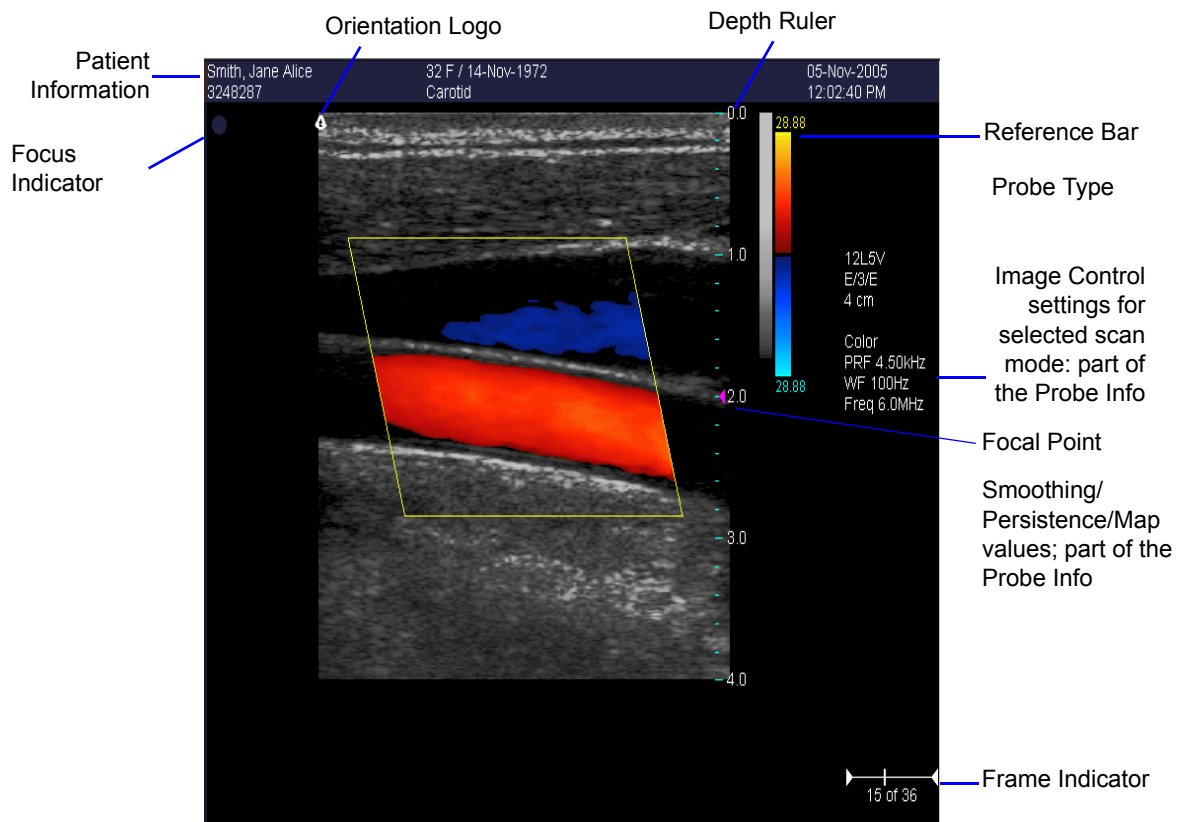
#### I.Q. Controls With I.P. Filter Control

If the dongle is not installed properly, or if some of the required software is missing, the I.P. Filter control does not display. If the control is present but grayed-out, the connected transducer is not supported by the TeraVision software. If either of these conditions occurs, call Terason for assistance.

The I.P. Filter numbers range from 0 to 6 or 8. All currently supported transducers have filter numbers 0 through 6, except for the 4V2, which has 0 through 8. The 0 setting applies no image processing. The larger the number, the more processing is applied to the image. With the 4V2, filters 7 and 8 are intended for cardiac imaging.

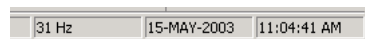
## Adding Guides to the Image Display

**Image Display Properties** on the View menu lets you add several guides to the scanned image. These properties provide details about the patient, transducer, and image control settings. The figure below shows an image with all of the available guides.



### Image Display Properties

The Zoom thumbnail only displays with the image is zoomed. The Frame Rate (in Hz) displays at the bottom right of the Terason window.



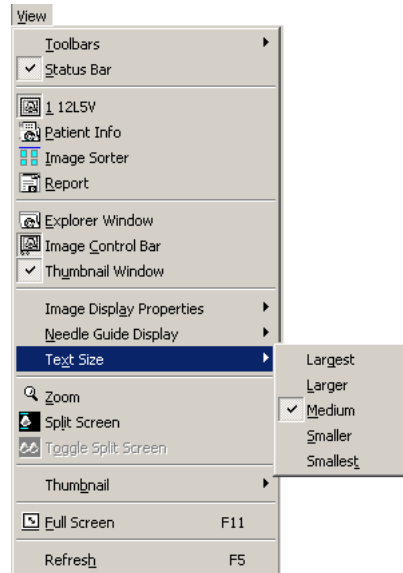
### Frame Rate (Hz value)

See Chapter 5, [Working with Scan Modes](#), on page 90 for details about the information provided by each of these image guides.

## Changing the Text Size

The Terason software lets you choose the font size for the text displayed in the Image Display window. If you choose a large text size, the text may overlap the image. If you choose a small text size, the text may be difficult to read.

To choose a text size, select **View > Text Size**, and then the specific size you want to set.




Changing the Text Size

## Using Split Screen Mode

The Terason software lets you split the Image Display screen into two sections to view two current scans for a patient. For example, you can acquire a 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, Color Doppler, Directional Power Doppler, or Power Doppler).

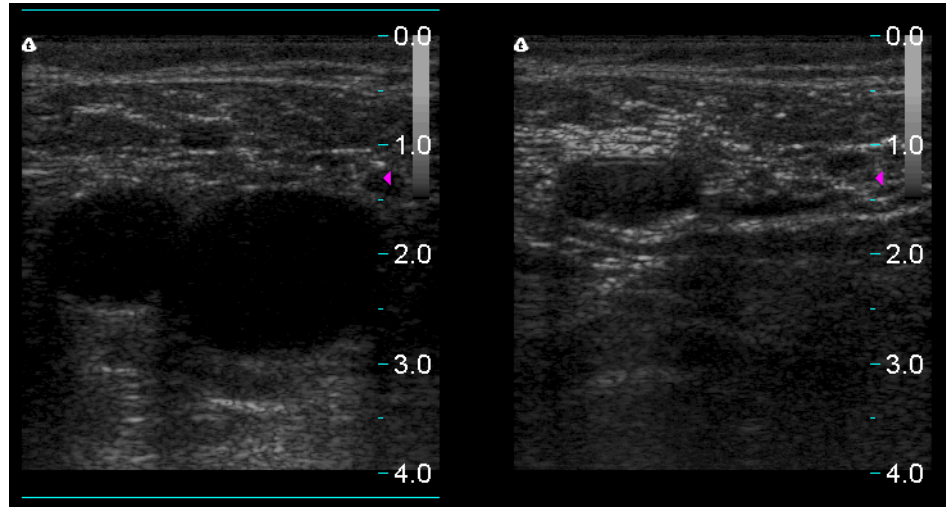
You can use any of the following methods to enter split screen mode:

- Click  Split
- Select **View > Split Screen**
- Type **S** when not in Text mode

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 cyan bars at the bottom and top of a screen indicate the active screen.

To **switch** between the two screens, perform any of these actions:

- Click  Toggle
- Click in the screen
- Select **View > Toggle Split Screen**
- Type **G** when not in Text mode

You can **exit** split screen mode using any of these methods:

- Click  Split
- Select a different exam
- Select M-Mode, PWD, or Triplex scan modes
- Select **View > Split Screen**
- Type **S** when not in Text mode

When saving .ult images in Split Screen mode, only the active window is saved. If you wish to save an image with both windows visible, save the image in a format other than .ult. See [Working with Image Files](#) on page 146 for information on saving images and loops.

When you exit Split Screen mode, 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 Image Display window. See [Working with Exams](#) on page 218 for information on saving custom exams.

## Working with Annotations

This section explains the following topics:

- [Working with Text](#) on page 82
- [Using Body Markers](#) on page 87

### Working with Text

To place text on an image, you must first view the image in the Image Display window. If the image has been saved, retrieve it from the Terason Explorer window. See [Finding Stored Images and Loops](#) on page 151 for instructions.


You can only add text to the 2D Image Display window. You cannot add text to the Time Series window.

To work with text annotation, you should understand:

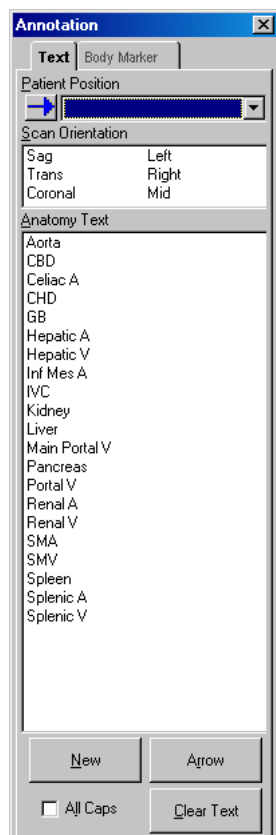
- [Adding Text to an Image](#) on page 82
- [Setting the Text Home Position](#) on page 84
- [Placing Arrows on the Image](#) on page 84
- [Moving Text](#) on page 85
- [Typing Text on an Image](#) on page 85
- [Editing Text](#) on page 86
- [Deleting Text from an Image](#) on page 86

### Adding Text to an Image

Use one of these methods to enter Text mode:

- Click 
- Select **Annotation > Text**
- Type **T** when not in Text mode

The Terason software opens the Text tab in the Annotation Window listing patient positions, scan orientations, and anatomy specific to the current exam.



#### Annotation Window (Abdominal Exam)

If you added custom text using the Option dialog box (see [Adding Custom Text to the Annotation Window](#) on page 248, that text shows in the anatomy list.

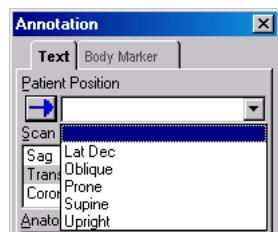
In this window:

- The **New** button starts a new line of text beneath the last line
- The **Arrow** button places an arrow next to the text (see [Placing Arrows on the Image](#) on page 84)
- The **Clear Text** button deletes all text (including manually typed text) from the image

You can also choose to use all caps (ALL CAPS) by clicking in the check box *before* you select the text. This check box has no affect on text already added to the image.

Click any text to add it to the image.

To add the Patient Position, select the appropriate position from the pull-down menu.



#### Patient Position Choices (Abdominal Exam)

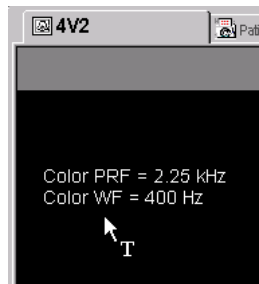
When you click a position, the Terason software adds that text at the home position. When you add a Patient Position, you can then click the blue arrow to add the shown patient position to the image (usually used for subsequent scans during an exam).

### Setting the Text Home Position

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

To set a text home position, complete these steps:

1. Select **Annotation > Set Text Home Position**. The cursor changes to an arrow with the Text symbol.



#### Setting the Text Home Position

2. Click the **location** on the Image Display tab where you want to set the home position.

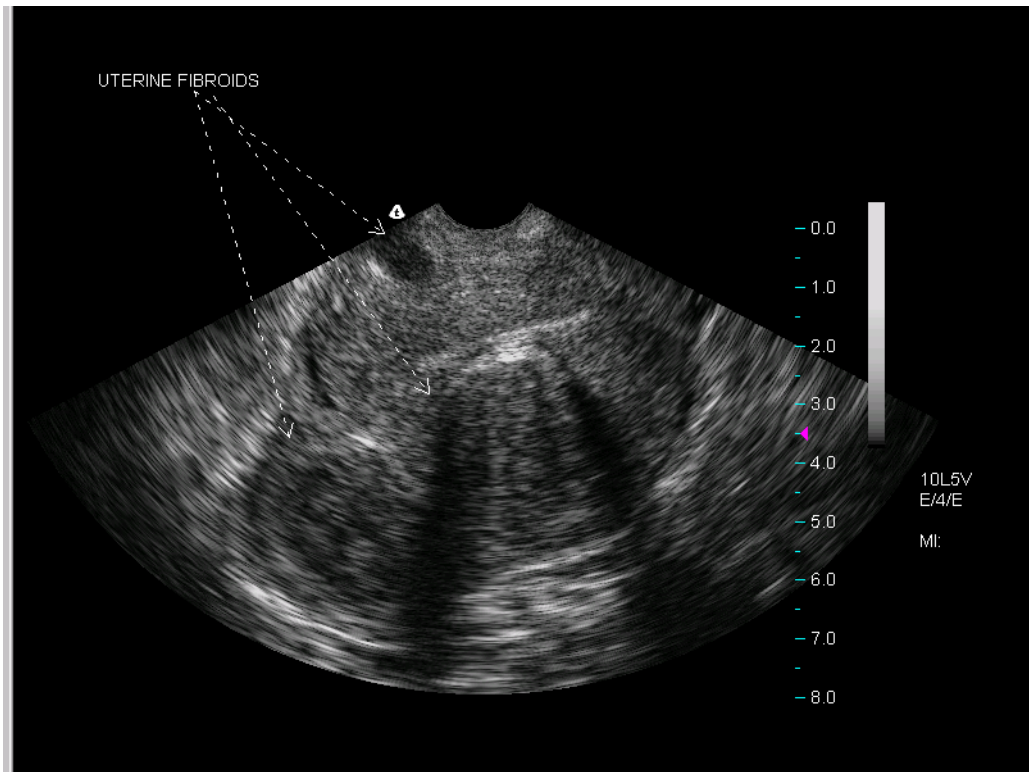
The Terason software uses this location when adding text from the Annotation Window, and as the cursor location when typing text. You can always move text after placing it.

### Placing Arrows on the Image

You can draw an arrow from text to the scanned anatomy. You can also add an arrow without adding text.

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

1. Add the **text** you need.
2. Click the **Arrow** button in the Annotation window. The Terason software draws a short arrow from the text toward the scan area.



#### Adding an Arrow to Text

3. Click the **arrowhead** and drag it to the proper location on the scanned image, and release the button.

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 arrows, you can:

- Add text before or after adding the arrow
- Move the arrow and text later if needed
- Add an arrow to existing text by right-clicking on the text and selecting Show Arrow from the pop-up menu
- Remove an arrow by deleting the text, or right-clicking on the text and selecting Show Arrow to toggle the check mark off

#### Moving Text


After placing text on an image, you can easily move it to any location within the Image Display tab. Just click the text, move it to a new location, and click where you want to place it.

#### Typing Text on an Image

In addition to choosing from the provided text phrases, you can type any text you want onto an image. You can only add text to the 2D Image Display window. You cannot add text to the Time Series window.


To add text to an image, complete these steps:

1. Use one of these methods to select the text tool:

- Click 
- Right-click the image and select **Text**
- Select **Annotation > Text** from the menu bar
- Type **T** when not in Text mode

The Terason software displays a cursor at the text home position.

2. Begin **typing**. The text displays in blue while you type.
3. To start a new line, hold the Shift key down and press the Enter key.

4. When finished, press the **Enter** key or click  to exit Text mode. The Terason software shows the text in white.

### Editing Text

The Terason software lets you edit text added to the image using the Annotation window, or that you manually typed onto the image.

1. Double-click the **text** you want to edit. The Terason software places the cursor at the end of the text and opens the Annotation window showing the Text tab.
2. Use the backspace key to delete text, or the arrow keys to move the cursor to where you want to delete or insert text.
3. Right-click the text and select **New Text** to add a new line.
4. Double-click any text **phrases** in the Text tab that you want to include on the image.
5. Use the **keyboard** to add or delete text.
6. Press the **Enter** key when finished.

### 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 78), but you cannot delete it.

To delete text, perform one of these actions:

- Click the text to highlight it and press the Del key on your keyboard
- Right-click top of the text and select **Delete Text**

To remove all text from the 2D window, perform one of these actions:

- Double-click the text and click the **Clear All** button in the Text tab of the Annotation Window
- Select **Edit > Clear All**
- Select **Annotation > Clear Text Annotation**
- Right-click in the 2D window and select **Clear Text Annotation**

## 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.

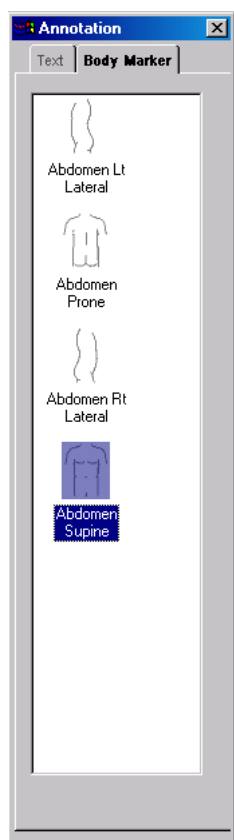
To work with body markers, you must understand:

- 
- [Adding a Body Marker](#) on page 87 [Changing the Icon in the Body Marker](#) on page 88 [Moving the Body Marker](#) on page 88 [Moving the Indicator](#) on page 88 [Changing the Indicator's Direction](#) on page 89 [Rotating the Indicator](#) on page 89 [Removing the Body Marker](#) on page 89

### Adding a Body Marker

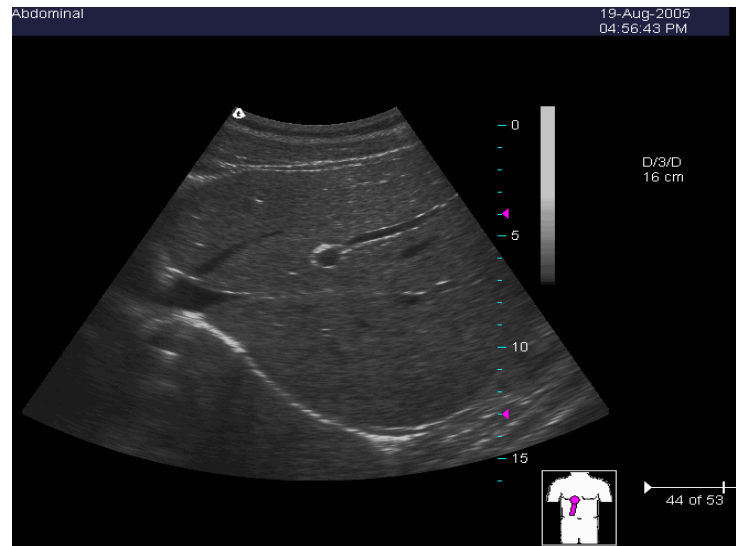
To add a body marker to an image, complete these steps:

1. Select **Annotation > Body Marker**. The Terason software opens the Annotation window.



#### Adding a Body Marker to a Scan

2. Click the view for the body marker you want. The Terason software adds the icon to the scan and closes the Annotation window. The pink rectangle within the marker icon indicates the precise location.



Scan with an Abdomen Supine Body Marker

### Changing the Icon in the Body Marker

To change the icon shown in the body marker, complete these steps:

1. Right-click the body marker and select **Body Marker**. The Terason software opens the Annotation window showing the Body Marker tab.
2. Click the an **icon** in the Body Marker pane. The Terason software updates the icon shown in the body marker and closes the Annotation window.

### Moving the Body Marker

The Terason software uses the bottom-right corner as the default location for the body marker. You can move the body marker to any location within the Image Display tab. To move the body marker, complete these steps:

1. Move the cursor over the **Body Marker**. When the cursor changes to a hand, click the cursor.
2. Drag the **marker box** to a new location
3. Click to lock the marker box in the new position.

### Moving the Indicator

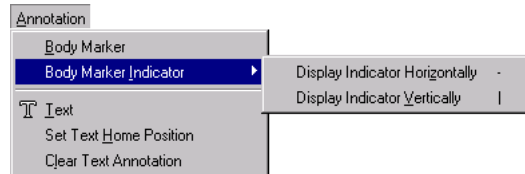
You can move the pink marker to anywhere on the icon to more precisely indicate the scanned anatomy. To move the pink marker, complete these steps:

1. Move the cursor over the rectangular end of the pink indicator. When the cursor changes to a circle with four arrows, click the cursor.
2. Move the cursor to the desired location on the body marker.
3. Click to lock the indicator in position.



## Changing the Indicator's Direction

You can use **Body Marker Indicator** on the **Annotation** menu if you must adjust the orientation of the pink rectangle.



### Changing the Orientation of the Body Marker Indicator

Click the direction (horizontal or vertical) that you want.

## Rotating the Indicator

You can rotate the pink rectangle to more positions by completing these steps:

1. Move the cursor over the round end of the pink rectangle.

The cursor shows a circular arrow.



### Rotating the Body Marker

2. Click and move the cursor until the pink rectangle is in the desired orientation.
3. Click to lock the rectangle in position.

## Removing the Body Marker

To remove the Body Marker from the image, right-click the body marker and select **Remove Body Marker**.

# Switching Transducers

The Terason system lets you hot swap transducers. This means that you can unplug one transducer and plug another one in without exiting the program.

Complete these steps to switch between transducers:

1. If necessary, save the active image or image loop. See [Saving Images and Loops](#) on page 148 for instructions.
2. Rotate the locking lever on the Terason engine (see the figure below), and carefully unplug the transducer.

## 5 Working with Scan Modes

### Scan Modes Overview

When you select a scan mode, the Image Control bar shows as many as four tabs. The **2D** and **I.Q.** tabs associated with 2D imaging are always displayed. All other modes available in the Terason Ultrasound System software include the 2D functions, and also include an additional tab or tabs with image controls for the selected scan mode.

In general, follow these guidelines to choose which scan mode to use for an exam:

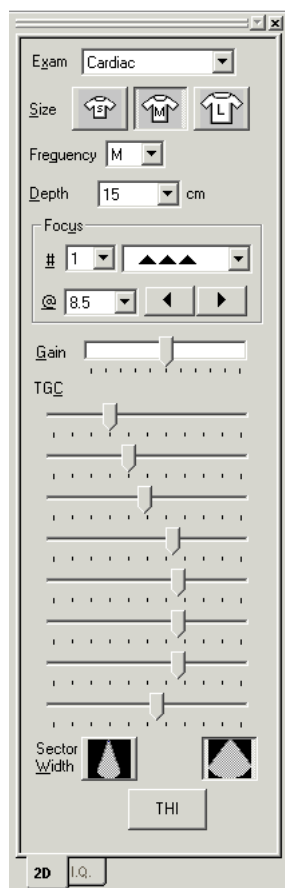
- Select **2D** to view a two-dimensional display of the anatomy. 2D controls adjust the size, depth, focus, overall image gain, brightness, and exam type. See [Using 2D and I.Q. Controls](#) on page 91.
- Select **M-Mode** to evaluate motion over time, such as viewing motion patterns of the heart. See [Using M-Mode Image Controls](#) on page 105.
- Select **Pulsed-Wave Doppler** (PWD) mode when you want obtain frequency or velocity information from a specific point along a scan line. See [Using the PWD Image Controls](#) on page 108.
- Select **Continuous Wave Doppler** (CWD) mode when aliasing is a problem, and when depth-specific information is not important. See [Using Continuous Wave Doppler Image Controls](#) on page 126.
- Select **Color Doppler** (CD) when you must view the mean velocity within an assigned region of interest. See [Using Color and Power Doppler Image Controls](#) on page 117.
- Select **Power Doppler** (Pwr) to view the density of blood, but not the velocity. Power Doppler is more sensitive to low flow than either color Doppler or Directional Power Doppler, and is often used to evaluate perfusion and vessel patency. See [Using Color and Power Doppler Image Controls](#) on page 117.
- Select **Directional Power Doppler** (DPD) to combine the density information provided by Power Doppler with the directional information of Color Doppler. See [Using Color and Power Doppler Image Controls](#) on page 117.

You can also configure image controls for Triplex scanning using the PWD tab with the CD, DirPwr or Pwr tabs.

## Using 2D and I.Q. Controls

### Controls on the 2D Image Control Window

The following figure shows the available 2D image controls. You can only adjust these image controls during live scanning. When you freeze a scan, the Terason software replaces the 2D tab with a 2D Measure tab, for making measurements on the scan image. (See Chapter 8 - [Working with Measurements](#).)

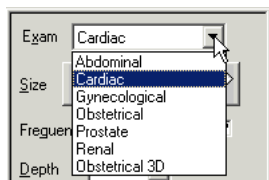


2-D Tab in the Image Control Window

### Choosing an Exam

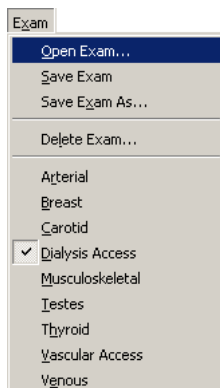
Terason provides customized exams for scanning different types of anatomy. When you choose an exam, the Terason software loads image controls settings on the 2D and I.Q. tabs that are customized for that anatomy and the connected transducer.

To select an exam, choose it from the Exam menu at the top of the 2D Image Control window. You can highlight the exam type box in blue and then either press the first letter of the exam type name or use the right and left arrow keys to cycle through the exam types. For example, if you are using a 12L5 probe and want the Carotid exam, click the exam control and type C.



### Choosing an Exam

The software displays only those exams supported by the connected transducer. You can also select an exam from the **Exam** menu.



### Selecting an Exam from the Menu Bar

The top group of menu items are used to work with custom exam types. The next group of menu items load the presets for the indicated exam type. If you created any custom exams, they show at the bottom of the Exam menu. See Chapter 9 - [Working with Exams](#) for more details about exam types and defining custom exams.

### Adjusting the Size

The “T-shirt” Size buttons on the 2D Image Control window load preset values that optimize the scan for the size of the patient or for the structured anatomy. Click the size button that matches the patient size for small, medium, or large (or for superficial, moderately deep, and deep areas of interest).

The Size setting applies a preset 2D transmit frequency. In general, Choosing the small size sets the highest transmit frequency, to yield the best 2D resolution, while the medium size sets a mid-range frequency, and the large size sets a lower frequency for the best penetration.

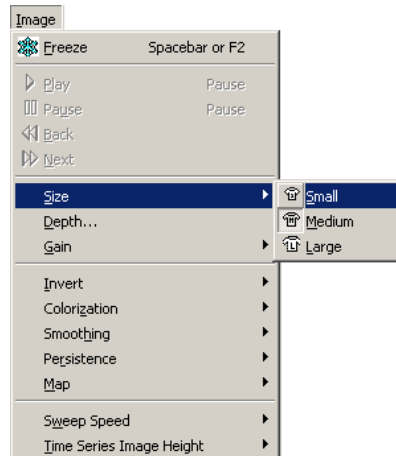
Choosing a Size setting also sets other 2D and Doppler settings. When you choose a size, you also load baseline settings for the other controls.

To set a patient size, click the appropriate T-shirt symbol.



### Patient Size Controls

You can also click **Size** on the Image menu and choose a size from the menu.



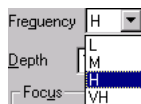
### Using the Menus to Set the Patient Size



**Note:** After selecting the size that suits the clinical situation, you can modify any available controls to further optimize the image.

### Adjusting the Frequency

When you select an exam, the Terason software sets an appropriate frequency for that exam and patient size (see [Adjusting the Size](#) on page 92). You can select an alternate frequency to better suit specific circumstances.



#### Frequency Control

In the Frequency list:

- L = Low
- M = Medium
- H = High
- VH = Very High (available only with the 12L5 transducer)

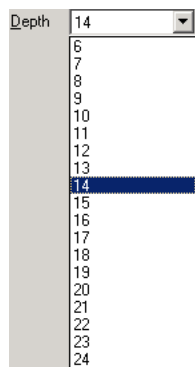
The exact frequencies vary, depending on the connected transducer.

### Adjusting the Depth

Depth 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, transducer, and patient size.

Select a depth (in cm) from the menu.

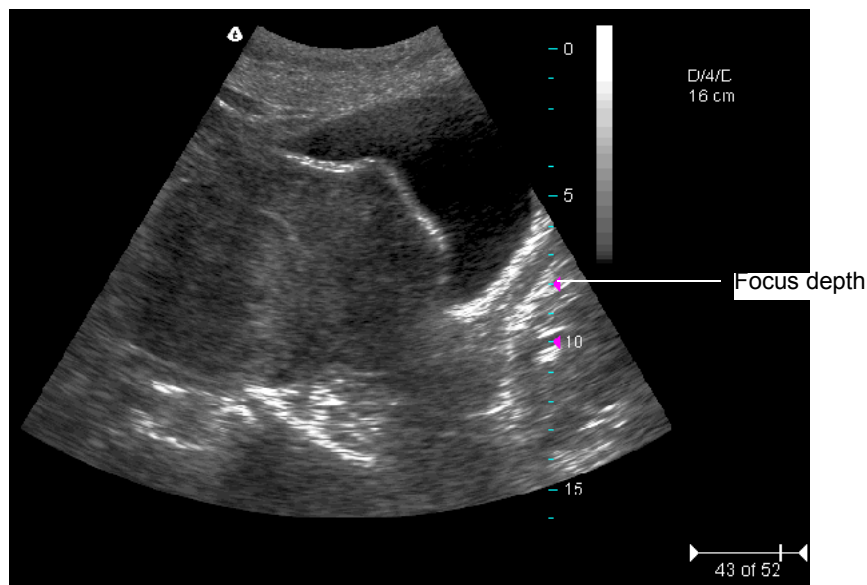


#### Choosing the Depth (Values in cm)

The values displayed in the menu depend on the transducer.

After adjusting 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 **View > Image Display Properties > Depth Ruler**. The figure below shows the depth ruler along the right side of the image.

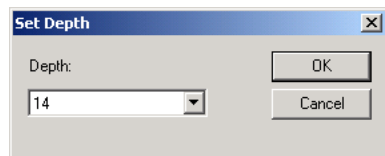


#### Example Depth Ruler

The pink triangle on the depth ruler indicates the focus depth.

You can also use the menu bar to set the depth. To do so, complete these steps:

1. Select **Image > Depth**. The Set Depth dialog box opens.



#### Set Depth Dialog Box

2. Select a **depth value** from the menu.
3. Click **OK**.

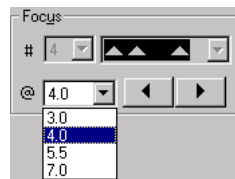
## Adjusting the Focus

Focus optimizes the image by increasing the resolution for a specific area. The depth ruler uses a pink triangle to indicate the focus depth. This indicator is only visible if you show the depth ruler.

When you select an exam type, the software updates the focus value to a preset value for the specific exam type, transducer, and patient size.

In 2D, you can set up to four focus depths. 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 for any mode other than 2D, or for a single focus point in 2D, select a value (in cm) from the @ pull-down menu.

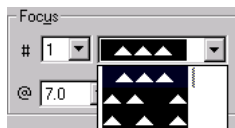


### Setting the Focus (Non-2D)

You can also use the left and right arrow buttons to increase or decrease the focus depth.

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

1. From the @ menu, select the **primary** focus depth. You can also use the left and right arrow to increase or decrease the depth.
2. From the # menu, select the **number** of focus points.
3. From the focus distribution menu, select a **distribution method**.



### Focus Distribution List

In the focus distribution menu:

- spaces the focus depths densely, centered on the primary focus depth
- spaces all but the deepest focus depth densely
- spaces the focus depths widely, centered on the primary focus depth

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 \(TGC\)](#) on page 96 for more information on TGC settings.

When you select an exam type, the Terason software sets the gain to a preset value for the specific exam type, transducer, and patient size.

To decrease the gain, click the slider and drag it to the left. To increase the gain, click the slider and drag it to the right.



### Changing the Gain

You can also adjust the gain by clicking in the 2D window and pressing the left (to decrease gain) and right (to increase gain) arrow keys. Or you can use the Image menu to move the gain one setting higher (Image > Gain > Up) or one setting lower (Image > Gain > Down).



### Changing the Gain from the Image Menu

When you adjust the gain setting, the Terason software automatically adjusts the Time Gain Compensation curve to support the new gain setting.

## Adjusting Time Gain Compensation (TGC)

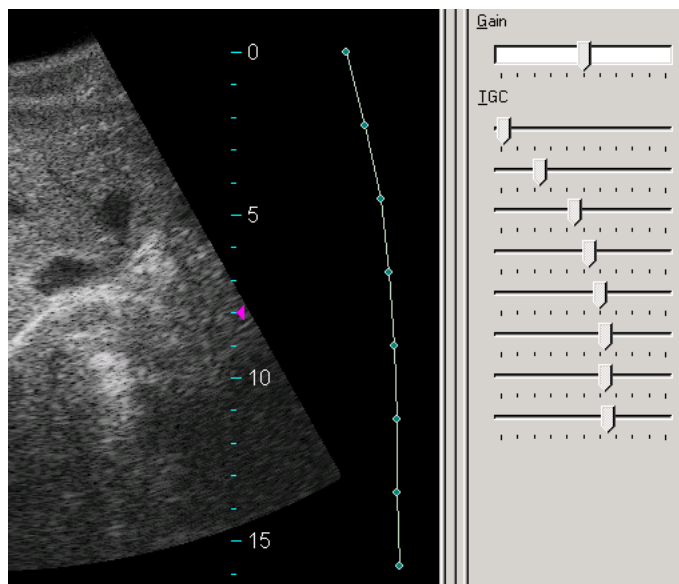
Scanning tissues at increasing depths causes attenuation of the returned signal. The TGC sliders adjust amplification of returning signals to correct for the attenuation. TGC balances the image to equalize the brightness of echoes from near field to far field.

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 patient size
- 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.

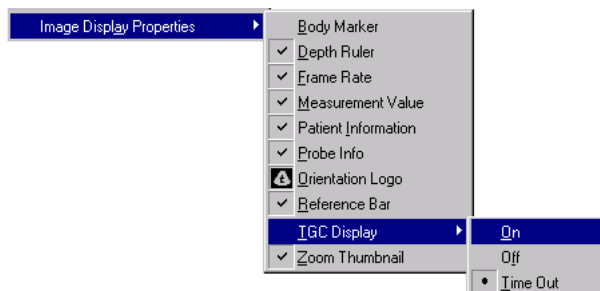




**Example TGC Curve on an Image**

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, select View > Image Display Properties > TGC Display.



#### TGC Curve Display Options

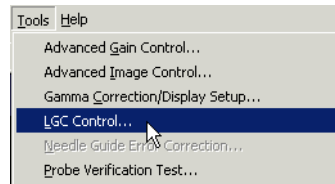
Select **On** to show the curve, or select **Off** to hide the curve. If you select **Time Out** (the default setting), the curve displays briefly when you start the application, adjust the gain, or adjust an individual TGC slider.

### Adjusting Lateral Gain Compensation (LGC)

A set of LGC sliders increase or decrease the gain of segments of the returned signal, when using some transducers. (Linear transducers do not support LGC.) These segments are arcs one eighth of the full width of the scan. Adjusting LGC can enhance imaging of the cardiac wall with some scanning orientations.

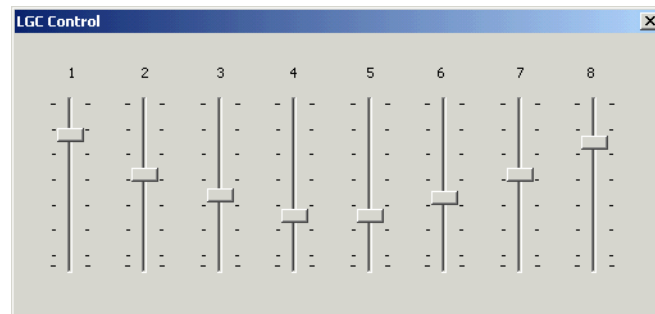
To use the LGC controls:

1. On the Tools menu, select **LGC Control...**



### Opening the LGC Controls

The LGC Control window opens.




### LGC Control Window

- To increase the gain on a sector, slide the **control** for that sector *up*.



**Note:** When the Cardiac exam is selected, lower-numbered sliders (at the left side of the LGC Control window) control segments at the *left* side of the display. When any other exam is selected, the left-right relationship between the LGC window controls and the scan is reversed (lower-numbered controls affect the *right* side of the display.)

- To close the LGC Control window, click the **close box** .

### Adjusting the Sector Width or Image Format

The Sector Width control lets you select the width of the acquired image. Decreasing the size of the sector increases lateral resolution, while increasing the size of the sector decreases lateral resolution.

With curvilinear array transducers, you can choose a small, medium, or large sector width.



### Sector Width Choices

Some phased-array transducers allow only small and large sector widths.

With linear transducers, Sector Width is replaced with Image Format. You can choose an image format of *linear* or *sector*.



### Image Format Choices

To select the shape or size of the sectors, click the associated button.

See [Changing the Display Mode Defaults](#) on page 244 for information on choosing defaults associated with sector width and image format.

### Tissue Harmonic Imaging (THI)

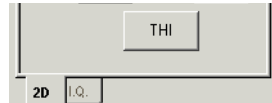
The transmitted ultrasound signal generates harmonics (signals at frequencies that are multiples of the transmitted signal frequency) in tissue. Tissue harmonic imaging processes a returned harmonic signal to enhance the displayed image. The harmonic used for THI is twice the frequency of the transmitted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

THI is only available when a 4V2 or 5C2A transducer is connected. When a different type of transducer is connected, the THI button does not display, and the THI menu item is grayed out on the Modes menu.

THI is most effective at mid-range depths. Shallow and deep scans do not benefit from THI.

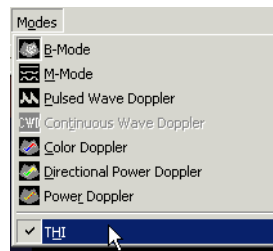
To turn THI on or off, use one of the following methods:

- Click the **THI** button at the bottom of the 2D Image Control window.



THI Button

- Select **THI** in the Modes menu.

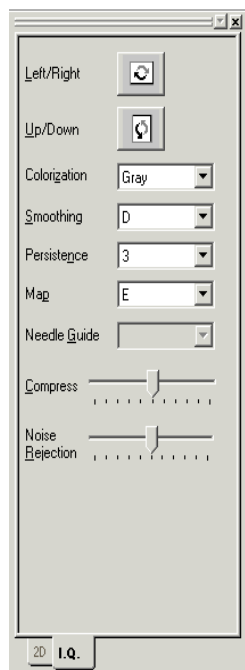


THI in Modes Menu

### Controls on the I.Q. Image Control Window

The preset values that load when you choose an exam are optimized for that exam using the selected ultrasound mode and transducer. You can use these optimized presets, or you can make individual adjustments as necessary for the current exam.

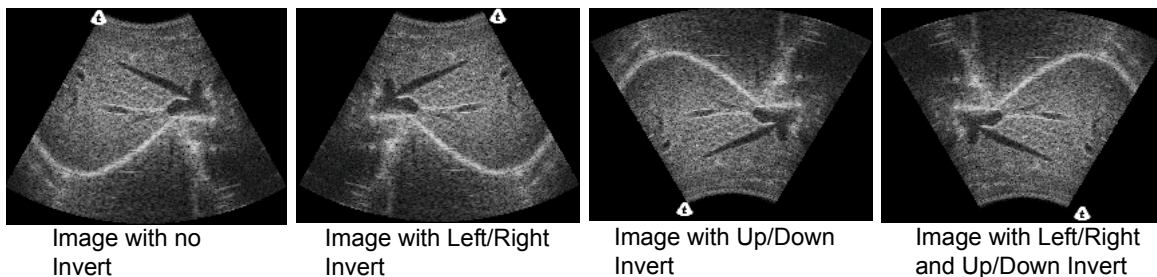
The following figure shows the I.Q. controls.

**I.Q. Controls**

### Inverting Images

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

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

**Effect of Inverting an Image**

To invert the scanned image, click the Left/Right or Up/Down button as needed.



### Inverting Images

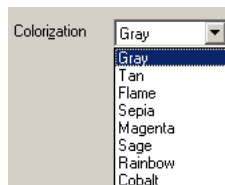
You can also select Image > Invert > Left/Right or Image > Invert > Up/Down to invert the image. You can use the invert options with live or frozen images, or with images saved in the ULT format.

## Adjusting Colorization

By default, the Terason software uses the Gray color scheme for 2D images. the Gray scheme displays images as shades of gray over a range from white to black. The Terason software provides several alternate schemes. To determine if another scheme improves visibility of the anatomy being scanned, cycle through the available options. Which scheme produces the best image depends on the anatomy that is being scanned.

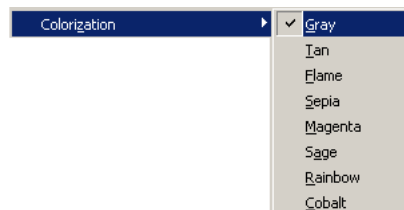
To select a different scheme, use one of the following methods:

- Click the down arrow next to the Colorization field in the I.Q. tab and select a colorization scheme from the menu.



### Selecting Colorization on the I.Q. Window

- Select Image > Colorization and choose a color scheme



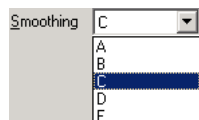
### Selecting a Colorization scheme from the Image Menu

## Adjusting Smoothing

Changing the value in the smoothing field can make an image appear smoother. The smoothing values are letters from A to E and represent different algorithms. Generally, the amount of smoothness increases as you select higher letters. Note that smoothness is subjective, and other image control settings affect how the smoothing algorithms work. Choosing a higher smoothing level may not always result in a visibly smoother image.

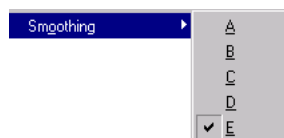
When you increase the value in the field, the software increases the amount of interpolation between scan lines, to make the image appear smoother. This also decreases the frame rate. When you decrease the amount of smoothing, the amount of interpolation between scan lines is decreased, making the image appear rougher, and the frame rate increases.

To adjust the smoothness of the image, click the down arrow to the right of the Smoothing field and select a value from the menu.



### Selecting a Smoothing Option

You can also select **Image > Smoothing** to choose a different smoothing option.

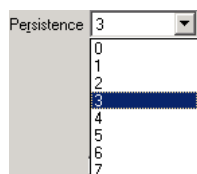


Selecting a Smoothing Option from the Image Menu

## 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 also increases the possibility of a blurred image if the tissue is moving when you freeze the image. When the persistence is low, the opposite is true.

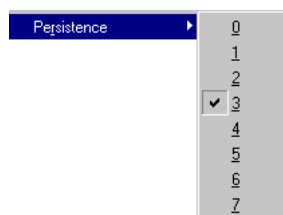
To indicate the amount of frame averaging you want, click the down arrow to the right of the persistence field and select a value from 0 to 7.



Choosing a Persistence Value

The 0 setting represents 0% and 7 represents 100% persistence.

You can also select **Image > Persistence** to choose a different setting.



Choosing Persistence from the Image Menu

To view the persistence setting on the image display, select **View > Image Display Properties > Probe Info** from the menu bar. The probe information includes a code such as C/2/A, where the middle item (2 in this example) is the Persistence value.

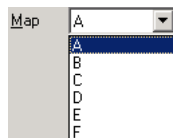
## Adjusting the Image Map

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, click the down arrow next to the Map field. You can choose any of eight maps, labeled from A to H.



**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.)



#### Choosing an Image Map in the I.Q. Window

You can also select Image > Map to choose a different image map setting.



#### Choosing an Image Map from the Image Menu

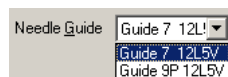
#### Image Map Reference Bar

The effect of your map choice is represented by a reference bar to the right of the depth scale on the image. Enable the reference bar by selecting View > Image Display Properties > Reference Bar.

The image information display on the scan window includes a code such as C/2/A below the transducer identification. In the C/2/A example, the third item (A) is the Map value.

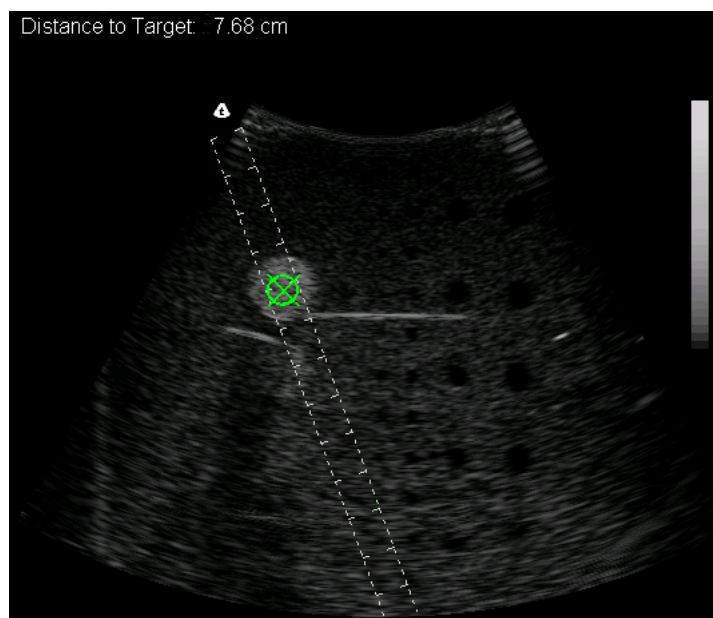
#### Selecting a Needle Guide

The needle guide control is available only when a transducer that supports biopsies or other medical procedures is connected. To perform the procedure, select the correct needle guide from the menu.



#### Selecting the Needle Guide

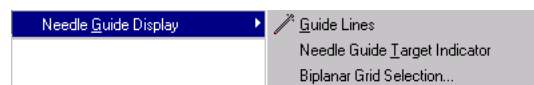
Depending on the connected transducer, you may only see one needle guide option. If the bracket for that transducer supports more than one angle, options for each supported angle are displayed.



### Needle Guides and Target for a Biopsy

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

If you do not see the needle guides in the Image Display window, click  or select View > Needle Guide Display > Guide Lines.



### Viewing Needle Guides

### Adjusting Compression

The Compress slider controls signal compression, which affects the contrast of the image. A number to the left of the slider indicates the amount of compression, from – 50 to 50.

Drag the slider to the right to increase compression, which darkens the image, or drag the slider to the left to decrease compression.



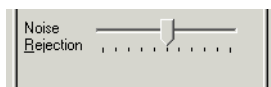
### Compress Slider

### Adjusting Noise Rejection

The Noise Rejection slider controls rejection of low-level returned signals. Increasing rejection darkens the image background. A number to the left of the slider indicates the level of noise rejection, from – 50 to 50.

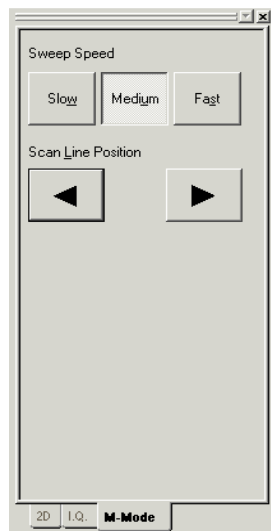
Drag the slider to the right to increase noise rejection, or drag the slider to the left to decrease it.



**Noise Rejection Slider**

## Using M-Mode Image Controls

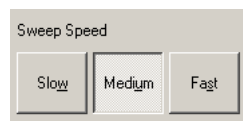
When you select M-Mode, the Terason software adds the M-Mode tab to the Image Controls window. When you freeze a scan, the Terason software removes the M-Mode tab.

**M-Mode Image Controls**

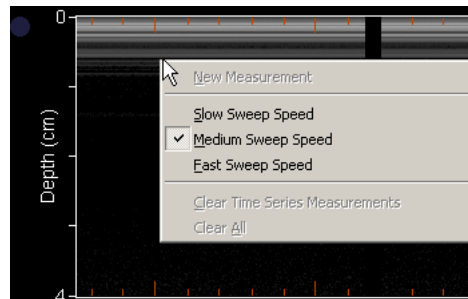
## Adjusting the Sweep Speed

The speed buttons set how fast the timeline is scanned across the Time Series window.

To set the sweep speed, click the Slow, Medium, or Fast button.

**Sweep Speed Controls**

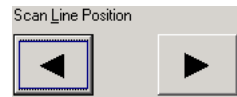
You can also choose the speed by selecting **Image > Sweep Speed** and choosing a speed, or by right-clicking in the M-Mode window and choosing a speed. The tick marks in the Time Series window are closer or farther apart depending on the speed. Each large tick mark represents one second.



Shortcut Menu in the Time Series Window of an M-Mode Scan

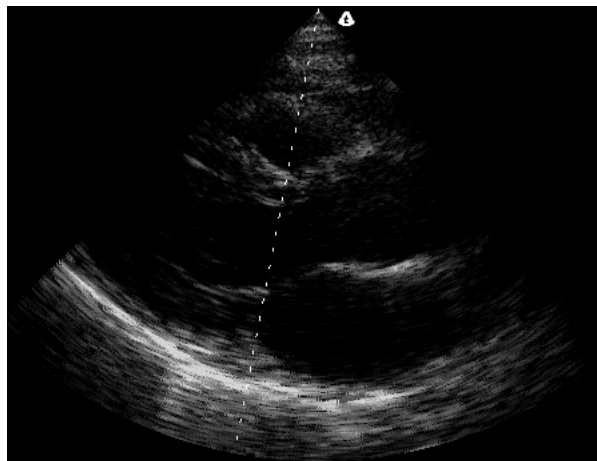
## Adjusting the Scan Line Position

To adjust the scan line in the 2D image display, click the left or right arrows under Scan Line Position.



Scan Line Position Controls

The following figure shows the scan line:



Scan Line

You can also move the scan line using these methods:

- Click the scan line, move your cursor to a new location, and click again.
- Type a period (.) to select the scan line, then use the keyboard left and right arrows to move it
- Click the scan line and use the keyboard left and right arrows to move it
- Double-click the image where you want to move the scan line

When the scan line remains in a fixed position for a few seconds, the Terason software locks it into that position.

## Using Anatomical M-Mode

Anatomical M-Mode is a feature available when you select the Cardiac exam with a 4V2 transducer connected. It is not available with other transducers or exams. Anatomical M-Mode lets you manipulate the scan line by clicking and dragging it. You can change the angle of the scan line, and offset the line in the scan area.

### Adjusting the Scan Line Angle

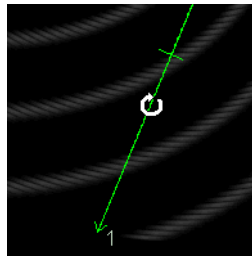
To change the scan-line angle using Anatomical M-Mode:

1. Click **Anatomical M-Mode** to enable it.

The software adds a crossbar and arrowhead to the scan line.

2. Click on the **scan line**.

The scan line turns green, and a curved arrow replaces the finger cursor.



#### Rotating the Scan Line With Anatomical M-Mode

3. Move the **cursor** to the left or right, and click again when the scan line angle is correct.

If the cursor is not moved for four seconds, the scan line and cursor revert to their normal appearance, and the scan line will not move.

### Adjusting the Scan Line Offset

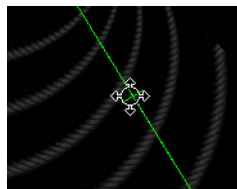
To offset the scan line in the scan area:

1. Click **Anatomical M-Mode** to enable it.

The software adds a crossbar and arrowhead to the scan line.

2. Click on the **crossbar**.

The scan line turns green, and a circle with four arrowheads replaces the standard cursor.



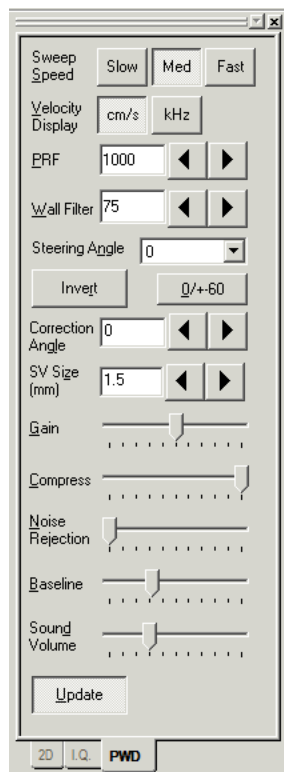
#### Offsetting the Scan Line With Anatomical M-Mode

- 3.
4. Move the **cursor**, and click again when the scan line offset is correct.

If the cursor is not moved for four seconds, the scan line and cursor revert to their normal appearance, and the scan line will not move.

## Using the PWD Image Controls

When you select Pulsed-Wave Doppler, the Terason software adds the PWD tab to the Image Controls window.



**PWD Image Controls**

The following sections describe how to change the settings in the PWD Image Control window. You can also move the scan line position, set the PWD gate position, and choose a display mode.

## Adjusting the Sweep Speed

The Terason software lets you choose the sweep speed for Pulsed-Wave Doppler mode. 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 tick represents one second. When an image is frozen, you cannot change the setting.

To choose a speed, click the Slow, Medium, or Fast Sweep Speed button.



**Sweep Speed Controls**

You can also select Image > Sweep Speed and then choose a speed, or right-click in the Time Series window and select a speed.

## Setting the Velocity Display Units

The Times Series window shows the velocity of flow in cm/s or kHz. You can change the units any time. Centimeters per second (cm/s) is available only when the correction angle (see [Adjusting the Correction Angle](#) on page 112) is between 0 and  $\pm 70^\circ$ . If you set a higher angle, the Terason software automatically changes the units to KHz.

To change the velocity display units, click the button for the units you want to use: cm/s or kHz.

## Adjusting Pulse Repetition Frequency (PRF)

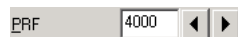
Pulse Repetition Frequency defines the velocity range of the display. The maximum value (in Hz) for the PRF depends on the specific transducer and the location of the sample volume.

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, click the right or left arrows next to the PRF field.



**PRF Control**



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

The increment value for each click depends on the current range, as defined in the following table. For example, if the PRF setting is 4000, 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.

#### PRF Ranges

Range (Hz)	Increment (Hz)
200-1000	100
1000-5000	500
5000-up	1000

Increasing the PRF also increases the Thermal Index (TI) value (refer to [General Description of Indices](#) on page 259 for more information about thermal indices).

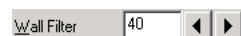
## Adjusting the Wall Filter

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 transducer.

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, click the right or left arrows next to the wall filter field.



#### Wall Filter Control

The wall filter range is from 1% to 25% of the PRF. The increment value for each click depends on the current range, as defined in the table below. For example, if the wall filter setting is 40, each time you click the right or left arrow, the Terason software adds or subtracts 10 Hz from that value, until the selected value falls into a lower or higher range.

#### Wall Filter Ranges

Range (Hz)	Increment (Hz)
2-10	2
10-50	10
50-100	25
100-300	50
300-up	100

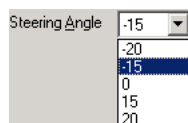
## Adjusting the Steering Angle

To obtain accurate velocities, you must maintain Doppler angles of 60° or less. However, it is common to use higher values of correction angle, especially in peripheral vascular applications where the blood vessels are more parallel to the face of the transducer.

Electronic steering is only available with flat linear-array transducers (the 7L3 and 12L5). This option does not display or is grayed out with all other transducers. Curved-linear and phased-array transducers cannot use electronic steering.

In the Terason Ultrasound System, the maximum value for the correction angle is  $\pm 70^\circ$ . The velocity display in centimeters per second (cm/s) is shown only in the range between 0 and  $\pm 70^\circ$ . Above 70°, the velocity calculation error is too large, and the velocity scale is converted to frequency, independent of the correction angle. However, the flow-direction cursor is still shown on the window, for reference.

To adjust the steering angle, select a different angle from the menu.



### Steering Angle Menu

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

You can also adjust the steering angle by typing a slash (/). When you type this character, the Terason software highlights the Steering Angle value and you can use the left and right arrow keys to change the value. If you press the key twice quickly, the Terason software highlights the Correction Angle.

## 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 114) 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, click the Invert button.

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

## Adjusting the Scan Line Position

To adjust the scan line in the 2D image display, move the cursor to the new position and double click. The scan line and Sample Volume move to the new position. You can also click the scan line, move it to the left or right as needed, and click again to lock it in position. Or, you can click the scan line and use the keyboard left and right arrows to move

it. The keyboard up and down arrow keys move the Sample Volume along the scan line. You can also type a period (.) to select the scan line, and then use the keyboard left and right arrows to move it.

When the scan line remains in a fixed position for a few seconds, the Terason software locks it into that position.

## Adjusting the Correction Angle

To obtain accurate velocities, you must maintain Doppler angles of 60° or less. However, it is common to use higher values of correction angle, especially in peripheral vascular applications where the blood vessels are more parallel to the face of the transducer.

In the Terason Ultrasound System, the maximum value for the correction angle is  $\pm 70^\circ$ . The velocity display in centimeters per second (cm/s) is shown only in the range between 0 and  $\pm 70^\circ$ . At angles greater than 70°, the error in the velocity calculation is too large, and the velocity scale is converted to frequency, independent of the correction angle. The flow-direction cursor still shows on the window, for reference.

To adjust the correction angle, click the right arrow to increase the angle, or the left arrow to decrease the angle.

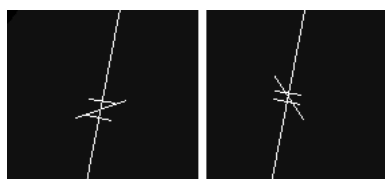


### Correction Angle Controls

You can also press the slash (/) key twice to select the Correction Angle value, then use the right and left arrow keys to select a different value.

To set the correction angle to 0 or 60°, click the 0/+60 button. This button sets the correction angle to -60, 0, or 60, whichever value is closer to the current value. The correction angle control is active on frozen and live images.

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



60 Angle, 4.5 mm (Left) and 45

## Adjusting the Sample Volume (SV) Size and Depth

The sample volume size control adjusts the size of the Pulsed-Wave 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 scan line 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, click the SV Size right arrow to increase the volume or the left arrow to decrease the volume.





### Sample Volume Size Control

You can set a value from 0.5 to 20 mm (in 0.5 mm increments). The value shows on the image display if Probe Info is enabled. You can also use the indicator to move the depth of the sample volume along the scan line. To do so, click the indicator and move the cursor up or down until it is located properly, then click to lock the indicator in position.

You can adjust the position of the sample volume using the touch pad or mouse. Left-click the sample volume (the line turns green), move it to the desired location, and left-click again to anchor it. You can also use the period (.) key to select the sample volume, then use the up and down arrow keys to change the depth.

If the sample volume is not moved for five seconds, it is anchored in position. You can also use the left and right arrow keys to move the scan line, and the up and down arrow keys to move the sample volume indicator.

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](#) on page 259 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 at the cursor location, and switch to Pulsed-Wave Doppler mode. The sample volume locks in position. When scanning in CD, DirPwr, or Pwr scan modes, this procedure switches to Triplex mode (if enabled by your license).

To locate the sample volume and switch to PWD or Triplex mode, you can double-click at the location in the 2D window to automatically set the gate position and switch to PWD or Triplex scanning.

The following procedure also sets the gate position and switches to PWD or Triplex scanning:

1. Select the scan mode and adjust all Image Control settings appropriate for the current exam.
2. Place the cursor inside the vessel of interest. You can use the Zoom tool (see [Enlarging an Area of the Image](#) on page 74) for more precise cursor placement.
3. Right-click the vessel of interest. The shortcut menu opens.



#### Shortcut Menu

#### 4. Select Set PWD Gate.

The Terason software locks the sample volume indicator in the position where you right-clicked and adds the Time Series window for PWD mode. You can now adjust the SV size, depth, or correction angle as needed for the scan.

## Adjusting the Gain

The gain setting on the PWD tab (not the gain setting on the 2D tab) 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 gain, click the slider and drag it to the left to decrease the gain, or drag it to the right to increase the gain.



#### PWD Gain Control

You can also adjust the gain by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys.

The **Image > Gain** menu adjusts the 2D gain, not the PWD gain.

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

## Adjusting the Baseline

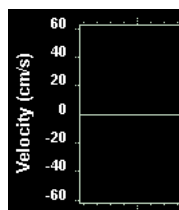
The baseline refers to the zero baseline in the Time Series Display window. Adjusting this control moves the zero baseline up or down. When you adjust the baseline, you can display more forward or reverse flow, taking advantage of the full scale available at that particular PRF value.

Drag the slider to the left to move the baseline down. Drag the slider to the right to move the baseline up.

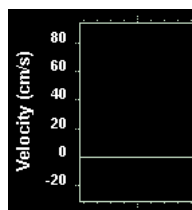


#### Baseline Control

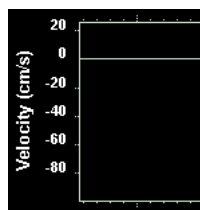
You can also adjust the baseline by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys. The figure below shows a centered baseline (the default), and adjusted baselines.



Centered Baseline  
(default)



Lowered Baseline



Raised Baseline

### Effects of Altering the Baseline

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

## Adjusting the Sound Volume

The **Sound Volume** control lets you define the volume of the Pulsed-Wave 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. Drag the slider to the left to lower the volume. Drag the slider to the right to raise the volume.



**Volume Control**

You can also adjust the volume by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys.

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.

## Compression

The **Compress** slider controls signal compression, which affects the contrast of the image. A number to the left of the slider indicates the amount of compression, from -50 to 50.

Drag the slider to the right to increase compression, which darkens the image, or drag the slider to the left to decrease compression.



**Compress Slider**

## Adjusting Noise Rejection

The **Noise Rejection** slider controls rejection of low-level returned signals. Increasing rejection darkens the image background. A number to the left of the slider indicates the level of noise rejection, from -50 to 50.

Drag the slider to the right to increase noise rejection, or drag the slider to the left to decrease it.



**Noise Rejection Slider**

## Updating the Displays

The **Update** button lets you choose whether or not to continue scanning the anatomy (displayed in the 2D window) while acquiring PWD scan data (displayed in the Time Series window). When Update is selected, the Terason software continuously updates the 2D scan while acquiring PWD data. When not selected, the Terason software freezes the 2D data while acquiring PWD data. When Update is selected, the button appears pressed in and is a lighter shade than its surroundings.

The default setting for this button in most exams is *selected* (continuous scanning of the 2D and PWD data). In The Cardiac and Renal exams, the default is *not selected*.

When you de-select the Update button (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 Image Controls When Update Disabled**

Image Control Tab	Available	Not Available	
2D	Size Exam	Frequency Depth Focus Gain	TGC curve Sector width THI
IQ	Left/Right invert Up/Down invert Colorization Smoothing Map Compression Noise Rejection	Persistence	

All image control settings on the PWD tab remain available.

You can change the action of the Update button for the currently-selected exam. See [Changing the PWD Update Button Action](#) on page 164.

To toggle the 2D window between live and frozen, click the Update button.



**Update Button**

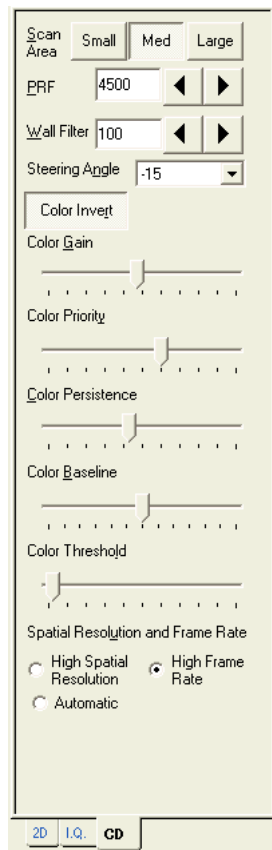
## Using Color and Power Doppler Image Controls

When you select Color Doppler, Power Doppler, or Directional Power Doppler, the Terason software adds a tab for the selected mode to the Image Control bar.



**Note:** CWD is not available when the Pwr mode is selected.

Pwr mode is not available when CWD is selected.



### Doppler Image Controls (Color Doppler Shown)

Although each mode adds a tab with the specific name of the selected mode, all the Doppler modes except Power Doppler use the same image controls. When in Power Doppler, a button enables Directional Power Doppler.

## 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.

For cardiac or arterial applications, use a small scan area to accurately visualize the flow dynamics. A medium or large scan might also be used for applications where the blood flow dynamics do not change rapidly, or to get a larger overall view of blood flow.

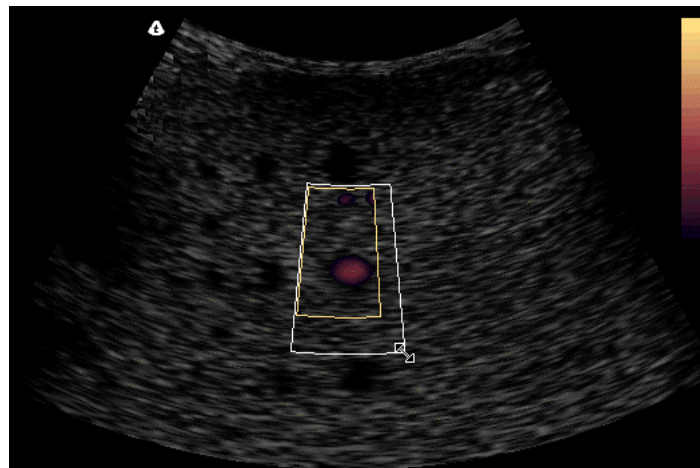
**Scan Area Control**

These options choose a pre-defined scan area based on the focus depth.

You can move the scan area by clicking on the region of interest border, moving the cursor to a new position, and clicking to anchor it. You can also type a period (.) to select the region of interest and use the keyboard arrows to move the region.

You can more precisely resize the scan area by completing these steps:

1. Position the cursor over one of the corners of the border defining the scan area.
2. Click a corner.
3. Move the cursor until the scan area is the desired size.

**Manually Resizing the Scan Area**

4. Click to anchor the region of interest.

You can also type a period (.) twice to select the region of interest. Then use the left/right arrow keys to decrease or increase the width, or the up and down arrow keys to increase or decrease the height.

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 Pulse Repetition Frequency (PRF)**

Pulse Repetition Frequency (PRF) defines the velocity range of the display. The maximum value (in Hz) for the PRF depends on the specific transducer, 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.

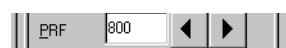
Aliasing occurs when the frequency of what you are observing exceeds one half of the sample rate. If the blood is moving faster than the pulse repetition rate, then the Doppler display will alias, or wrap-around, the baseline. Aliasing may occur for Color Doppler or Directional Power Doppler, but does not occur with Power Doppler.

If the PRF is set too high, low-frequency shifts caused by low-velocity flow may not show. Typically, the PRF is set higher for cardiac and arterial applications than it is for venous or small-parts applications.

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 this control setting.

To adjust the PRF value, click the right or left arrows next to the PRF field.



#### PRF Control

The increment value for each click depends on the current range, as defined in the table below. For example, if the PRF setting is 4000, 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.

#### PRF Ranges

Range (Hz)	Increment (Hz)
200-500	50
500-1000	100
1000-3000	250
2000-5000	500
5000-up	1000

Increasing the PRF also increases the Thermal Index (TI) value (refer to [General Description of Indices](#) on page 259 for more information about thermal indices).

## 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 transducer.

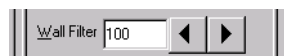
Raising the wall filter setting reduces the display of low velocity tissue motion. Lowering the wall filter setting displays more information. However, more wall tissue motion is also displayed.

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 (such as cardiac), or in instances where the transducer 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, click the right arrow to increase the setting, or the left arrow to decrease the setting.



#### Wall Filter Control

The wall filter range is from 1% to 25% of the PRF. The increment value for each click depends on the current range, as listed in the table below. For example, if the wall filter setting is 40, each time you click the right or left arrow, the Terason software adds or subtracts 10 Hz from that value, until the selected value falls into a lower or higher range.

#### Wall Filter Ranges

Range (Hz)	Increment (Hz)
2-10	2
10-50	10
50-100	25
100-300	50
300-up	100

## Adjusting the Steering Angle

When using Color 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 (90° 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 Color Doppler information. In most instances, the more nearly parallel to the flow the Color Doppler beam is (the lower the angle-to-flow), the better the received signal. Angles of 60° or less provide the best quality Color and Power Doppler.

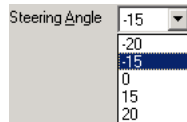
Electronic steering is useful when the flow is at a poor angle to the Color Doppler beam. However, it is often also necessary to press on one end of the transducer or the other to improve the Doppler angle-to-flow.

Electronic steering is only available with flat linear-array transducers (the 7L3, and 12L5). This option does not display with any other transducers. Curved linear and phased array transducers are not capable of electronic steering, and depending on the clinical situation, may require that you press down on one corner of the transducer 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, select an angle from the menu.





### Steering Angle Menu

You can also adjust the steering angle by typing a slash (/). When you type this character, the Terason software highlights the Steering Angle value, and you can use the left and right arrow keys to change the value.

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

## Inverting the Doppler Display (Color Invert)

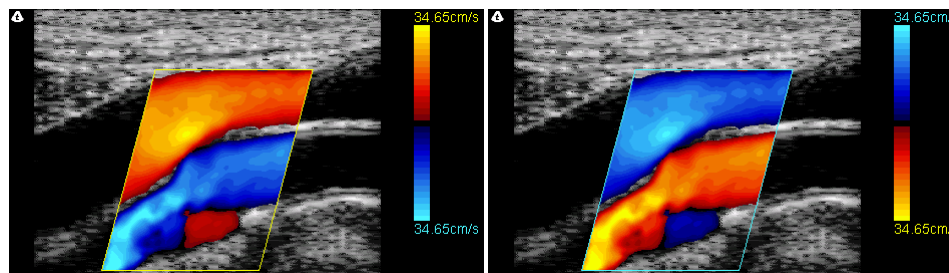
In Color Doppler and Directional Power Doppler modes, you can invert the color scale. This feature is not available with the Power Doppler mode.

Normally, the color red is assigned to positive frequency shifts (flow toward the transducer), and blue is assigned to negative frequency shifts (flow away from the transducer). However, this color assignment can be reversed by clicking the Color Invert button. Whether the display is inverted or not, flow toward the transducer is assigned the colors of the top half of the color bar, and flow away from the transducer is assigned the colors of the bottom half of the color bar.

When you click the Color Invert button, 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 transducer. 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.

button:



Color Invert Not Selected

Color Invert Selected

### Effects of the Color Invert Button

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

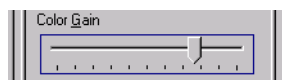
The figure above should be viewed in color; when printed in black and white, the effect may be obscured.

## Adjusting the 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.

To increase the color gain, drag the slider to the right. To decrease the color gain, drag the slider to the left.



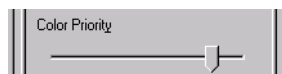
**Color Gain Control**

You can also adjust the color gain by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys.

## 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 all the way to the left, no color is displayed.

To increase the color priority, drag the slider to the right. To decrease the color priority, drag the slider to the left.



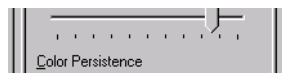
**Color Priority Control**

You can also adjust the color priority by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys.

## 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.

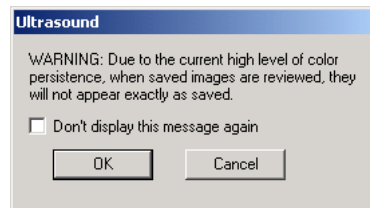
To increase the color persistence, drag the slider to the right. To decrease the color persistence, drag the slider to the left.



**Color Persistence Control**

You can also adjust the color persistence by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys.

When color persistence is set high, a recalled saved image (single frame) may not look exactly the same as when the image was saved. When you save a Color Doppler image with a high color persistence setting to the local computer, this warning displays:

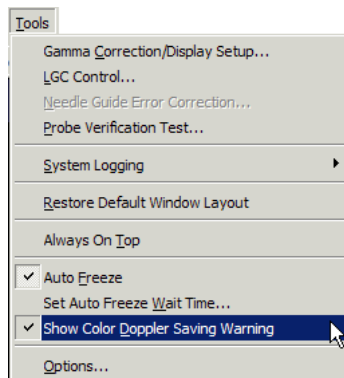


### Color Doppler Save Warning

This warning does not display when you send images to a DICOM server, only when you save images on the local computer.

If you do not want to see this warning when you save Color Doppler images with high persistence settings, you can select the check box in the message above before you click OK to clear the message.

You can also use Show Color Doppler Save Warning on the Tools menu to enable or disable the warning. In the figure below, the warning is enabled.



### Tools Menu

Click the Show Color Doppler Saving Warning menu item to toggle its setting between enabled (check mark) and disabled (no check mark).

## Adjusting the Color Baseline

In general, color baseline adjustments are 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.

This image control works with Color Doppler and Directional Power Doppler scan modes. It does not work with the Power Doppler scan mode.

To move the color baseline up, drag the slider to the right. To move the color baseline down, drag the slider to the left.



#### Color Baseline Control

You can also adjust the color baseline by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys.

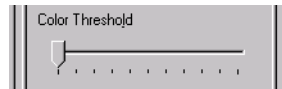
You can see the effect of your change on the color reference bar. If the bar is not visible, select **View > Image Display Properties > Reference Bar** to add it to the image display.

## Adjusting the Color Threshold

The color threshold control only works with Color Doppler. It does not work with Directional Power Doppler or Power Doppler scan modes.

This slider lets you choose how much low velocity data displays. When the slider is set all the way to the left, all velocity data displays in the Image Display window. If you move the slider, the Terason software removes some of the low velocity data. How much data is suppressed depends on how far to the right you move the slider.

To hide low velocity data, drag the color threshold slider to the right. To show low velocity data, drag the color threshold slider to the left.



#### Color Threshold Control

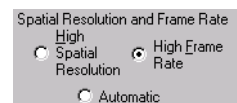
You can also adjust the color threshold by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys.

## Choosing the Frame Rate/Spatial Resolution

The three radio buttons near the bottom of the window adjust the frame rate. You can choose one of these options:

- **High Spatial Resolution**, which produces an image with higher line density, resulting in better spatial resolution
- **High Frame Rate**, which uses a lower line density resulting in better frame rate
- **Automatic**, which chooses a line density based on the lowest frame rate, usually resulting in about a 3 Hz increase in the frame rate

Use High Frame Rate when the flow rate is high, such as in cardiac or certain arterial applications. Choose a method by clicking on that method's radio button.



#### Spatial Resolution and Frame Rate Control

Increasing the PRF also increases the Thermal Index (TI) value (refer to “General Description of Indices” in the *Terason Ultrasound System User Guide* for more information about thermal indices).

## Special Cardiac Image Controls

Two controls on the CD Image Control window are only active when using the 4V2 transducer with the Cardiac exam presets.

### 2D Suppress

Selecting 2D Suppress narrows the width of the displayed image to the region of interest. This increases the Color Doppler frame rate.

To apply 2D Suppress, click the 2D Suppress button on the CD Image Control window.



**2D Suppress Control**

### 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.

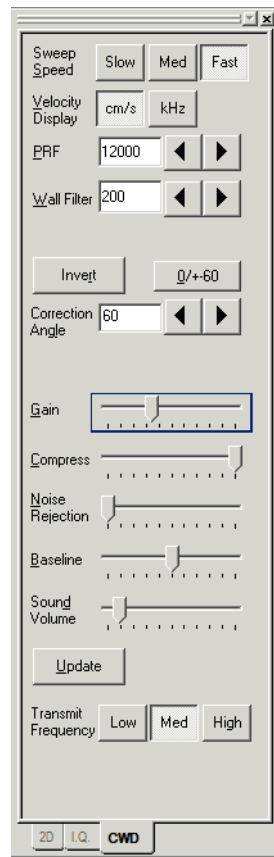
To apply tissue Doppler imaging, click the TDI button on the CD Image Control Window.



**Tissue Doppler Imaging Control**

## Using Continuous Wave Doppler Image Controls

When you select Pulsed-Wave Doppler, the Terason software adds the CWD tab to the Image Controls window.



### Continuous Wave Doppler Image Controls



**Note:** CWD is not available when the Pwr mode is selected.  
Pwr mode is not available when CWD is selected.

## Adjusting the Sweep Speed

The Terason software lets you choose the sweep speed for Continuous Wave Doppler mode. 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 tick represents one second. When an image is frozen, you cannot change the setting.

To choose a speed, click the Slow, Medium, or Fast Sweep Speed button.



#### Sweep Speed Controls

You can also select Image > Sweep Speed and then choose a speed, or right-click in the Time Series window and select a speed.

## Setting the Velocity Display Units

The Times Series window shows the velocity of flow in cm/s or kHz. You can change the units any time. Centimeters per second (cm/s) is available only when the correction angle (see [Adjusting the Correction Angle](#) on page 112) is between 0 and  $\pm 70^\circ$ . If you set a higher angle, the Terason software automatically changes the units to KHz.

To change the velocity display units, click the button for the units you want to use: cm/s or kHz.

## Adjusting Pulse Repetition Frequency (PRF)

Pulse Repetition Frequency defines the velocity range of the display. The maximum value (in Hz) for the PRF depends on the specific transducer 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, click the right or left arrows next to the PRF field.



#### PRF Control



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

The increment value for each click depends on the current range, as defined in the following table. For example, if the PRF setting is 4000, 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.

#### PRF Ranges

Range (Hz)	Increment (Hz)
200-1000	100
1000-5000	500
5000-up	1000

Increasing the PRF also increases the Thermal Index (TI) value (refer to [General Description of Indices](#) on page 259 for more information about thermal indices).

## 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 transducer.

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, click the right or left arrows next to the wall filter field.



Wall Filter Control

## Inverting the Doppler Display (Color Invert)

In Color Doppler and Directional Power Doppler modes, you can invert the color scale. This feature is not available with the Power Doppler mode.

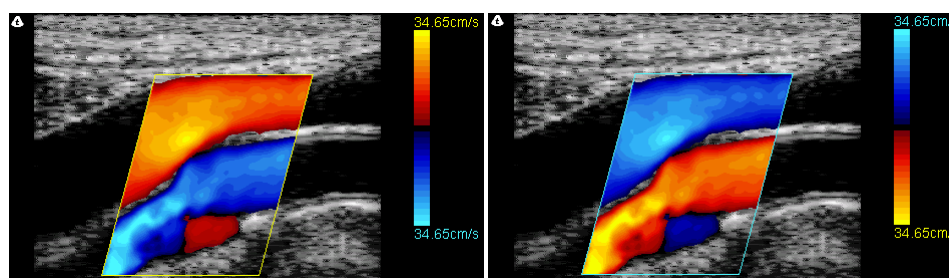
Normally, the color red is assigned to positive frequency shifts (flow toward the transducer), and blue is assigned to negative frequency shifts (flow away from the transducer). However, this color assignment can be reversed by clicking the Color Invert button. Whether the display is inverted or not, flow toward the transducer is assigned the colors of the top half of the color bar, and flow away from the transducer is assigned the colors of the bottom half of the color bar.

When you click the Color Invert button, 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 transducer. 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.



The following figure shows the effect of using the button:



Color Invert Not Selected

Color Invert Selected

#### Effects of the Color Invert Button

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 Correction Angle

To obtain accurate velocities, you must maintain Doppler angles of 60° or less. However, it is common to use higher values of correction angle, especially in peripheral vascular applications where the blood vessels are more parallel to the face of the transducer.

In the Terason Ultrasound System, the maximum value for the correction angle is  $\pm 70^\circ$ . The velocity display in centimeters per second (cm/s) is shown only in the range between 0 and  $\pm 70^\circ$ . At angles greater than 70°, the error in the velocity calculation is too large, and the velocity scale is converted to frequency, independent of the correction angle. The flow-direction cursor still shows on the window, for reference.

To adjust the correction angle, click the right arrow to increase the angle, or the left arrow to decrease the angle.



#### Correction Angle Controls

You can also press the slash (/) key twice to select the Correction Angle value, then use the right and left arrow keys to select a different value.

To set the correction angle to 0 or 60°, click the 0/+/-60 button. This button sets the correction angle to -60, 0, or 60, whichever value is closer to the current value. The correction angle control is active on frozen and live images.

#### Angle, 2.0 mm (Right)

The long line is the scan line. The = is the sample volume size and location.

## Adjusting the Gain

The gain setting on the CWD tab (not the gain setting on the 2D tab) 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 artifacts are created.

To adjust the gain, click the slider and drag it to the left to decrease the gain, or drag it to the right to increase the gain.



#### CWD Gain Control

You can also adjust the gain by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys.

The Gain item on the Image menu adjusts the 2D gain, not the CWD gain.

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

## Adjusting Compression

The Compress slider controls signal compression, which affects the contrast of the image. A number to the left of the slider indicates the amount of compression, from – 50 to 50.

Drag the slider to the right to increase the range of contrast, which displays more shades of gray, or drag the slider to the left to decrease the range of contrast.



#### Compress Slider

## Adjusting Noise Rejection

The Noise Rejection slider controls rejection of low-level returned signals. Increasing rejection darkens the image background. A number to the left of the slider indicates the level of noise rejection, from – 50 to 50.

Drag the slider to the right to increase noise rejection, or drag the slider to the left to decrease it.



#### Noise Rejection Slider

## Adjusting the Baseline

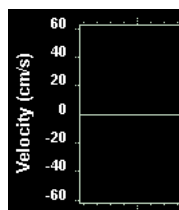
*Baseline* refers to the zero baseline in the Time Series Display window. Adjusting this control moves the zero baseline up or down. When you adjust the baseline, you can display more forward or more reverse flow, to take advantage of the full scale available at that particular PRF value.

Drag the slider to the left to move the baseline down. Drag the slider to the right to move the baseline up.

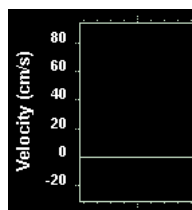


#### Baseline Control

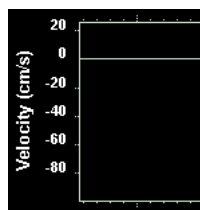
You can also adjust the baseline by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys. The figure below shows a centered baseline (the default), and adjusted baselines.



Centered Baseline  
(default)



Lowered Baseline



Raised Baseline

### Effects of Altering the Baseline

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

## Adjusting the Sound Volume

The **Sound Volume** control lets you define the volume of the Continuous Wave 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. Drag the slider to the left to lower the volume. Drag the slider to the right to raise the volume.



### Volume Control

You can also adjust the volume by clicking on the slider (a blue box displays around the slider) and using the left and right arrow keys.

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** button lets you choose whether or not to continue scanning the anatomy (displayed in the 2D window) while acquiring CWD scan data (displayed in the Time Series window). When Update is selected, the Terason software continuously updates the 2D scan while acquiring CWD data. When not selected, the Terason software freezes the 2D data while acquiring CWD data. When Update is selected, the button appears pressed in and is a lighter shade than its surroundings.

The default setting for this button in most exams is *selected* (continuous scanning of the 2D and CWD data). In Cardiac and Renal exams, the default is *not selected*.

When you de-select the Update button (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 Image Controls When Update Disabled**

Image Control Tab	Available	Not Available	
2D	Size Exam	Frequency Depth Focus Gain	TGC curve Sector width THI
IQ	Left/Right invert Up/Down invert Colorization Smoothing Map Compression Noise Rejection	Persistence	

All image control settings on the PWD tab remain available.

You can change the action of the Update button for the currently-selected exam. See [Changing the PWD Update Button Action](#) on page 164

To toggle the 2D window between live and frozen, click the Update button.



**Update Button**

## Scanning in Triplex Mode

Triplex scan mode combines Pulsed-Wave Doppler or Continuous Wave Doppler scanning with Color Doppler, with Power Doppler, or with Directional Power Doppler scanning. You can enable Triplex scanning using any of the following methods:

- Select a Doppler mode (CD, PD, or DPD), then select Pulsed-Wave Doppler or Continuous Wave Doppler mode.
- Select a Doppler mode, then right-click in the scan window, and select Set PWD Gate from the shortcut menu.
- Select a Doppler mode, then type **P** (for PWD), or **W** (for CWD).
- Position the cursor in the 2D image where you want to set the range gate, then double-click.

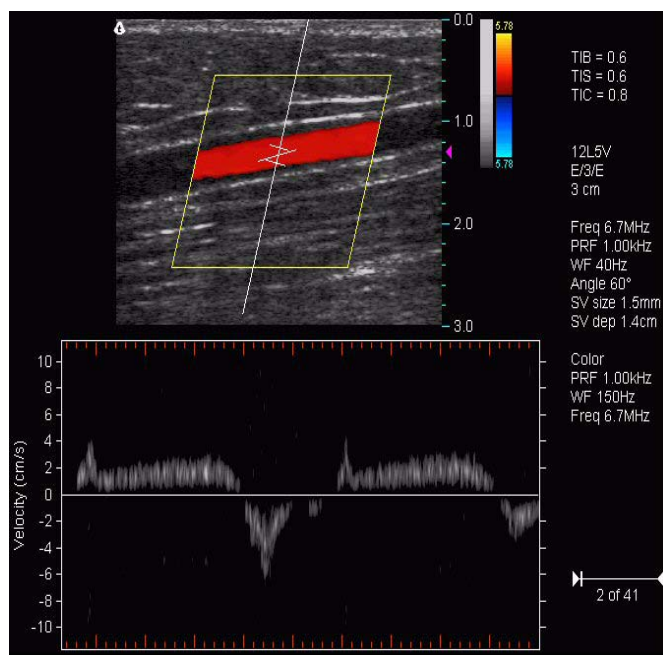


**Note:** Continuous Wave Doppler mode is only available with the 4V2 transducer.

To adjust image controls for Triplex scanning, first adjust the image controls for the 2D scan mode, then go to the Color Doppler window, then double-click the PWD line and Sample Volume location.

Some of the 2D image controls cannot be adjusted when running in Triplex, so you must adjust the image controls (described in [Controls on the 2D Image Control Window](#) on page 91) before you initiate Triplex scanning.

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



Live Triplex Scan

## Region of Interest

When scanning in Triplex mode, you cannot directly move the region of interest or adjust its size. However, you can move the range gate, as described in [Adjusting the Sample Volume \(SV\) Size and Depth](#) on page 112. When you set the new location for the range gate, the Terason software centers the region of interest around the new location.

## Image Controls

The Terason software does not provide a unique Image Control tab for Triplex scanning. You use the 2D scan mode controls (CD, DirPwr, or Pwr tab) and the PWD tab to set image controls for Triplex scanning.

Notice that the Probe Info shows two sets of PRF values. The Terason software requires the same PRF value for both PWD and the 2D scan. If you change the PRF value on one tab, the Terason software duplicates that value on the other tab.

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

## Updating the Displays

The **Update** button allows you to freeze the 2D window while acquiring PWD scan data. This may provide a clearer signal and allows using a higher Doppler PRF.

The default setting for this button is enabled (continuous scanning of the 2D and PWD data).

When you disable the **Update** button, you cannot adjust some of the image controls on tabs other than the PWD tab. The table below lists the image controls that can and cannot be adjusted when the 2D image is frozen in Triplex scanning.

**Availability of Image Controls When Update Disabled**

Image Control Tab	Available	Not Available	
2D	Size Exam	Frequency Depth Focus Gain	TGC curve Sector width THI
IQ	Left/Right invert Up/Down invert Colorization Smoothing Map Compression Noise Rejection	Persistence	
CD/DirPwr/Pwr		Scan Area PRF Wall filter Color Invert Color Gain Color Priority	Color Persistence Color Baseline High Spatial Resolution vs. High Frame Rate

## 6 Performing Medical Procedures

The Terason Ultrasound System can aid in performing medical procedures such as biopsies, brachytherapy, and cryoablation. Depending on whether you purchased the additional equipment required for these procedures, you may have to understand:

- [Assembling the Needle Guide](#); see page 135
- [Performing a Biopsy](#); see page 140
- [Verifying the Alignment](#); see page 143
- [Setting the Error Correction](#); see page 144
- [Cleaning the Transducers and Brackets](#); see page 145

This chapter describes how to use the Terason Ultrasound System to support medical procedures. It does not describe how to perform the procedure itself. Always follow proper medical protocols!

### Assembling the Needle Guide

To use the Terason Ultrasound System while performing a biopsy or other medical procedure, you must:

1. Obtain the correct needle guide kit and brackets
2. Assemble the equipment for the biopsy

This User Guide describes how to use the Terason Ultrasound System to aid in performing a biopsy. Follow the correct clinical procedure for the specific biopsy you must perform.

### Equipment Description

To perform a biopsy, you need a transducer, needle, needle guide kit, and bracket. The biopsy feature can be used with the following transducer:

- 12L5V
- 7L5
- 8EC4V

### Needle Guide Kits

A needle guide kit contains several parts that fit together to attach the needle to the transducer and provide a guide that directs the needle into the patient.

There are two types of needle guide kits, both of which are ordered directly from Civco (www.civco.com) or Protek (www.protekmedical.com):

- Starter needle guide kit
- Replacement needle guide kit

Starter needle guide kits contain both disposable and reusable parts that you need to perform a biopsy. Replacement needle guide kits contain only disposable parts. After the first time, you must use a new replacement needle guide kit each time you perform a biopsy.

Different needle guide kits are required for each type of transducer. The following table lists the Terason transducers 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 transducer.

**Terason Needle Kit Numbers**

Model	Starter Kit Contents	Replacement Kit
8EC4V	<ul style="list-style-type: none"> <li>• Disposable needle guide bracket</li> <li>• Disposable sterile cover</li> </ul>	Not applicable.
12L5V	<ul style="list-style-type: none"> <li>• Non-sterile L5, L7, 6L3, 8L5 single-angle bracket</li> <li>• Ultra-Pro II needle guide</li> <li>• CIV-Flex cover</li> </ul>	Not applicable.
7L5	<ul style="list-style-type: none"> <li>• Non-sterile L5, L7, 6L3, 8L5 single-angle bracket</li> <li>• Ultra-Pro II needle guide</li> <li>• CIV-Flex cover</li> </ul>	Not applicable

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 Terason 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:** Ensure that you discard all disposable parts after using a needle guide kit.  
Prevent heat damage to needle guides. Keep them below 50°C (122°F).

### Brackets

The figure below shows the correct bracket for the 12L5 transducer:





12L5 Transducer (Left) and Bracket (Right)

## Assembling the Bracket and Guide

Each transducer works with only one bracket. These instructions describe how to assemble the bracket for the 12L5 transducer (from Sound Tech). You can also follow the procedure provided in the biopsy kit to assemble the bracket and needle guide.

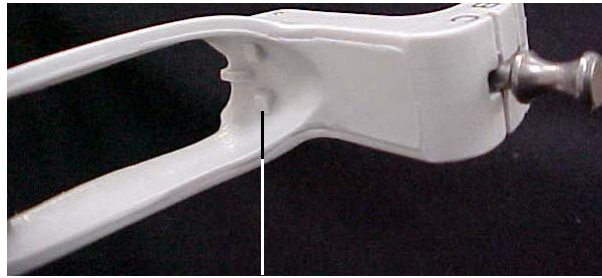
Before performing a biopsy, you must assemble the needle guide parts and prepare the transducer for the biopsy by completing the following steps:

1. Collect the following **items**, which are required to complete the biopsy procedure:
  - Transducer
  - Bracket
  - Needle
  - Needle guide clip
  - Gauge insert pin



Items Required for Biopsy Procedure

2. To attach the bracket to the transducer, align the **guide pins** on the inside of the bracket with the corresponding depressions on the transducer.



Alignment Pins on the 12L5 Bracket



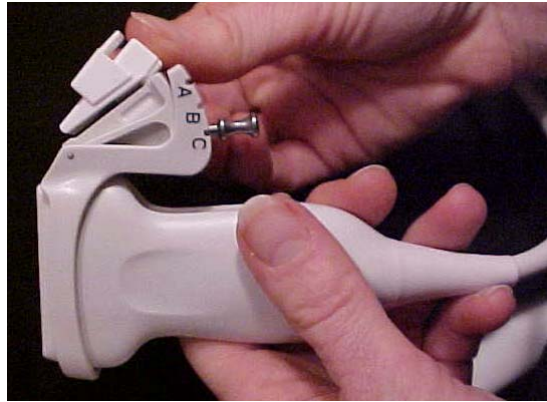
Alignment Depressions on the 12L5 Transducer

3. Snap the **bracket** onto the transducer face, starting with the bottom end of the bracket (opposite end from the alignment pins).



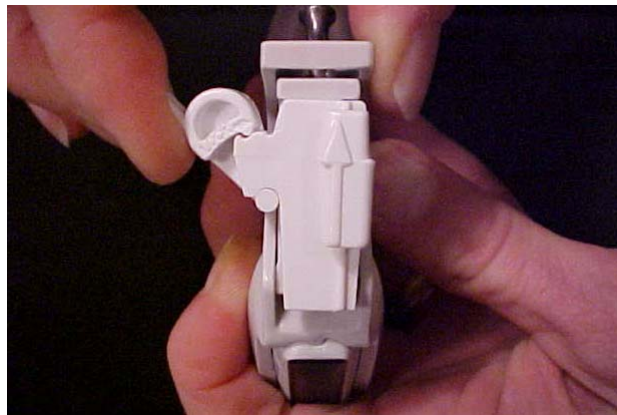
Attaching the Bracket

4. Slide the **bottom end** of the bracket on first, and then snap the top of the bracket onto the transducer.
5. Place the slot in the needle **guide clip** against the bracket.



**Placing the Needle Guide Clip**

6. Holding the needle guide clip securely in place against the bracket, close the **latch** to secure the needle guide clip to the bracket.



**Closing the Latch**

7. Select a **gauge insert pin**.
8. Ensure that the gauge insert pin is equal to or larger than the size of the **needle** you plan to use.
9. Align the **arrow** on the gauge insert pin with the arrow on the needle guide clip.



**Aligning the Needle Guide Clip**

10. With the parts oriented as shown above, push the **gauge insert pin** down as far as it will go.



**Inserting the Pin**

This insert pin has a small hole through which the needle will be placed. Each needle guide kit contains gauge insert pins ranging from 13 to 22 gauge.

11. When you begin the biopsy, you will insert the **needle** into the gauge insert pin, pushing the needle down through the slot and into the region of interest in the patient.

## Performing a Biopsy

When all of the preparatory steps are complete, and you have recently verified the alignment (see [Verifying the Alignment](#) on page 143), 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.

The Terason software displays guide lines for the specific transducer, bracket, and needle gauge used in a biopsy or other medical procedure.

The needle guides work only in these modes:

- 2D
- Color Doppler mode
- Directional Power Doppler
- Power Doppler mode

You cannot use the needle guides in:

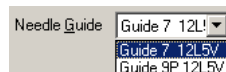
- M-Mode
- Pulsed-Wave Doppler mode
- Continuous-Wave Doppler mode
- Triplex
- Zoom mode
- Split Screen mode

You can only see the target indicator on a live image; the Terason software removes it when you freeze the image.

To perform a biopsy using the Terason Ultrasound System as a guide, complete these steps:


### 1. Start live imaging.

On the I.Q. tab, select the **needle guide** that corresponds to the guide attached to the transducer (you might only have one option, depending on the transducer).

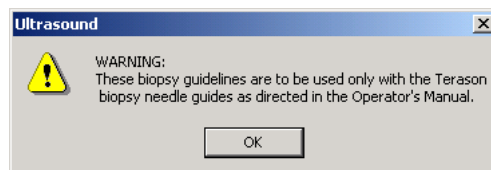


#### Needle Guide Choices (I.Q. Tab)

### 2. If the guides do not display, use one of these methods to display the needle guides:

- Click  on the Tools toolbar.
- Select **View > Needle Guide Display > Guide Lines**
- Type **N** to show the needle guide

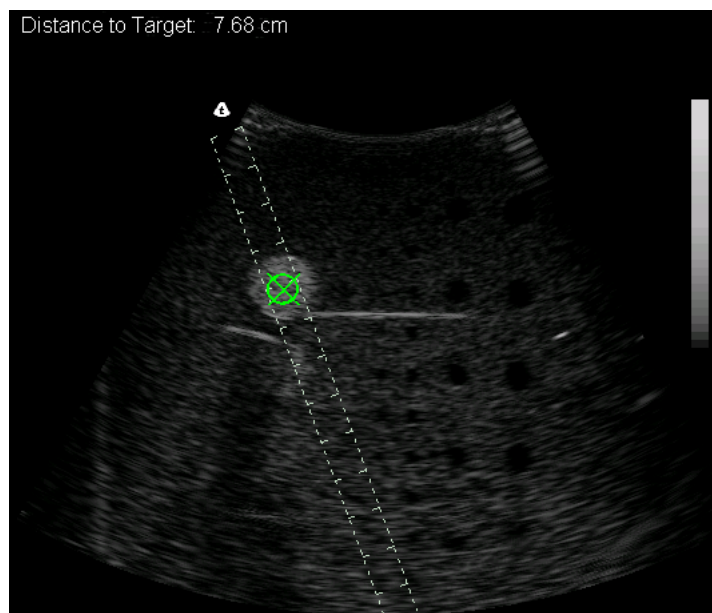
The needle guide lines show in the Image Display window, along with the following message:



#### Biopsy Warning

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 target indicator (green circle with an X) 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 ticks on the guide lines are at 1 cm intervals, and the distance between the guide lines is fixed at 1 cm.

4. If the Target Indicator (green circle with an X) does not show within the guides, select **View > Needle Guide Display > Needle Guide Target Indicator**.

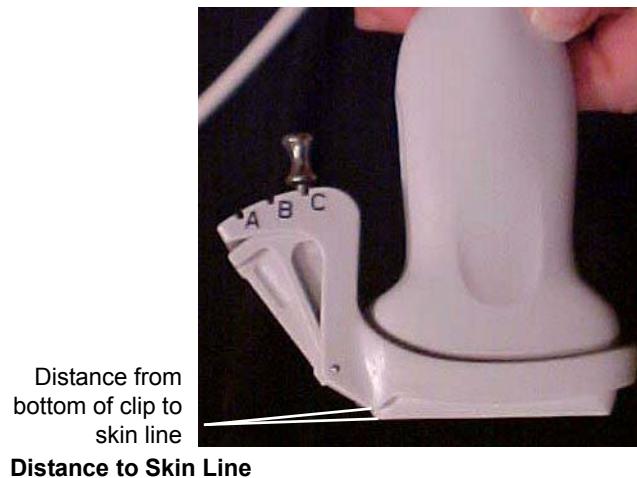
The Terason software adds the “Distance to Target” value at the top of the image.



**Caution:** If the message “Uncalibrated” displays next to the “Distance to Target” text, the transducer may be uncalibrated, or your calibration file may be missing or corrupted. Uncalibrated transducers can apply harmful levels of energy to the patient. Contact your Terason representative.

5. Move the cursor within the lines to highlight the target of the biopsy or other procedure and determine the depth of that target. 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.



To turn off the needle guides, click .

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 on the I.Q. tab. If you have, stop the procedure immediately and contact a Terason representative.

## Verifying the Alignment

To ensure that the transducer 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 transducer and biopsy attachment, complete these steps:

1. If the needle guides are not visible, select **View > Needle Guide Display > Guide Lines**. The biopsy guides appear in the Image Display window.
2. From the Needle Guide menu on the I.Q. tab, select the needle guide that you want to use for the test.
3. Assemble the bracket, needle guide clip, and gauge insert pin as described in [Assembling the Bracket and Guide](#) on page 137.
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 transducer.

## Setting the Error Correction

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 select **Needle Guide Error Correction** from the **Tools** menu, the Terason software displays the correct dialog box for the current transducer.

### Correcting Needle Guide Positioning for Biopsies

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.

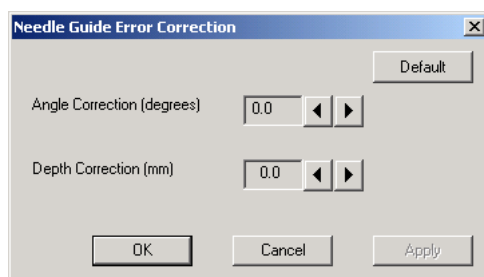
You can make marginal changes to the upper and lower limits for angle and depth on the Needle Guide Error Correction dialog box. Your changes to these settings are visible in the needle guidelines, and are saved by the system and used for all biopsies until you change them again.

You can enter a value within these ranges:

- Angle:  $-2^{\circ}$  to  $2^{\circ}$
- Depth:  $-1$  mm to  $1$  mm

To change the needle guide error correction values for any transducer except the biplanar transducer, complete these steps:

1. Click **Tools > Needle Guide Error Correction**. The Needle Guide Error Correction dialog box opens.



**Needle Guide Error Correction 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.

2. Next to the Angle Correction field, click the left and right arrows to correct the angle by the number of degrees.
3. Next to the Depth Correction field, click the left and right arrows to correct the depth by the number of millimeters.
4. Click **OK** to save your entries and close the dialog box.



## **Cleaning the Transducers and Brackets**

The transducer must be cleaned and high-level disinfected between patients. For instructions, refer to [Between-Use Processing of Terason Transducers](#) on page 272.

To sterilize the brackets, complete the procedure recommended by Civco or Protek.

## 7 Working with Image Files

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

- [Storing Images and Loops](#); see page 146
- [Finding Stored Images and Loops](#); see page 151
- [Managing Files](#); see page 156
- [Editing Images and Loops](#) on page 163
- [Printing Images](#); see page 165
- [Using Images with a DICOM Printer or Server](#) on page 224

### 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:

- [Checking Disk Space](#); see page 146
- [Selecting File Types](#); see page 147
- [Saving Images and Loops](#); see page 148
- [Exporting a File](#); see page 150

By default, images and loops are saved in the Terason format and have a file extension of **.ult**.

You can also copy the image in the 2D Image window by selecting **Edit > Copy Image** (or pressing the F4 key), and pasting the image into another application on your computer.

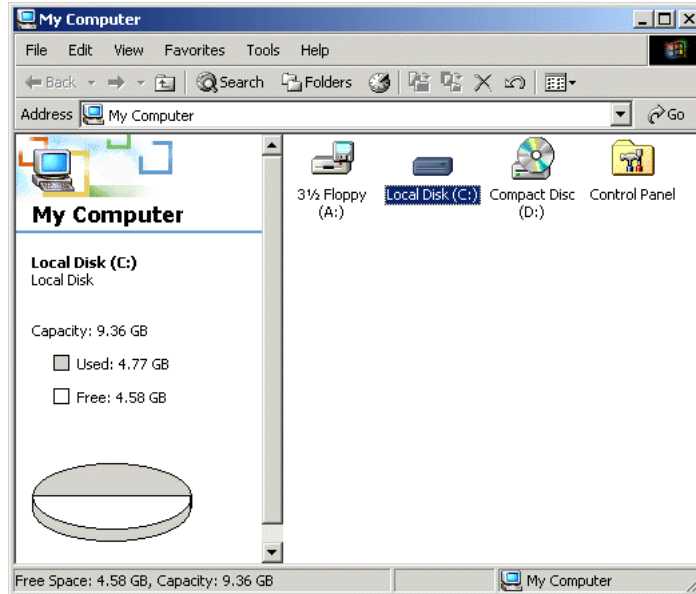
### Checking Disk Space

You should periodically check 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 contribute to the size of an image file, such as the scan mode, measurements or annotations, and image size. 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.

To check disk space, complete these steps:

1. Double-click the **My Computer** icon on the Desktop. Windows opens the following window:



#### My Computer Window (Large Icons View)

Depending on your desktop setup, your window may not show the My Computer pane. The status bar (along the bottom of the window) lists the free space.

2. Click the **Local Disk (C:)** icon. The left side shows the capacity of the C: drive and how much space is left. In the above example, the disk has more than 4 GB free.

If the disk space does not display, complete the following steps:

1. Right-click the **Local Disk (C:)** icon.
2. In the pop-up menu, click **Properties**.

If you run low on disk space, the message Disk space is low appears in the Windows status bar. If you see this message, you should move files to a backup CD (see [Backing Up Files on a CD](#) on page 157) or delete unimportant files (see [Deleting Files](#) on page 162).

## Selecting File Types

The Terason software allows you to save an image or loop in any of these formats:

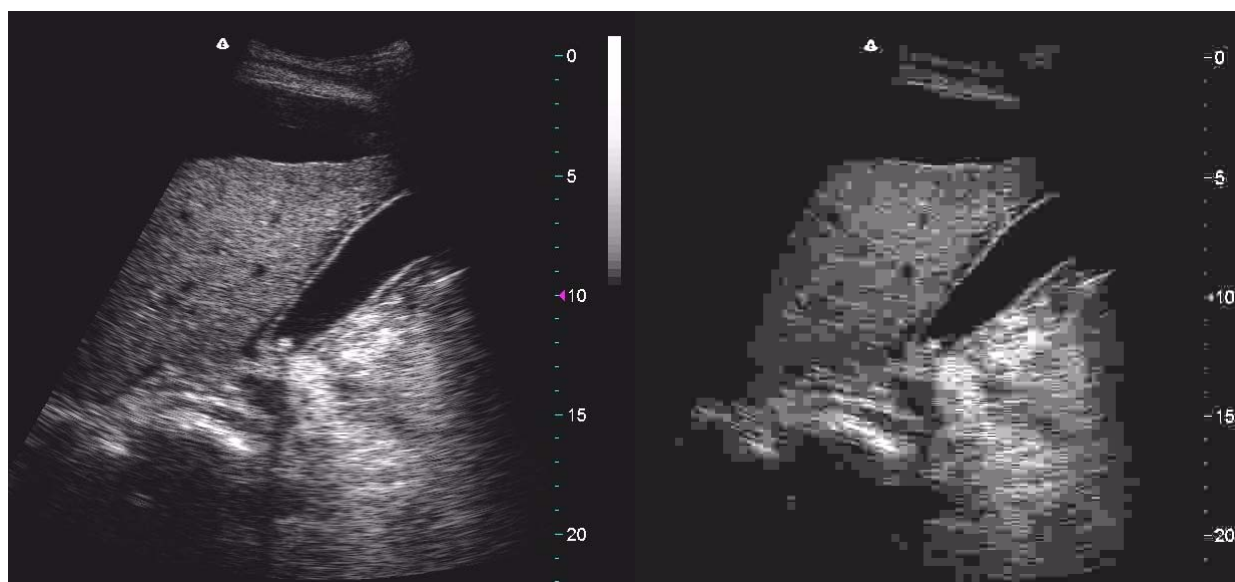
- .ult Terason image file
- AVI
- Bitmap
- DICOM
- JPEG
- TIFF

To create images that can be viewed by others who do not have the Terason software, use a format other than the Terason format (.ult). 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.



**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 Patient directory in the appropriate patient folder, or in the Image directory, if not associated with a patient.

When you save a file, the image or loop is assigned a filename based on the exam type and any additional text. For example, if you are saving an image with a Cardiac exam type, and added the text, “new exam”, the default filename would be “CAR NEW EXAM.ULT.”

For Split Screen mode, you can save the Split Screen image (as a single frame showing both screens) when you save to the DICOM, TIF, JPEG, or BMP file formats. If you save to the Terason format (ULT), only the active screen is saved.

You can save the Split Screen image as a loop file using the DICOM or AVI formats. When you do, the Terason software saves the active screen as an image loop, and the other screen as a single frame. When you save a Split Screen image to the Terason format (ULT), only the loop in the active screen is saved. The frame data for the other screen is discarded.

To save an image or loop with a default name, complete these steps:

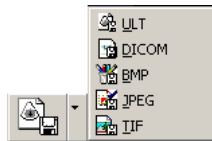
1. Click  if viewing a live image.

2. To save an image, Click  (Save Image).

You can also use one of these methods to save an image:

- Press the F8 key
- Select **File > Save Image (ULT)**

3. To save the file as a different format, click the **arrow** on the Save Image button and click a file type:



You can also select **File > Save Image As** and click a file type

4. To save an image loop, click the **Save Loop** button .

You can also use one of these methods to save a loop:

- Select **File > Save Loop (ULT)**
- Press F9

5. To save the loop as a different format, click the **arrow** on the Save Loop button and click a file type:



You can also select **File > Save Image As** and click a file type

The application displays a message indicating that the image or loop is being saved.

The Save and Save Loop icons may look different if you changed the default format (see [Setting Image Save and Print Defaults](#) on page 242).

Saved files are located in this folder in the computer's file system:

C:\Program Files\Teratech\Terason 3000

The Terason software uses the Patient folder to store all images when the patient is known (patient information was loaded as part of the exam). Within the Patient folder, the Terason software creates a folder for each patient. Each patient's folder contains their patient info file, and one or more dated folders that contain saved images for the indicated date.

If you did not load patient information for an exam, the Terason software uses the Image folder to store files. This folder contains one or more dated folders, and each folder contains all of the saved images for all unidentified patients on that date.

To save a file to a destination other than the Patient folder (for files that are associated with patient data) or the Image folder (for files without patient data), you must use the **Export** item on the **File** menu (see [Exporting a File](#), below).


You can view the contents of these folders in the Terason Explorer window as described in [Finding Files in the Terason Explorer](#) on page 151.

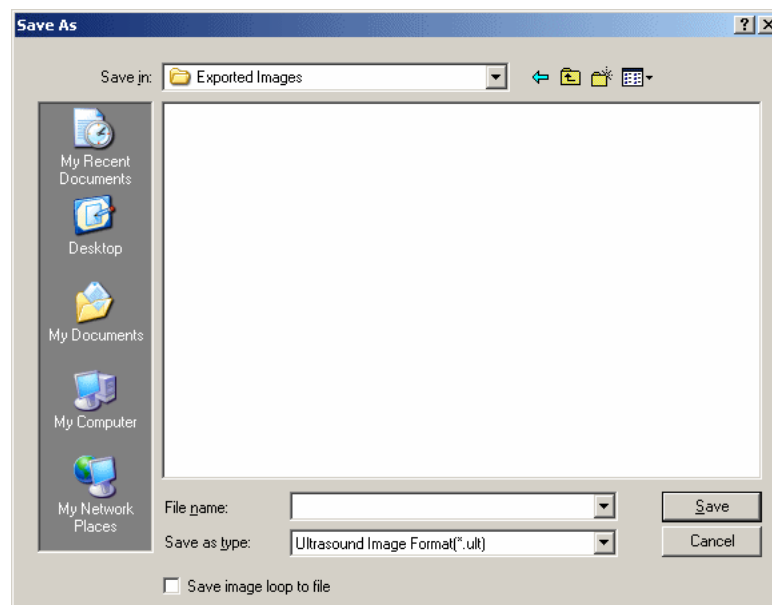
If you open an image file and then save it again, the Terason software creates a new file; it does not overwrite the original file. To overwrite the original file, use the **Export** item on the **File** menu option and select the original file before you click the Save button.

## Exporting a File

To save the image or loop in a different location or with a specific name, you must use the **Export** item on the **File** menu.

You can save the file anywhere on your computer, or on a network server that your computer can access. To export an image or loop, complete these steps:

1. Click  if viewing a live image.
2. Select **File > Export**.



**Save As Dialog Box**

3. Choose a location from the **Save in:** menu.
4. Enter a filename in the **File name:** field.
5. Select a file format from the **Save as type:** menu.
6. To save the file as a loop file, click the **check box**.

You can only select the check box if you choose Terason Image File, AVI, or DICOM file as the format.

7. If you selected a file format other than the Terason format, choose an **Image Size** from the menu.

More pixels in an image produce a larger file. Fewer pixels produce a lower-quality and smaller file.

8. Click **Save**.

## Finding Stored Images and Loops

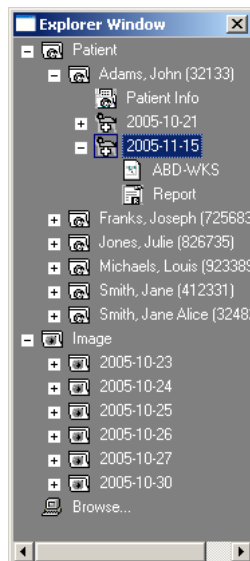
You can use these tools to perform the following operations:

- Finding Files in the Terason Explorer
- Finding Files in the Image Sorter Window
- Browsing to Find Files


For archived images, insert the required CD and select **File > Open**.

## Finding Files in the Terason Explorer

If you must view a saved image or loop, you can use the Terason Explorer window to find it and open it.



Locating Saved Images and Loops

To open a folder, click the  symbol or double-click the folder name. To open an image file, you can either:














- Double-click the file name

or

- Right-click the file and select **Open**

Images and loops have different icons in the Terason Explorer, so you can distinguish them. If you save files in formats other than the Terason ultrasound format, the icon shows the file format. The following table shows what each icon in the Terason Explorer represents.

**Terason Explorer File Icons**

Icon	Description	Icon	Description
	Patient Folder		DICOM Image
	Patient Data file		DICOM Loop
	Image folder in a Patient Folder		AVI Loop
	Image folder		Bitmap Image
	Terason Ultrasound Image		JPEG Image
	Terason Ultrasound Image Loop		TIFF Image
	Report File		

To find a specific image or loop:

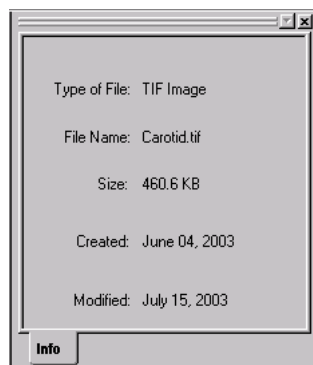
- If you loaded patient information before saving the file, look in the **Patient** folder for the patient's name, and then in the dated folder under that patient's name.
- If you did not load or enter patient information when you saved the file, look in the **Image** folder, in a folder with the date of the exam.
- If you used the File > Export menu, double-click **Browse** and use the Windows dialog box to locate the image.
- If you do not know the date of an image, or there are several that could be the one you are looking for, view the folder in the **Image Sorter** window (see [Finding Files in the Image Sorter Window](#) on page 154).
- If you have moved, deleted, or renamed files using Windows Explorer while the Terason software is running, right-click in the Terason Explorer window and select **Refresh** to update.

The Terason software loads the selected image file into a new tab in the Image Display window. When finished with the image file, select **File > Close Image** and the Terason software removes the tab.



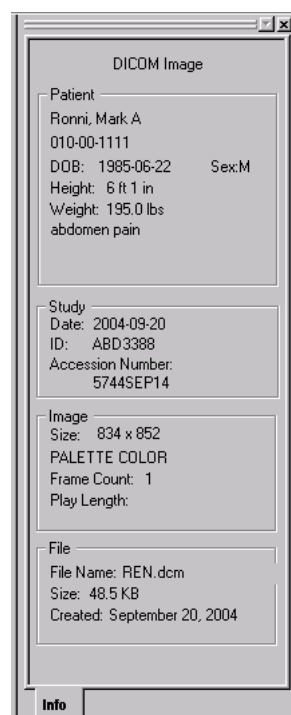
For .ult files (Terason ultrasound format), the image control settings are also loaded. You can edit those settings as described in [Editing Images and Loops](#) on page 163.

For AVI, Bitmap, JPEG, or TIFF file types, an Info tab replaces the Image Control tabs. The Info tab shows the file type, size, and the dates it was created and last modified.



#### Info Tab for a Non-ULT Image

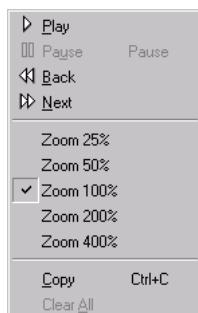
For DICOM files, the Info tab displays the data saved as part of the DICOM image.



#### Info Tab for a DICOM Image

If the image is larger than the Image Display window, the window includes scroll bars along the right and bottom edges. These bars let you see the parts of the image that do not fit within the window. Click and drag in a scroll bar to see a different part of the image.

For non-ULT files, the Terason software provides a shortcut menu that lets you use the Playback functions (for AVI or DICOM loops), resize the image to a selected percentage, or copy the image for pasting into an external application.

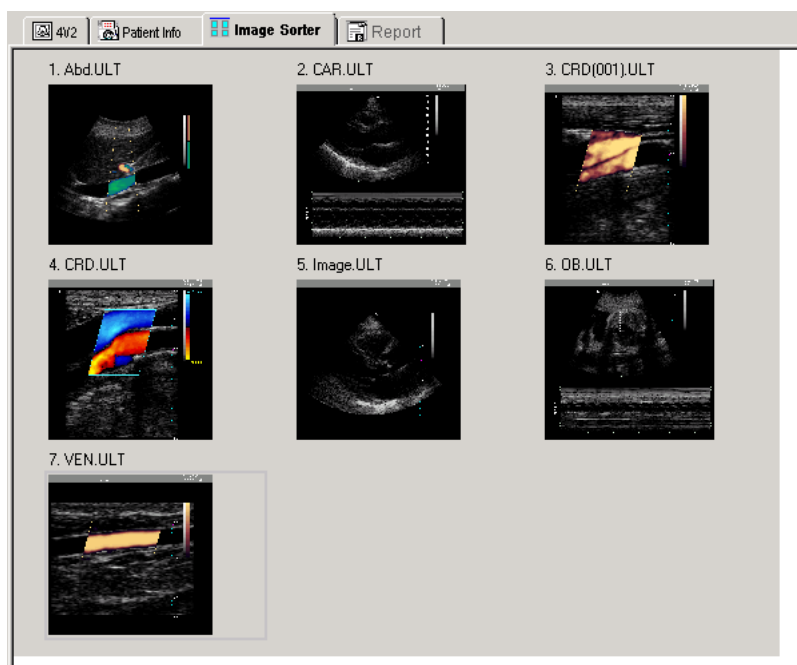


**Shortcut Menu for non-ULT Image Files**

## Finding Files in the Image Sorter Window

The Image Sorter window lets you display thumbnail images for a specific date. When you select a dated folder in the Terason Explorer (either for a specific patient or in the Image folder), the Image Sorter window automatically displays thumbnail images for all files in the selected folder.

To view the Image Sorter window, click the Image Sorter tab.



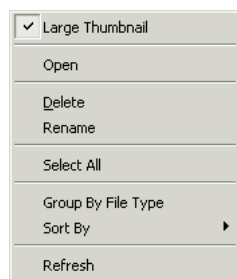
**Image Sorter Tab (Large Thumbnails)**

You can also use this window to print all of a set of ultrasound images instead of printing them one at a time (see [Printing Images](#) on page 165 for instructions).

To open an image or loop, double-click the thumbnail.

You can view large thumbnails (which makes it easier to tell what the images are) or small thumbnails (which makes more thumbnails visible). Select **View > Thumbnail > Large Thumbnail** to toggle between large and small thumbnail images. The large thumbnail is 160 by 120 pixels. The small thumbnail is 100 by 75 pixels.

You can also right-click in the Image Sorter window to choose large or small thumbnails.



#### Shortcut Menu for the Image Sorter Window

The **Delete** item in the shortcut menu deletes selected images from the folder. Make sure you do not need an image before you delete it.

The **Group By File Type** and **Sort By** items let you change the order in which the thumbnails display in the window. By default, this window shows files sorted by Creation Time (earliest first). **Group By File Type** sorts the files based on file type. You can also choose **Sort By** and then **Name** (sorts them alphabetically) or **Creation Time** (earliest first).

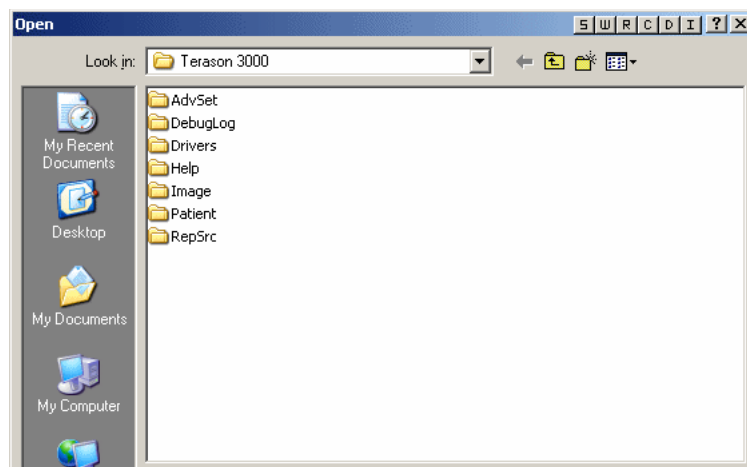
If you use Windows Explorer to rename or delete files, you can select **Refresh** from the shortcut menu (or **View > Refresh**) to update the thumbnails displayed in the Image Sorter window.

## Browsing to Find Files

Terason recommends that you save all patient and image files in the default folders. However, if you have archived images, or if the images are stored elsewhere for any reason, you can still use the Terason Explorer or the File menu to locate those files.

To locate files that were not saved in the Terason default folder, complete these steps:

1. Double-click **Browse** in the Terason Explorer window, or select File > Open. The default folder or the last folder viewed opens in the Open dialog box.



#### Browsing for a File

2. Use the Windows **navigation tools** to find the image you need.
3. Click the **file name** to highlight it.
4. Click **Open**.

The file displays in the Image Display window.

## Managing Files

Using the Terason Ultrasound System produces hundreds of image files. To manage those files, you should understand:

- [Copying Files](#); see page 156
- [Backing Up Files on a CD](#); see page 157
- [Moving Files](#); see page 161
- [Renaming Files](#); see page 161
- [Deleting Files](#); see page 162

## Copying Files

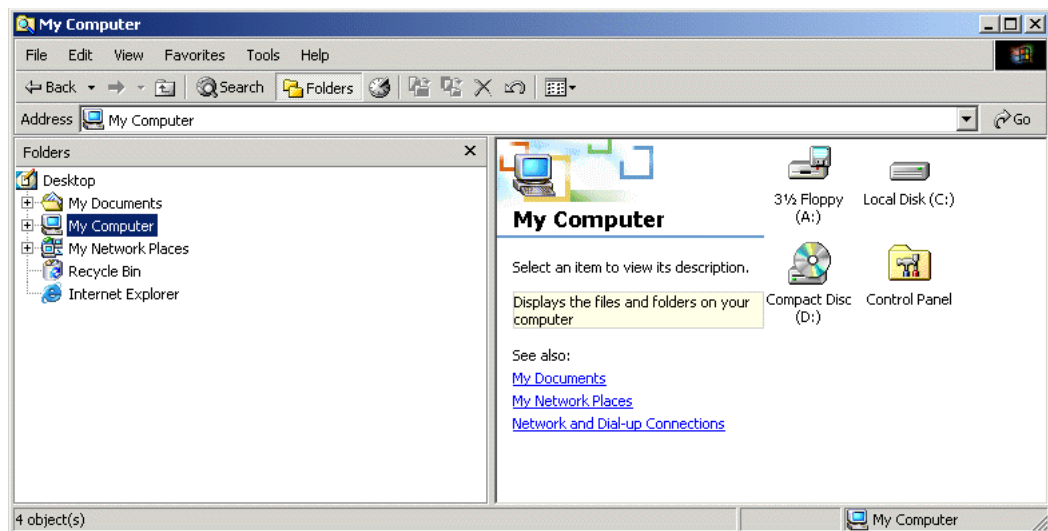
You can copy files to another folder or directory. The method described here is only one of the many ways you can use Windows to copy files from one location to another.



**Note:** Do not use this procedure to copy files to a CD. Always use the CD writing software on your computer when writing to a CD.

To copy a Terason image or patient file, complete these steps:

1. Click the **Start** button at the bottom left of the screen, and choose **Programs > Accessories > Windows Explorer**.



### Windows Explorer

2. In the left pane of the window, open **folders** by clicking them until the folder or file that you want to copy displays.
3. In the right pane of the window, click the **file or folder** to copy.
4. Select **Edit > Copy**.

5. On the left pane of the window, locate and highlight the **folder** where you want to store the folder or file.
6. Select **Edit > Paste**.

Windows copies the file or folder to that folder. You now have two copies of that file or folder.

## Backing Up Files on a CD

Backing up, or archiving, files saved by the Terason software is important. It ensures that you do not lose medical records. You can also archive files for later retrieval if needed. You should back up files at regularly scheduled intervals, such as weekly or at the end of each day.

Backing-up files is copying the files to another place, such as a CD or another computer on a network. The backup copies can be used if your computer is infected with a computer virus or develops a hard drive problem that makes it impossible to access files on the Terason system.

You can use Windows Explorer or another file management program to back up your files. If you do not already have these activities scheduled, talk to the computer administrator at your site about setting-up a schedule. If your site does not support automatic backups, you may have to perform the backups yourself.

Use the CD writer software on your computer to back up files to a CD.

The following instructions are for Nero. If you have a different CD-writer software, refer to its user guide or online help for instructions.

## Using Nero to Write to a CD

To copy images to a CD, complete these steps:

1. Close the Terason **application**.
2. Insert a writable **CD** into the CD drive.
3. Double-click the **Nero** icon on the desktop (created with Nero StartSmart).



### Nero Desktop Shortcut

The startup menu window opens.



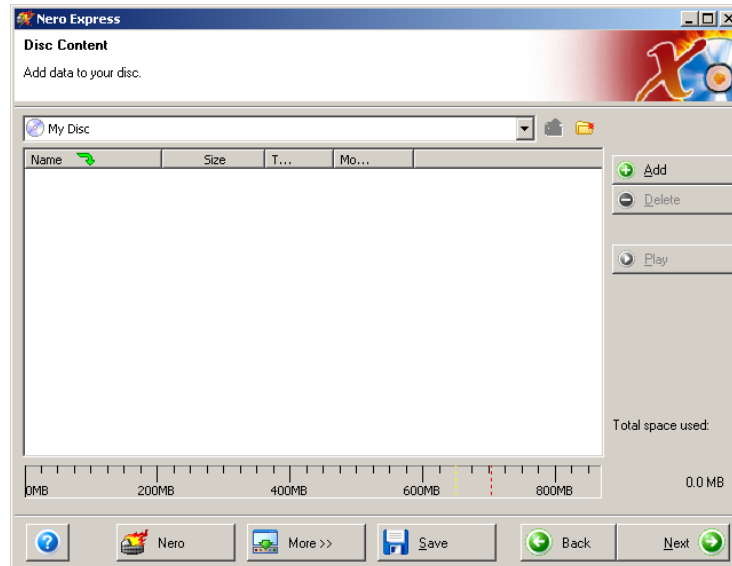
**Nero Favorites Menu**

4. Double-click the **Make Data Disc** icon.



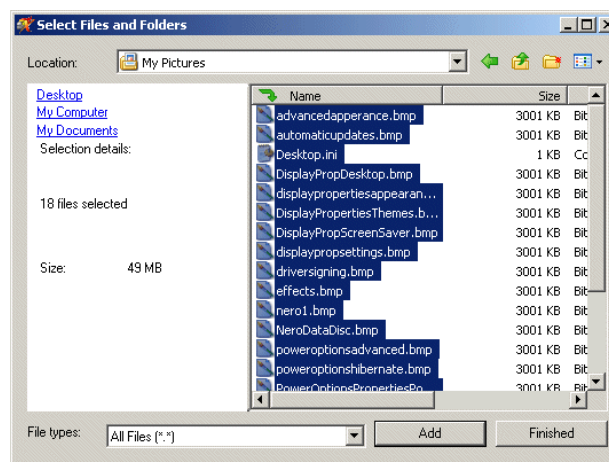
**Nero Data Menu Window**

5. Click **Make Data Disc**. The Disc Content window opens.



Nero Express Disc Content Window

6. Click **Add**. The Select Files and Folders window opens.



Nero Select Files and Folders Dialog Box

7. Open the **Program Files** folder, the Teratech folder, and the Terason 3000 folder.
8. Follow these **guidelines** to choose what to copy:

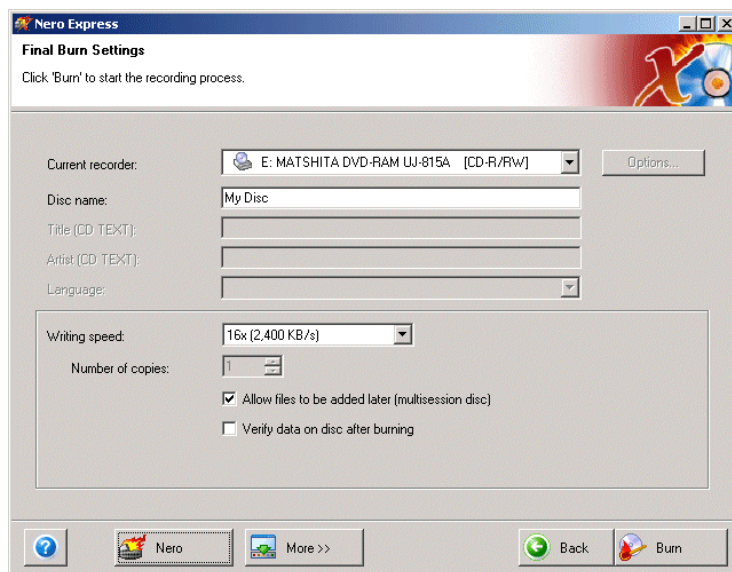
#### Guidelines for Item Selection

To copy...	Do this...
All patient folders	Highlight the Patient directory
An individual patient folder	Open the Patient directory and highlight the folder with the patient's name
An Image directory	Open the Image directory and highlight the folder with the needed date
A single image or loop file	Highlight the file name

9. Highlight the needed folders or files and click **Add**.

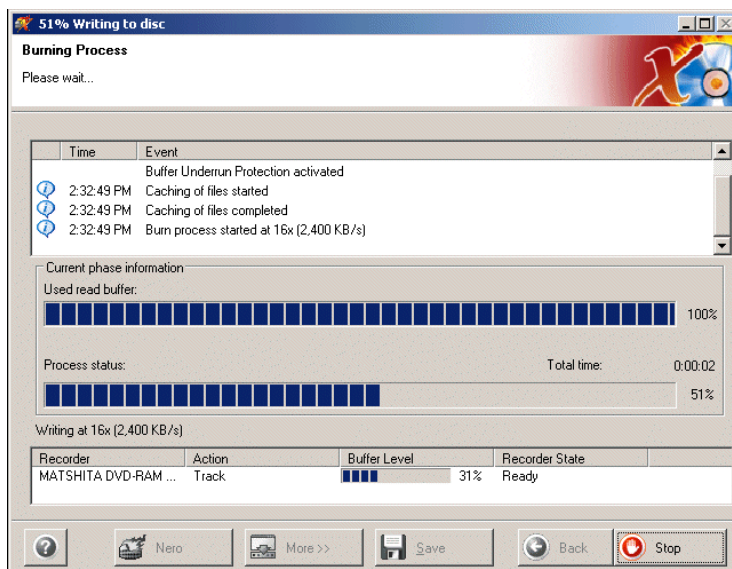


10. Repeat **steps 6-9** for all folders and files you want to write to the CD.
11. Verify that the **Estimated Free Space** listed in the Status bar is at least 1 MB.
12. Click **Next**. The Final Burn Settings dialog box opens.



#### Nero Final Burn Settings

13. Select both **check boxes**:
  - Allow later file addition (multisession disc)
  - Verify data on disc after burning
14. Click **Burn**. The status window shows the copying progress.



#### Nero Progress Message

15. When the program finishes copying the files and displays the success message, click **OK**. The Nero window displays.
16. Click **Next**. Nero displays the Favorites menu window.



17. Click **Exit**. Nero displays a message asking if you want to save your project.
18. Click **No**.
19. Verify that the files can be opened:
  - a. Start the **Terason** software.
  - b. In the Terason Explorer window, click **Browse**.
  - c. Select an image file on the CD that you just created and click **Open**.

If the image file opens correctly, you have successfully written the files to the CD.  
If you cannot open an image file, check the CD creation program for any messages.  
You may have to write the CD again.
20. Remove the CD and **label** it.
21. **Close** the CD creation program.

## Moving Files

Terason does not recommend that you move files out of the default location. Only files in the default directory display in the Terason Explorer window, and you may have difficulty locating other files. Typically, you only move files when you are archiving older files that you do not need on your computer.

To move a file, complete these steps:

1. Click the Start button at the bottom left of the screen, and choose **Programs > Accessories > Windows Explorer**.
2. In the left pane of the window, open folders by clicking them until the file or folder that you want to move displays.
3. In the right pane of the window, click the file or folder you want to move.
4. Select **E**dit > **C**ut.
5. In the left pane of the window, open the **folder** where you want to store the file or folder.
6. Select **E**dit > **P**aste.

## Renaming Files

You can rename files using the Terason Explorer or using Windows Explorer.

### Renaming Files in the Terason Explorer, Image Sorter, and Thumbnail window

You can use these to edit the name of any image file, but not to edit the name of a Patient Info file. To edit a file name, complete these steps:

1. Click the **file name** to highlight it.
2. Right-click and select **Rename**.
3. Type the new name and press **Enter**.

The Terason software changes the name of the file.

### **Renaming Files in Windows Explorer**

You can rename both image and patient info files using Windows Explorer. To rename files from Windows Explorer, complete these steps:

1. Click the **Start** button at the bottom left of the screen, and select **Programs > Accessories > Windows Explorer**.
2. Open folders by clicking them until the file or folder you want to rename is highlighted.
3. Right-click the file or folder and select **Rename**.
4. Type a new name and press **Enter**.

### **Deleting Files**

Terason recommends that you delete unnecessary files to free up disk space. You cannot directly delete patient info files using the Terason Explorer; you can only delete folders and image or loop files.

You can delete files using:

- Terason Explorer, Image Sorter, or Thumbnail window: files are immediately and permanently removed from the system, freeing disk space
- Windows Explorer: files are moved to the Windows Recycle bin

If you used Windows Explorer, you can:

- Retrieve files from the Recycle bin before they are permanently deleted
- Empty the Recycle bin to permanently delete the files

### **Deleting Files Using the Terason Explorer, Image Sorter, and Thumbnail window**

To delete files from the Terason Explorer, Image Sorter or Thumbnail window, complete these steps:

1. Click the **file** that you want to delete, or click a folder to delete all files within the folder.
2. Press the Del key, or right-click the file name and select **Delete** from the shortcut menu. The software prompts you to verify that you want to delete your selection.
3. Click **Yes** to delete the file.

### **Deleting Files Using Windows Explorer**

Files deleted from Windows Explorer go into the Recycle bin, where you can retrieve them if necessary, until the Recycle bin is emptied. Emptying the Recycle bin permanently removes all files from the system; they cannot be recovered. You can use Windows Explorer to delete Patient Info files.

To delete files from Windows Explorer, complete these steps:

1. Click the **Start** button at the bottom left of the screen, and select **Programs > Accessories > Windows Explorer**.
2. Open **folders** by clicking them until the file or folder you want to delete is highlighted.
3. Click the file or folder to delete, and press the **Del** key.
4. To confirm the deletion, click **Yes**.

### Retrieving Files from the Recycle Bin

If you mistakenly delete a file using Windows Explorer, you can retrieve it from the Recycle bin if you have not emptied the bin yet.

To retrieve a file from the Recycle bin, complete these steps:

1. Double-click the **Recycle bin** on the Desktop.
2. Select the **file** to restore, noting its path on the right (the file will be restored to this location) in the Recycle bin window.

To restore multiple files at the same time, press the Ctrl key while clicking each file name.

3. Select **File > Restore**.

The file is returned to its original location.

### Emptying the Recycle Bin

Emptying the Recycle bin permanently deletes all of the files in it from your hard disk; they cannot be retrieved.

To empty the Recycle bin, complete these steps:

1. Double-click the **Recycle bin** on the Desktop.
2. To permanently remove only a few **files** from the system, click them while holding down the Ctrl key, then press the Del key.
3. To permanently remove all files listed, select **File > Empty Recycle Bin**.
4. Click **Yes** to confirm deletions.

## Editing Images and Loops

The Terason Ultrasound System lets you modify saved images and loops. Before making modifications, you must first retrieve the image or loop. The types of modifications you can make depend on whether you are working with an image or a loop. The Terason software can edit only Terason Image Format files and loops (.ult). You can use the Terason software to view images saved in other formats, but not to edit them.

For a retrieved image, you can edit any of these image controls:

- Add or delete measurements
- Add or delete text
- Zoom in on an image (if the image is re-saved, the new zoom setting is not saved)
- Invert Left/Right
- Invert Top/Bottom
- Select a different image map
- Adjust the brightness
- Adjust the contrast
- For Color Doppler and Directional Power modes only:
  - Invert the color
- For Pulsed-Wave Doppler/Triplex only:
  - Correction angle
  - Pulsed-Wave Doppler gain
  - Pulsed-Wave Doppler baseline
  - Wall filter

For a retrieved loop, you can edit any of the above image controls, plus these image controls (depending on the scan mode of the saved loop):

- Color gain
- Color priority
- Color persistence
- Color baseline (not available for Power Doppler)
- Color threshold (Color Doppler only)
- Wall filter

The loop must be in playback mode to make modifications.

You can re-save the file by clicking the Save Image or Save Loop button (depending on the file type). The Terason software creates a new file. To replace the original file with the one you edited, select **File > Export**, locate the original file and select it, then click **Save**. A message indicates that the file already exists, and asks if you want to overwrite it. Click **Yes**.

## 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. To print an entire image loop, you must use the DICOM option. See [Printing Files to a DICOM Printer](#) on page 225 for instructions.





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**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. A printer or network connection 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.

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You can use any of the following methods to print images (described in more detail in the subsequent sections):

- Click 
- Select **File > Print**
- Select thumbnails in the **Image Sorter** window, then click 
- Select **File > Print Preview**, then click the Print button
- Print a split screen image
- Select **File > Print DICOM Image** (see [Printing Files to a DICOM Printer](#) on page 225)

You can also use **Print Setup** on the File menu to select a default printer and default print settings, such as page size and orientation.

## Printing the Displayed Image

When viewing an image in the Image Display or Image Sorter windows, you can click



to print the image or images. When you click the Print button, the Terason software immediately sends selected images to your system's default printer. You cannot set up any custom options, such as number of copies or paper size.

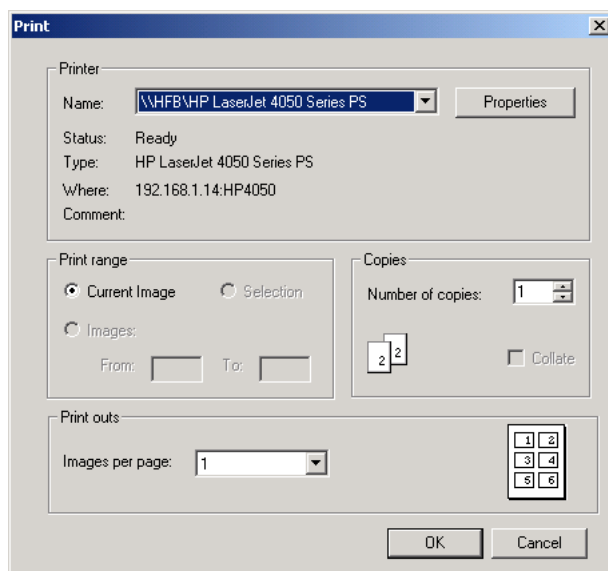
You must freeze live images before you can print them.

If you used **Options** on the **Tools** menu to change the Toolbar Print handling to Send to DICOM Printer, the Terason software sends the image directly to the DICOM printer. See [Setting Image Save and Print Defaults](#) on page 242 to make this change.

## Printing from the File Menu

To send the image to a printer other than your default, or to set up specific print options, complete these steps:

1. Use one of these methods to select an image to print:
  - Load an image into the Image Display window
  - Freeze a live image or pause a loop image
  - Select the images in a folder in the Image Sorter window
2. Select **File > Print**. The Terason software opens the Windows Print dialog box.



### Windows Print Dialog Box

3. Choose a **printer**, and change options as needed.

The Images per page and Print Range options only work when printing from the Image Sorter window.

If you highlighted specific images in the Image Sorter window, the print range is Selection.

To print the image to see details, choose a smaller value for Images per page. To print many images on a page, choose a larger value.

4. Click **OK**.

## Printing from the Image Sorter Window

To print all of the images shown in the Image Sorter window, click . The Terason software sends the print job to your default printer with a default layout of six images per page.

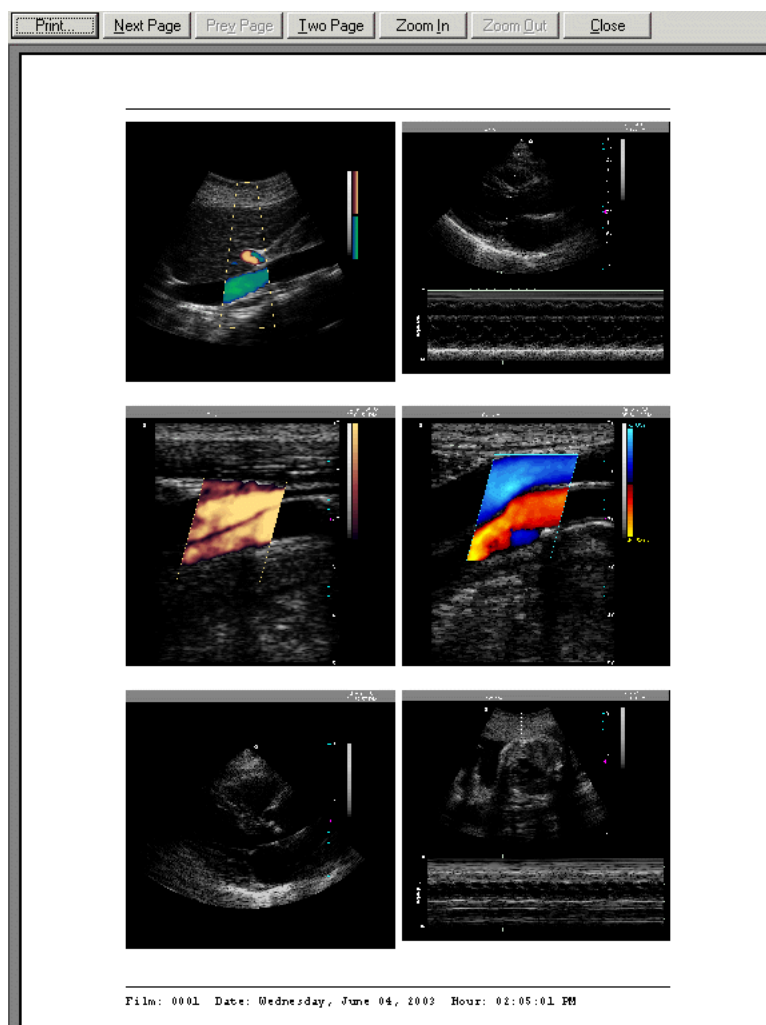
The Terason software scales the images to fit the selected number on the page. The smaller the number of images, the larger each image prints. To change the number of images per page, use the **File** menu as described in [Printing from the File Menu](#) on page 166.

If you only want to print some of the images, hold the Ctrl key down and click the images you want to print. The Terason software draws a blue line around selected images, and when you click the **Print** button, the software prints only the selected images.

## Printing from the Print Preview Window

**Print Preview** on the **File** menu lets you see the expected printout for the image or images in the Image Display or Image Sorter window, whichever window is active.

When you select **File > Print Preview**, the Terason software opens the Print Preview window.



**Print Preview Window (Selected with Image Sorter Window Active)**

Click the **Print** button at the top to send the job to your default printer.

This example shows the Print Preview window opened with the Image Sorter window active and showing a folder containing seven images, using the six images per page layout.


The buttons at the top of this window perform the functions listed in the following table:

**Buttons on the Print Preview Window**

Button	Result
Print	Prints all pages on your computer's default printer
Next Page	Displays the next page of images (if there are at least two pages)
Prev Page	Displays the previous page of images (if at least two pages)
Two Page	Displays two pages of images at the same time
Zoom In	Enlarges the preview so you can see more details
Zoom Out	Reduces the preview; only active if you have zoomed in
Close	Closes the Print Preview window and shows the Terason window

## Printing in Split Screen Mode

When in Split Screen mode, the Terason software prints both screens. For the best quality print, use the Full Screen function before printing.

1. Make sure that both screens are **frozen** and that you have added any necessary measurements or annotations.
2. Press the **F11** key. The Terason software enlarges the Image Display window to cover the entire screen.
3. Click  .

The Terason software prints the Image Display window, including both screens.



## 8 Working with Measurements

Measurements accompanying ultrasound images are intended to supplement other clinical procedures available to the attending physician. Accuracy of the measurements is determined not only by the Terason Ultrasound software, but also by proper use of medical protocols.

When you freeze a scan, the Terason software adds one or two measure tabs to the Image Control bar. For example, if you scanned in M-Mode, a 2D Measure and an M Measure tab display. Each tab provides tools specific to the measurements applicable to the scan mode.

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

You can create measurements on the currently acquired image (frames temporarily stored) or a loaded image or loop if it was saved using the ULT format.

To make measurements on scanned images, you must understand:

- [Measuring in the 2D Window](#); see page 170
- [Measuring in the M-Mode Window](#); see page 184
- [Measuring in the PWD Window](#); see page 185
- [Measuring Cardiac Exams](#); see page 195
- [Selecting Measurements](#); see page 213
- [Deleting Measurements](#); see page 214
- [Working with Reports](#); see page 214
- 

You can also make measurements on both screens when using Split Screen mode.

To obtain a complete set of measurements, you often have to acquire multiple scans. You can make as many scans and measurements as needed for the patient without losing any measurements. When you start imaging, measurement values remain on the Image Display window. Measurements remain on the Image Display window until you:

- Select a different exam
- Select a different scan mode (except for an Obstetrical exam\*)
- Load a different patient

\* Measurements made in an Obstetrical exam remain on the 2D image when you select a different scan mode.

## Measuring in the 2D Window

The Measure function in the 2D window allows:


- [Measuring Distances](#); see page 170
- [Measuring Volume](#); see page 172
- [Measuring Elliptical Circumference and Area](#); see page 173
- [Tracing Areas on the Image](#); see page 174
- [Calculating Percent Stenosis](#); see page 176
- [Working with Measurements on an Obstetrical Exam](#); see page 177
- [Making Gynecological Measurements](#); see page 183

In general, select what you want to measure from the menu of Measurements. If you select a specific measurement, such as FL, only the button that works with that measurement is available. If you select a default measurement, such as Distance, you can click any button to choose a different default measurement.

You can also make a measurement by right-clicking and selecting **New Measurement** from the pop-up menu. This starts a measurement of the type currently selected in the 2D Measure tab.

### Measuring Distances


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

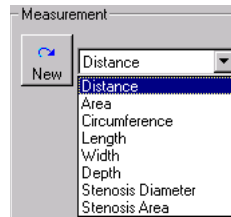
1. Click . If playing a loop, click .

The measure tabs for the selected scan mode are added to the Image Control window.



**2D Measure Tab**

2. If necessary, click the **2D Measure** tab or click in the 2D window.
3. To measure a detailed area with precision, use the **Zoom** function (see [Enlarging an Area of the Image](#) on page 74) to enlarge an area of the 2D scan.
4. Select the **type of measurement** you want to make from the menu, or click . The software uses the Measurement selection to label the completed measurement.




### Measurements for the 2D Window

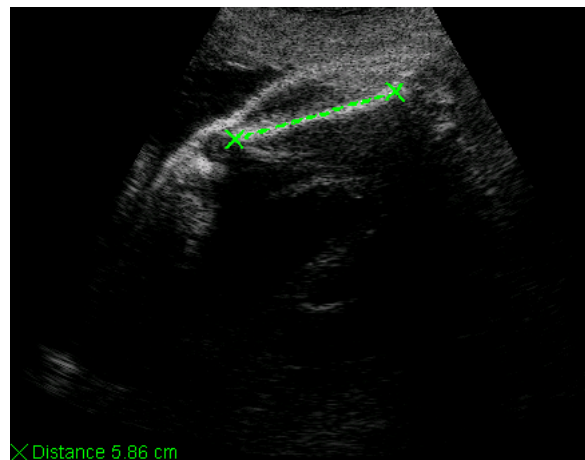
The Fetal Cardiac, Cardiac, Obstetrical, and Gynecological exams allow additional measurements, which display in the list.

The Area, Circumference and Stenosis Area measurements do not use the Distance tool.

5. Click where you want to **start** measuring, move the cursor, and click where you want to **finish** measuring.

Selecting a measurement type enables the start-point cursor. If you did not select a measurement type, click New  to enable the cursor.


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



### Distance Measurement on an Image

6. To move the start or end point of a measurement, click one of the anchors (calipers), move the cursor to a new position, and click.

If you do not see the measurement value, select **View > Image Display Properties > Measurement Value**.


To make more than one measurement of the same type on an image, click **New** , then make the additional measurement. You can also double-click the image pane to get another caliper to make another measurement of the same type.

When measuring in Split Screen mode, the measurements are displayed in a single list, regardless of which screen contains that measurement. You must make the specific screen (left or right) active by clicking in the screen or clicking the Toggle button before you can make a measurement.

## Measuring Volume

When you measure length, width, and depth, the Terason software automatically calculates the volume in cubic centimeters. Because you must make two scans to properly measure volume, these instructions use the Split Screen option so you can retain both scans.

Complete the following steps (you can make the length, width, and depth measurements in any order that make sense for the specific scan):

1. Click . The measure tabs for the selected scan mode are added to the Image Control window.
2. If necessary, click the **2D Measure** tab or click in the 2D window.
3. Select **Length** from the Measurement list.
4. Click at the **starting point** of the area's length, then click at the **ending point** of the area's length.


The Terason software displays the *length* measurement.

5. Select **Width** from the Measurement list.
6. Click at the **starting point** of the area's width, then click at the **ending point** of the area's width.

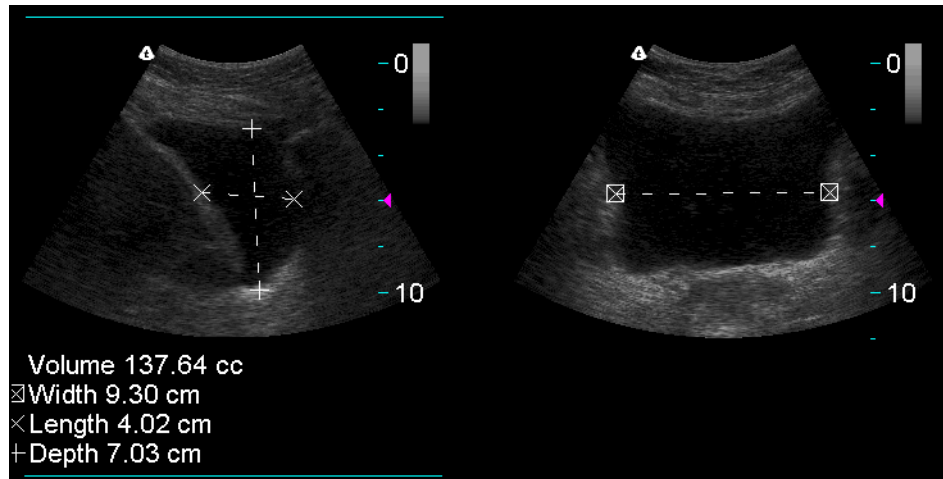
The Terason software displays the *width* measurement.

7. Click .

The Terason software adds a new live scan adjacent to the frozen scan.



8. Click .
9. Select **Depth** from the Measurement list.
10. Click at the **starting point** of the area's depth, then click at the **ending point** of the area's depth.

The Terason software displays the depth measurement and the volume calculation.







Split Screen Volume Measurements

## Measuring Elliptical Circumference and Area

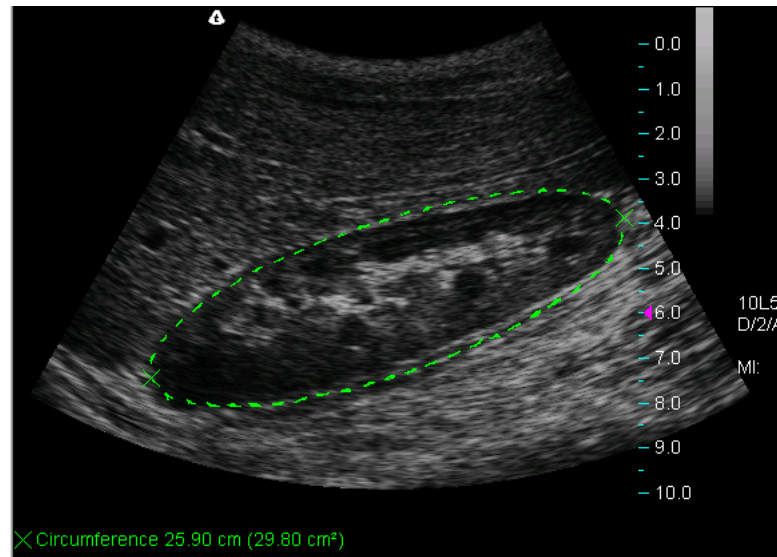
You can use either the  (ellipse) tool or the  (trace) tool to measure a circumference on the image. To measure an oval area, use the Ellipse tool. To measure the area of an irregular shape, use the Trace tool. See [Tracing Areas on the Image](#) on page 174 for instructions on using the trace tool.

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. Click . If playing a loop, click .
- The measure tabs for the selected scan mode are added to the Image Control window.
2. If necessary, click the 2D Measure tab or click in the 2D window.
3. Use one of the following methods to activate the ellipse tool:
  - Click the **Ellipse button** 
  - Select **Circumference** from the Measurement menu
  - Select **Area** from the Measurement menu, then click 
4. Position the cursor at **one end** of the area that you want to measure and click.
5. Move the cursor to the desired **other end** of and click.

The Terason software display a green line and shows the circumference and area values at the bottom of the image.



### Ellipse Measurement on an Image

If the measurement value does not show on your computer, select **View > Image Display Properties > Measurement Value**.

6. To change the shape of an ellipse:
  - a. Move the cursor along the perimeter until it changes to a pointer (  ).
  - b. Click to select the **ellipse**.
  - c. Move the **cursor** to change the shape of the ellipse.
  - d. Click when **finished**.

You can also click the caliper and move it to a new location, which changes the shape of the ellipse.

## Tracing Areas on the Image



The Terason software lets you trace the contour of any shape on an image to measure the circumference and area. You can also use the Ellipse tool to measure a circumference or area (see [Measuring Elliptical Circumference and Area](#) on page 173 for instructions.)



You can use the trace tool to:

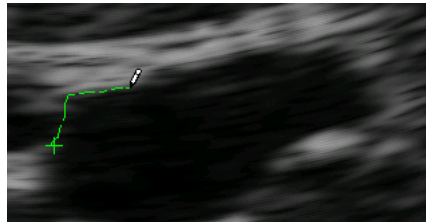
- Trace an irregular shape by sketching the outline
- Draw a polygon by clicking on corners of the shape

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

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

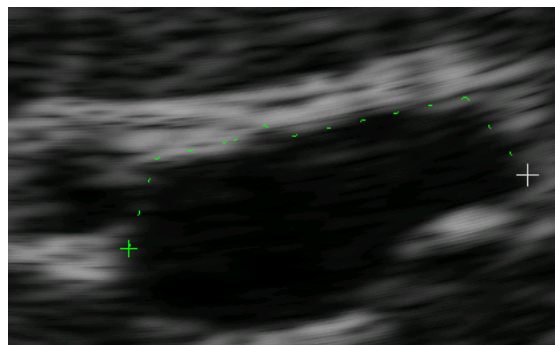
1. Click . If playing a loop, click . The measure tabs for the selected scan mode are added to the Image Control bar.
2. If necessary, click the **2D Measure** tab or click in the 2D window.
3. Use one of the following methods to select the trace tool:

- Click  on the 2D Measure tab
  - Select **Area** from the Measurement menu.
  - Select **Circumference** from the Measurement menu then click 
4. To trace an outline:
    - a. Click where you want to **start** measuring.
    - b. Hold the **left mouse button** down, and drag the cursor around the object you want to trace. The cursor looks like a pencil while you draw the outline.



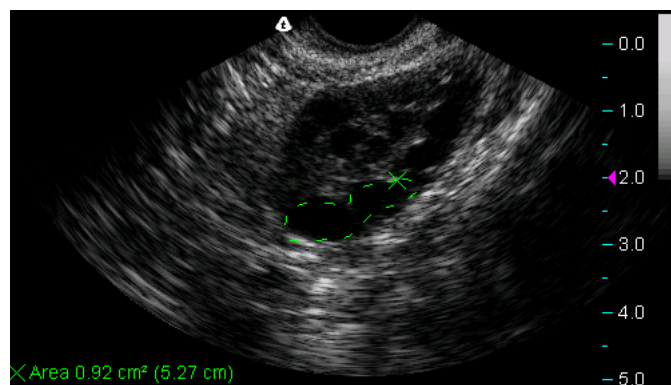
Tracing an Outline

- c. To erase part of the tracing, release the mouse button and press the **Backspace** key to delete line segments, then press the left mouse button and continue tracing.
5. To draw a polygon:
  - a. Click where you want to **start** measuring.
  - b. Click the **next corner** of the shape. The cursor looks like + while you draw the polygon.



Tracing a Polygon

- c. Continue clicking on **corners**.
  - d. To erase part of the polygon, press the **Backspace** key to remove unwanted line segments, then continue clicking on corners.
6. To complete the trace, double-click the **starting point**. The Terason software displays the circumference and area of the measured area. If you right-click or double-click at a location other than the starting point, the trace tool draws a straight line from that location to the starting point to complete the tracing.



Trace Measurement on an Image



## Calculating Percent Stenosis

If the 2D scan shows stenosis, you can measure the percent diameter or area stenosis depending on the protocol in use.

To calculate the percentage, you must make two measurements: the full area or diameter of the vessel and the residual lumen. When you complete the second measurement, the Terason software calculates the percent of the area or diameter stenosis.

You can make these measurements in any order; the Terason software always uses the largest measurement as the diameter or area of the vessel.

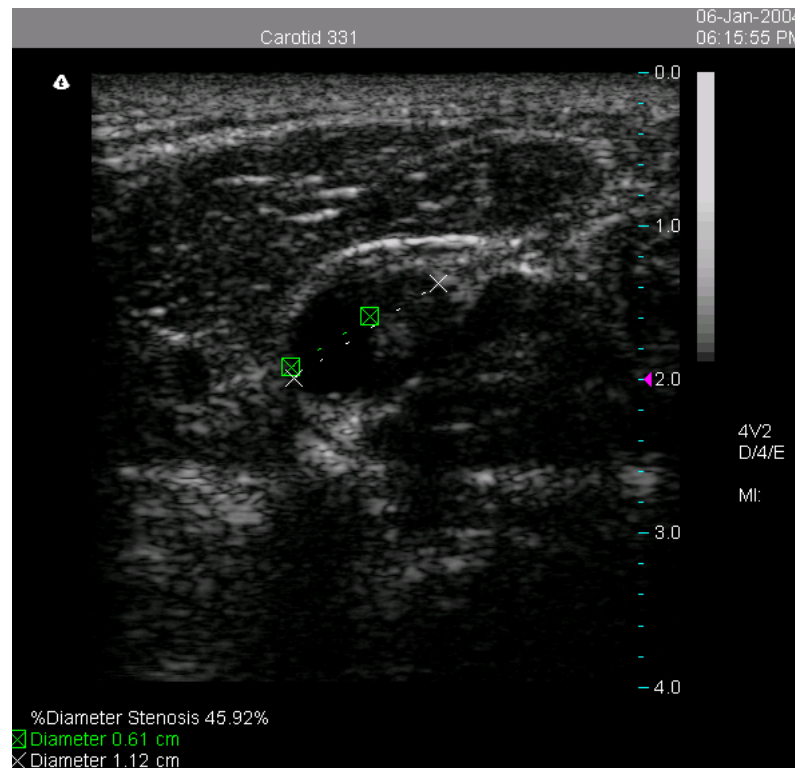
This procedure shows you how to measure the percentage of stenosis based on the diameter:

1. Click Freeze . If playing a loop, click Pause . The measure tabs for the selected scan mode are added to the Image Control window.
2. If necessary, click the **2D Measure** tab or click in the 2D window.
3. Select **Stenosis Diameter** from the Measurement menu.
4. Click at the start and end points of the **vessel**.

The Terason software calculates the length of the line and displays the Diameter value.

5. Click at the start and end points of the **residual lumen**. The Terason software displays the second Diameter value and calculates the percentage stenosis.





#### Calculated % Diameter Stenosis

You can use the same procedure to calculate the % Area Stenosis. Just select Stenosis Area from the measurement menu and use the Trace tool to measure the vessel and the residual lumen.

If you wish to see either Stenosis Diameter or Stenosis area on a report, see [Working with Reports](#) on page 214.

## Working with Measurements on an Obstetrical Exam

The Obstetrical exam allows you to measure anatomy on up to six fetuses labelled A through F. You can make any combination of measurements on any fetus during an exam. When you freeze an Obstetrical exam, the following operations are enabled:

- [Making Obstetrical Measurements](#); see page 178
- [Calculating Estimated Fetal Weight](#); see page 181
- [Calculating Gestational Sac Size and Age](#); see page 182



**Caution:** An additional computer or connection 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.

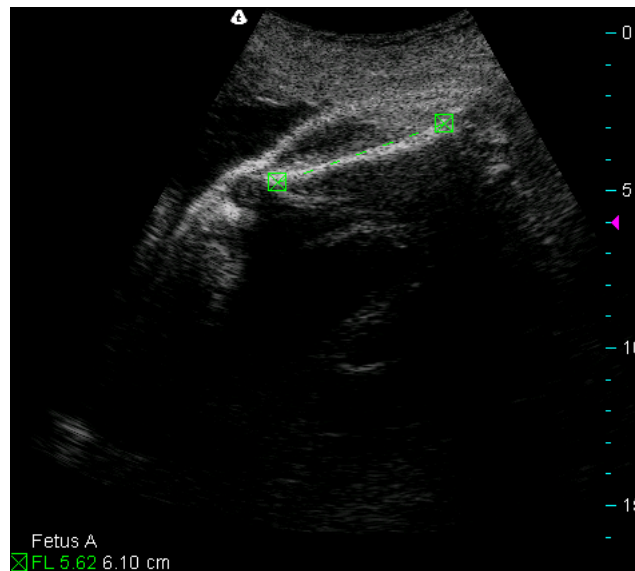
See [Setting Measurement Defaults](#) on page 248 for instructions on setting with port on your computer is connected to the other computer.

## Making Obstetrical Measurements

When there are multiple fetuses, only the measurements for the selected fetus display on the 2D image. For example, if you made three measurements for Fetus A and two measurements for Fetus B, you only see the measurements for whichever Fetus is selected in the 2D Measure tab.

All measurements use the distance tool (see [Measuring Distances](#) on page 170), except that abdominal circumference (AC) and head circumference (HC) use the Ellipse or Trace tools (see [Measuring Elliptical Circumference and Area](#) on page 173 or [Tracing Areas on the Image](#) on page 174).

You can make multiple measurements of one type, on multiple scans, to acquire all the needed measurements. For example, the following scan shows a femur length (FL) measurement.



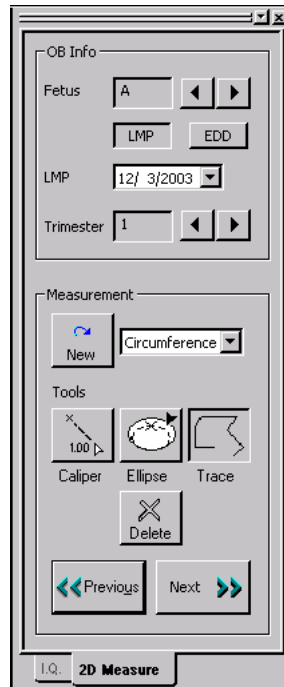
**FL Measurement on an Image**

In this example, the 6.10 cm FL measurement was made on a prior scan. If both measurements are made on the same scan, you can click the value to highlight the measurement.

The Terason software adds an OB information section to the 2D Measure tab when you freeze an Obstetrical scan. When you make any of the measurements in the following list, the software estimates the average ultrasound age (AUA), and from that, an estimated due date (EDD), and displays them in the OB information section.

The measurements that generate an AUA and an EDD are:

- AC
- BPD
- CRL
- FL
- HC
- A mean gestational sac measurement (See [Calculating Gestational Sac Size and Age](#) on page 182.)



**2D Measure Tab for the Obstetrical Exam**

The OB Info section lets you select the Fetus (from A to F) and identify the trimester of the fetus. You can directly set the trimester to 1, 2, or 3 using the right and left arrows, or you can click either the LMP (last menstrual period) or EDD (estimated due date) button and enter the date. To choose the date, click the down arrow and use the calendar tool to click the date of the LMP or EDD (depending on which button is selected). When you enter a date, the Terason software updates the Trimester accordingly.

The trimester setting determines which measurements are available. When you select the trimester (using LMP, EDD, or the Trimester arrows), the Terason software updates the list of measurements to show only those measurements applicable to that trimester.

The following table lists the measurements for each trimester. The label shows on the 2D Image Display, and in the menu to select the measurement. When selecting a measurement, if you do not see the needed measurement, check the Trimester value. You may need to set the trimester to access the needed measurement.

**OB Measurements**

First Trimester Measurement	Label	Second & Third Trimester Measurement	Label
Abdominal Circumference	AC	Abdominal Circumference	AC
Bi-Parietal Diameter	BPD	Amniotic Fluid Index Quadrant 1	AFI Q1
Crown Rump Length	CRL	Amniotic Fluid Index Quadrant 2	AFI Q2
Femur Length	FL	Amniotic Fluid Index Quadrant 3	AFI Q3
Gestational Sac Diameter Width	GSDW	Amniotic Fluid Index Quadrant 4	AFI Q4
Gestational Sac Diameter Height	GSDH	Abdominal Anterior-Posterior Diameter	APD
Gestational Sac Diameter Length	GSDL	Abdominal Transverse Diameter	APTD
Head Circumference	HC	Bi-Parietal Diameter	BPD
Nuchal Translucency	NT	Cerebellum Size	CER
Yolk Sac Size	YS	Cis Magnum Size	CMAG
		Crown Rump Length	CRL
		Fibula Length	FIB
		Femur Length	FL
		Head Circumference	HC
		Humerous Length	HL
		Lateral Ventricular Width	LV
		Nuchal Skin Fold Thickness	NSF
		Nuchal Translucency (second trimester only)	NT
		Occipital Frontal Diameter	OFD
		Outer Orbital Diameter	OOD
		Inner Orbital Diameter	IOD
		Right Foot Length	RFT
		Left Foot Length	LFT
		Radius Length	RAD
		Tibia Length	TIB
		Ulna Length	ULN


If you make all four AFI measurements, the Terason application shows the AFI total.

AFI Q1, AFI Q2, AFI Q3, and AFI Q4 are used to calculate the amniotic fluid index (AFI), and the OFD measurement is used to calculate the cephalic index (CI).

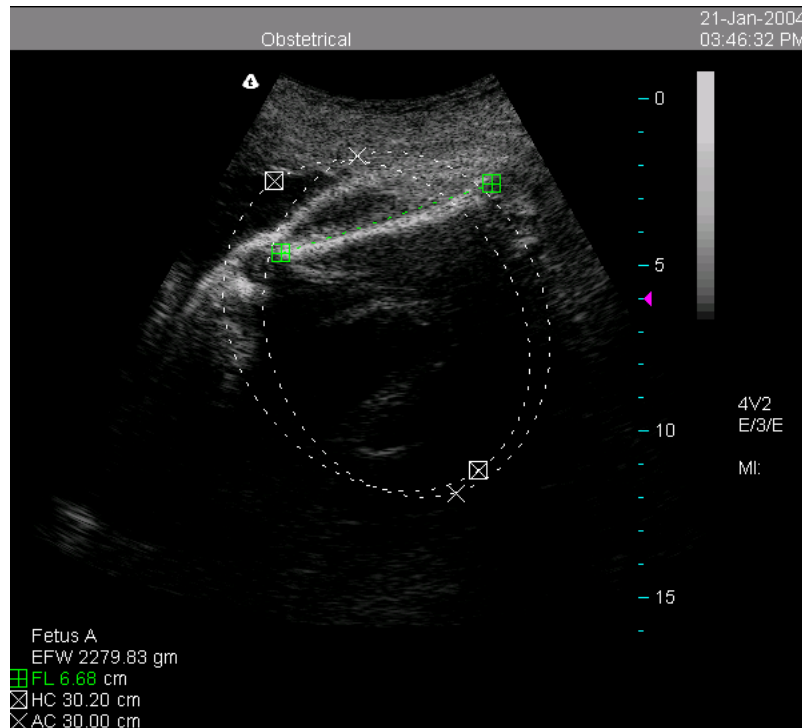
### Calculating Estimated Fetal Weight

The Terason software can estimate the weight of a fetus. Terason uses the Hadlock formula (see Appendix D - [Gestational Tables](#)) based on the abdominal circumference, head circumference, and femur length measurements. To use a measurement setup other than Hadlock, see [Setting Measurement Defaults](#) on page 248. If you choose a different setup, the selected setup may not support the EFW calculation.

To calculate the estimated fetal weight, complete the following steps:

1. Perform an obstetrical **exam**.
2. Click  .
3. Select **AC** from the Measurement menu and use the Ellipse tool to measure the abdominal circumference.
4. If necessary, click **Live** and acquire a view for the head circumference measurement, then click **Freeze**.
5. Select **HC** from the Measurement menu and use the **Ellipse** tool to measure the head circumference.
6. If necessary, click **Live** and acquire a view for the femur length measurement, then click **Freeze**.
7. Select **FL** from the Measurement menu and use the Distance tool to measure the femur length.

When the Terason software places AC, HC, and FL on an obstetrical exam, it automatically calculates the estimated fetal weight (EFW).






**Estimated Fetal Weight Calculation**

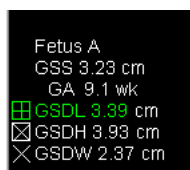
### Calculating Gestational Sac Size and Age

For a first trimester obstetrical exam, the Terason software can calculate the mean gestational sac size (GSS), and based on that size, provide the estimated gestational age (GA). Terason uses the Hadlock formula and tables (see Appendix D - [Gestational Tables](#)). To use a measurement setup other than Hadlock, see [Setting Measurement Defaults](#) on page 248. If you choose a different setup, the selected setup may not support the GSS and GA calculation.

To measure the mean gestational sac size, complete the following steps:

1. Perform an obstetrical **exam**.
2. Click .
3. Select **GSDH** from the Measurement menu and measure the gestational sac diameter height.
4. If necessary, click  and acquire a view for the gestational sac diameter width measurement, then click the Freeze button .
5. Select **GSDW** from the Measurement menu and measure the gestational sac diameter width.
6. If necessary, click **Live** and acquire a view for the gestational sac diameter length measurement, then click **Freeze**.
7. Select **GSDL** from the Measurement menu and measure the gestational sac diameter length.

When all three labels are assigned, the application calculates the gestational sac age.



#### Gestational Sac Measurements

The GSS value is the mean of the three measurements. The GA value is the age retrieved from lookup tables.

If the GA value does not display, follow the instructions in [Setting Measurement Defaults](#) on page 248 to select the Terason default measurement setup.


## Making Gynecological Measurements

All gynecological measurements use the distance tool (see [Measuring Distances](#) on page 170). When you freeze a Gynecological exam, the Terason software lets you choose any of the default 2D measurements, plus the measurements in the following table.

#### Available Gynecological Measurements

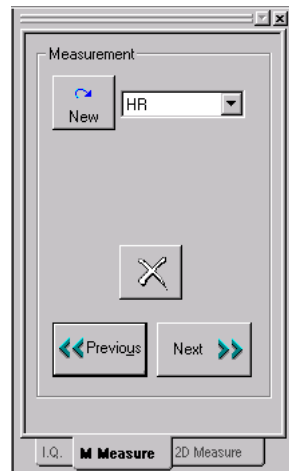
Gynecological Measurement	Label
Uterus Length	UTL
Uterus Width	UTW
Uterus Height	UTH
Endometrial Thickness	ENDO
Right Ovary Length	ROVL
Right Ovary Width	ROVW
Right Ovary Height	ROVH
Left Ovary Length	LOVL
Left Ovary Width	LOVW
Left Ovary Height	LOVH

To make a gynecological measurement, complete the following steps:

1. Perform an gynecological **exam**.
2. Click  .
3. Select the needed **measurement** from the Measurement list. The Terason software selects the Caliper tool.
4. Click at the **beginning and end points** of what you want to measure. The Terason software displays the measurement value.

## Measuring in the M-Mode Window

When you freeze an M-Mode scan, the Terason software adds the 2D Measure and M Measure tabs to the Image Control bar, with the M Measure tab active.



**M Measure Tab**

## 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)



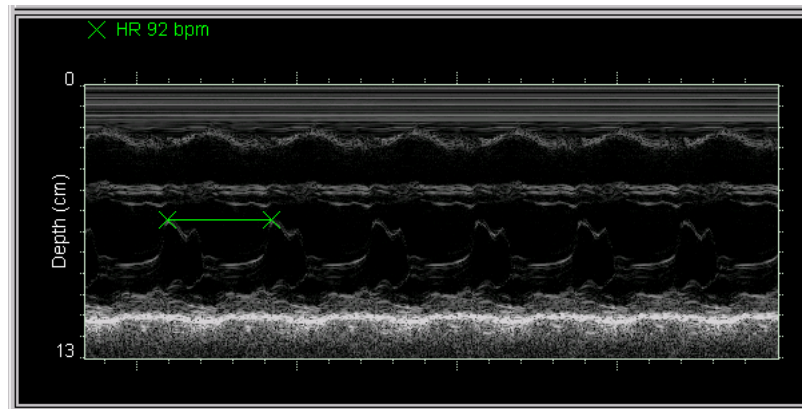
**Note:** To make more than one measurement of the same type on a scan, click the New button to make the second and any subsequent measurements.

When you save an image to the ULT format, measurements in the M-Mode window are saved. You can edit those measurements when you view the file.

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

1. Click . If playing a loop, click . The measure tabs for the selected scan mode are added to the Image Control bar.
2. Select a **measurement type** from the drop-down menu on the M Measure tab.
3. Click the cursor where you want to **start** measuring.
4. Move the cursor and click at the desired **end** location. The measurement displays at the top left of the Time Series window.

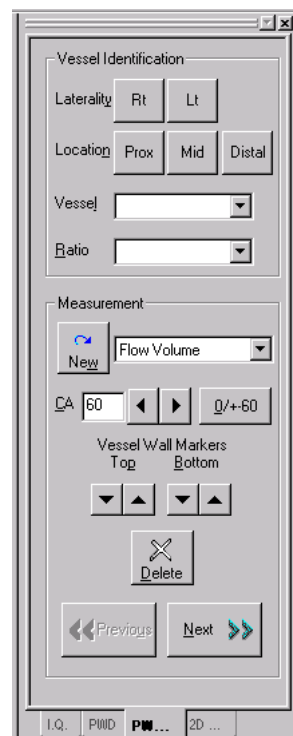


**M-Mode Measurement**

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

## Measuring in the PWD Window

When you freeze a Pulsed-Wave Doppler or Triplex scan, the Terason software adds the 2D Measure and PWD Measure tabs to the Image Control bar.

**PWD Measure Tab**

The Measurement section of the panel controls the following operations:

- [Measuring Vessel Blood Velocities](#); see page 190
- [Calculating Arterial Ratios](#); see page 191
- [Measuring Heart Rate and Rise Time](#); see page 192
- [Measuring Flow Volume](#); see page 193



**Note:** You can only make one measurement of each type on a scan. For example, you cannot have two Flow Volume measurements on the same scan. If you need to edit a measurement, you can move one or both of the endpoints, or you can delete it and start over.

You can use the CA (correction angle) arrows and the 0/+60 button 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 112.

The Vessel Info section lets you label the scanned vessel. When you make a measurement, you can identify what is being measured by selecting:

- Laterality (right or left)
- Location (prox, mid, or distal)
- Vessel

Ratio is used to indicate whether the selected vessel will be used as Artery 1 or Artery 2 in an arterial ratio calculation (see [Calculating Arterial Ratios](#) on page 191).

The vessel wall markers move the top and bottom of the gate along the scan line when measuring flow volume as described in [Measuring Flow Volume](#) on page 193.

The available vessels depend on the selected exam. In the following tables, the Menu/Label column lists the abbreviation used to select the vessel from the menu and to label the vessel on the image.

#### Available Vessels Based on Exam

Exam	Menu/Label	Vessel
Abdominal	Aorta	Aorta
	Celiac	Celiac Trunk
	Hepatic A	Hepatic Artery
	Hepatic V	Hepatic Vein
	Int Mammary A	Internal Mammary Artery
	IVC	Inferior Vena Cava
	Main Portal V	Main Portal Vein
	Portal Vein	Portal Vein
	Renal A	Main Renal Artery
	Renal V	Renal Vein
	SMA	Superior Mesenteric Artery
	SMV	Superior Mesenteric Vein
	Splenic A	Splenic Artery
	Splenic V	Splenic Vein

**Available Vessels Based on Exam (Continued)**

<b>Exam</b>	<b>Menu/Label</b>	<b>Vessel</b>
Arterial	ATA	Anterior Tibial Artery
	Axillary A	Axillary Artery
	Brachial A	Brachial Artery
	CFA	Common Femoral Artery
	CIA	Common Iliac Artery
	DPA	Dorsalis Pedis Artery
	Ext Iliac A	External Iliac Artery
	Innominate A	Innominate Artery
	Peroneal A	Peroneal Artery
	PFA	Profunda Femoral Artery
	Popliteal A	Popliteal Artery
	PTA	Posterior Tibial Artery
	Radial A	Radial Artery
	SFA	Superficial Femoral Artery
	Subclavian A	Subclavian Artery
	Ulnar A	Ulnar Artery
Breast	Axillary A	Axillary Artery
	Int Mammary A	Internal Mammary Artery
	Intercostal A	Intercostal Artery
	Lat. Thoracic A	Lateral Thoracic Artery
	Sup. Epigastric A	Superior Epigastric Artery
Carotid	Bulb	Bulb
	CCA	Common Carotid Artery
	ECA	External Carotid Artery
	ICA	Internal Carotid Artery
	Innominate A	Innominate Artery
	Subclavian A	Subclavian Artery
	Vertebral A	Vertebral Artery
Dialysis Access	Anastomosis	Anastomosis
	Fistula	Fistula
	Graft	Graft
	Shunt	Shunt

**Available Vessels Based on Exam (Continued)**

<b>Exam</b>	<b>Menu/Label</b>	<b>Vessel</b>
Fetal Cardiac	Ao	Aorta
	AV	Aortic Valve
	LVOT	Left Ventricular Outflow Tract
	MV	Mitral Valve
	PV	Pulmonic Valve
	RVOT	Right Ventricular Outflow Tract
	TV	Tricuspid Valve
Musculoskeletal	Artery	Artery
	Vein	Vein
Obstetrical	Ext Iliac A	External Iliac Artery
	Fetal Ao	Fetal Aorta
	Fetal ICA	Fetal ICA
	Fetal MCA	Fetal MCA
	Fetal RA	Fetal Renal Artery
	Int Iliac A	Internal Iliac Artery
	Ovarian A	Ovarian Artery
	Placental	Placenta
	Radial A	Radial Artery
	Umbilical A	Umbilical Artery
	Umbilical V	Umbilical Vein
	Uterine A	Uterine Artery
Prostate	IPA	Inferior Pudendal Artery
	IVA	Inferior Vesical Artery
	MHA	Middle Hemorrhoidal Artery
	MVA	Middle Vesical Artery
	SRA	Superior Rectal Artery

**Available Vessels Based on Exam (Continued)**

<b>Exam</b>	<b>Menu/Label</b>	<b>Vessel</b>
Renal	Aorta	Aorta
	Arcuate A	Arcuate Artery
	Interlobar A	Interlobar Artery
	IVC	Inferior Vena Cava
	Renal A	Renal Artery
	Renal V	Renal Vein
	Segmental A	Segmental Artery
Testes	Cremasteric A	Cremasteric Artery
	Spermatic Artery	Spermatic Artery
	Testicular A	Testicular Artery
	Testicular V	Testicular Vein
Thyroid	Inf. Thyroid A	Inferior Thyroid Artery
	Sup. Thyroid A	Superior Thyroid Artery
	Thyroidal A	Thyroidal Artery
Vascular Access	Antecubital V	Antecubital Vein
	Axillary A	Axillary Artery
	Axillary V	Axillary Vein
	Basilic V	Basilic Vein
	Brachial A	Brachial Artery
	Cephalic V	Cephalic Vein
	CFA	Common Femoral Artery
	CFV	Common Femoral Vein
	GSV	Greater Saphenous Vein
	LSV	Lesser Saphenous Vein
	Med. Basilic V	Median Basilic Vein
	PFA	Profunda Femoral Artery
	Popliteal A	Popliteal Artery
	Popliteal V	Popliteal Vein
	SFA	Superficial Femoral Artery
	SFV	Superficial Femoral Vein
	Subclavian V	Subclavian Vein

Available Vessels Based on Exam (Continued)

Exam	Menu/Label	Vessel
Venous	Antecubital V	Antecubital Vein
	ATV	Anterior Tibial Vein
	Axillary V	Axillary Vein
	Basilic V	Basilic Vein
	Brachial V	Brachial Vein
	Cephalic V	Cephalic Vein
	CFV	Common Femoral Vein
	Com Iliac V	Common Iliac Vein
	Ext Iliac V	External Iliac Vein
	GSV	Greater Saphenous Vein
	Innominate V	Innominate Vein
	IJV	Internal Jugular Vein
	LSV	Lesser Saphenous Vein
	Med Antecubital V	Median Antecubital Vein
	Peroneal V	Peroneal Vein
	PFV	Profunda Femoral Vein
	Popliteal V	Popliteal Vein
	PTV	Posterior Tibial Vein
	Radial V	Radial Vein
	SFV	Superficial Femoral Vein
	Subclavian V	Subclavian Vein
	Ulnar V	Ulnar Vein



## Measuring Vessel Blood Velocities

When you select PS/ED to measure an arterial velocity, the Terason software calculates the following measurements:

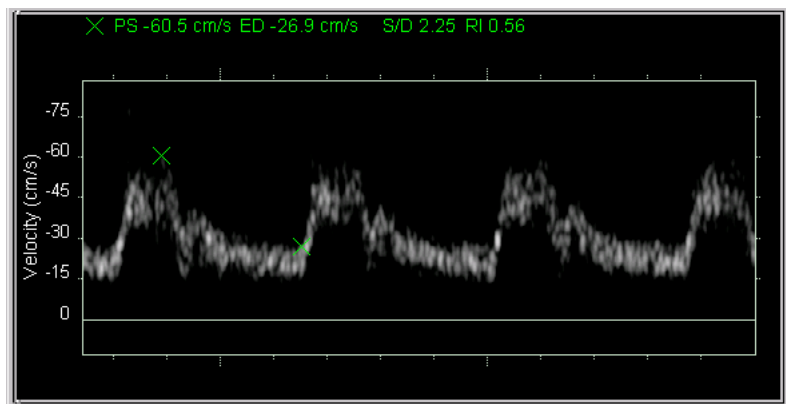
- Peak Systole
- End Diastole
- Peak Systole/End Diastole ratio (S/D)
- Resistance Index (RI)

You can measure PS/ED for a scan that uses frequency (kHz) or velocity (cm/s) as the velocity display units (the Y-axis of the Time Series window).

Complete the following steps to measure the PS/ED values for an artery:

1. Click  . If playing a loop, click  . The 2D and PWD measure tabs are added to the Image Control bar.
2. Click the Rt (right) or Lt (left) button to specify the **Laterality** of the scanned artery.
3. Click the Prox, Mid, or Distal button to specify the **Location** of the scanned artery.
4. Select the scanned **vessel** from the Vessel list.
5. Select **PS/ED** from the Measurement menu.
6. In the Time Series window, click where you want to **start** measuring, move the cursor to the **end** location and click.

When you click the second time, the Terason software enters the measurements in the Time Series window.




Pulsed-Wave Doppler Measurements


## Calculating Arterial Ratios

When scanning in PWD mode and Triplex mode, you can calculate the ratio between two arteries for selected exams. When using the Carotid, Abdominal, or Arterial exams, you can measure two arteries (different scans) and the Terason software calculates the S and D ratios between those arteries. You can use this feature to measure internal carotid artery to common carotid artery (ICA to CCA) ratios, or systolic renal artery to aorta ratio.



Before you make a PS/ED measurement, select Artery 1 (denominator) or Artery 2 (numerator) from the Ratio menu. This selection determines the order of calculation for the ratio. For example, if you scanned the ICA as Artery 2 and CCA as Artery 1, then the S and D ratios represent the ICA/CCA ratios. You do not need to select Artery 1 or Artery 2 to get an ICA/CCA or Renal Artery/Aorta ratio. The software automatically selects them for you.

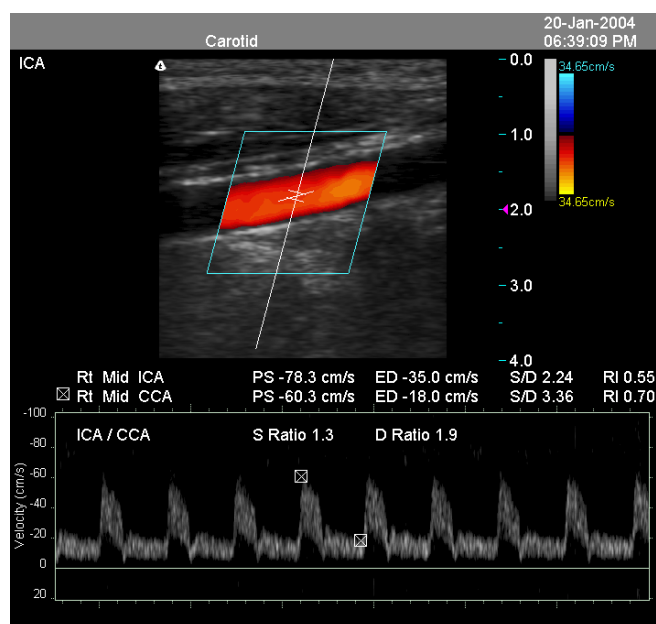
To measure velocities for two arteries and calculate ratios, complete the following steps:

1. Click  and select the needed **exam** from the Exam menu of 2D tab (Carotid, Arterial, or Abdominal).

2. Scan an **artery** and click .
3. Complete steps 1-5 in [Measuring Vessel Blood Velocities](#) on page 190.
4. Select the **artery** to use as the denominator (Artery 1) from the Ratio menu.
5. In the Time Series window, click where you want to **start** measuring, move the cursor to the **end** location, and click to complete the measurement.

The Terason software shows the PS and ED measurements.

6. Click  and scan the **second artery**, then click .
7. Repeat steps 3 to 5, selecting the other Artery label (Artery 2) from the Ratio menu.





**PS/ED Ratio for Two Arteries**

If the ratio does not display, check the two PS/ED measurements for the following items:

- Both measurements have a vessel name
- You selected opposite sides, but they used different vessels or different locations

## Measuring Heart Rate and Rise Time

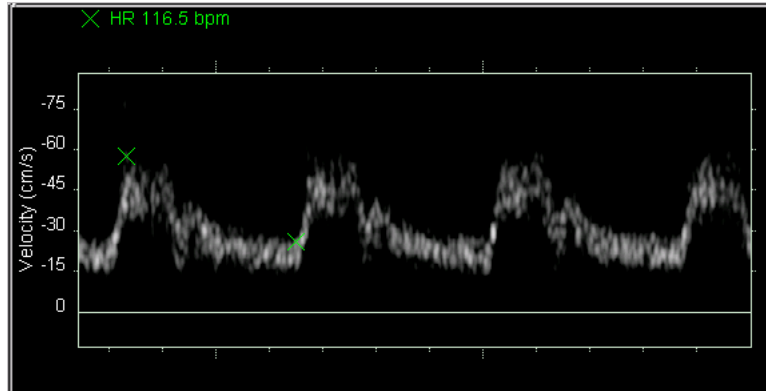
Complete the following steps to measure the heart rate or rise time values for an artery:

1. Click . If playing a loop, click . The 2D and PWD measure tabs are added to the Image Control bar.
2. Click the Rt (right) or Lt (left) button to specify the **Laterality** of the scanned artery. This is not required.
3. Click the Prox, Mid, or Distal button to specify the **Location** of the scanned artery.



4. Select the scanned **vessel** from the Vessel menu.
5. Select **HR** (for Heart Rate) or **RT** (for Rise Time) from the Measurement menu.
6. In the Time Display window, click where you want to **start** measuring, move the cursor to the **end** location and click.

When you click the second time, the Terason software enters the measurements in the Time Series window.



Heart Rate Measurement on PWD Scan


## Measuring Flow Volume

The Terason software automatically calculates flow when you select the Flow Volume measurement. The following values are included in this calculation:

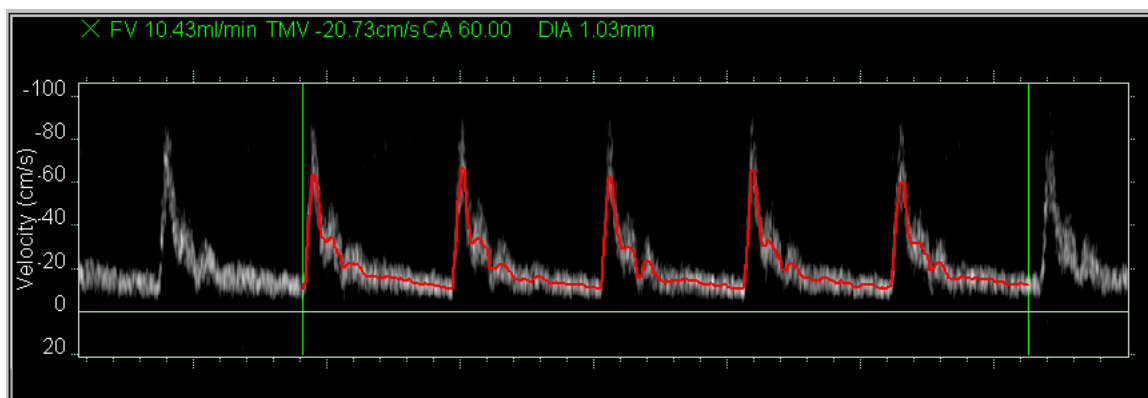
- FV: flow volume (milliliters/minute)
- TMV: time mean velocity (centimeters/second)
- DIA: diameter (millimeters)
- CA: correction angle (degrees)

To accurately measure flow volume, the range gate must be open from wall-to-wall within a vessel. The following procedure shows you how to adjust the size of the range gate for a frozen scan.

To measure flow volume, complete the following steps:

1. Set the sample volume size (**SV Size**) and location and acquire image data.
2. Click . The 2D Measure and PWD Measure tabs are added to the Image Control bar.
3. On the PWD Measure tab, select **Flow Volume** from the Measurement menu.


The Terason software measures the flow volume.



Flow Measurement on a PWD Scan

The red tracing indicates the waveform used to calculate these values. The measurement is calculated from the diastolic end of one cycle to the diastolic end of another cycle as indicated by the green vertical bars. The blue = on the scan line in the 2D window indicates the size and location of the range gate.



4. Use the arrows, , to adjust the size of the **range gate** to encompass the entire vessel from wall-to-wall. The Terason software updates the DIA and FV calculations for each change of size of the range gate.
5. To adjust the start or end locations of the measurement to include fewer or more cycles on the waveform, click the **green bar**, move to another end diastolic location, and click.

## Making Vascular Measurements

When you make a measurement in the 2D Image Display window, the the measurement value displays at the bottom left of the window. If you make a series of measurements that result in the Terason software calculating another value, the calculated values display at the bottom left of the window.

The Terason software provides Vascular measurements for the 2D image display window, the M-Mode Time series window, and the Spectral window. These measurements can then be viewed in a report.

The following table lists the measurements available in each scan mode.

### Vascular and Cardiac Measurements by Window

Measurement Group	Measurements	Tool Used
<b>Vascular Measurements in the 2D Image Display Window</b>		
Stenosis Diameter	%Diameter Stenosis	Caliper
Stenosis Area	%Area Stenosis	Trace

**Vascular and Cardiac Measurements by Window (Continued)**

Measurement Group	Measurements	Tool Used
<b>Vascular Measurements in the M-Mode Time Series Window</b>		
HR	HR	Time Caliper
<b>Cardiac Measurements for PWD/CD Time Series Window</b>		
PS/ED	PS	Velocity Point
	ED	Velocity Point
RT	RT	Time Caliper
HR	HR	Time Caliper
Flow Volume	FV	Flow Volume
	TAMV	Derived
	DIAM	Derived
PI	TAPV	Pulsatility Index
	PI_Vmax	Derived
	PI_Vmin	Derived

## Measuring Cardiac Exams

When you freeze a Cardiac exam, you can make any of a number of 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 left bottom of the window. If you make a series of measurements that result in the Terason software calculating another value, the calculated values display at the top left of the 2D Image Display window.

There are two sets of tables in this section:

- [Available Cardiac Measurements](#); see page 200
- [Formulas Used in Echocardiography Measurements](#); see page 204

There is also a sample Echocardiography Report; see [Cardiac Reports](#) on page 209.

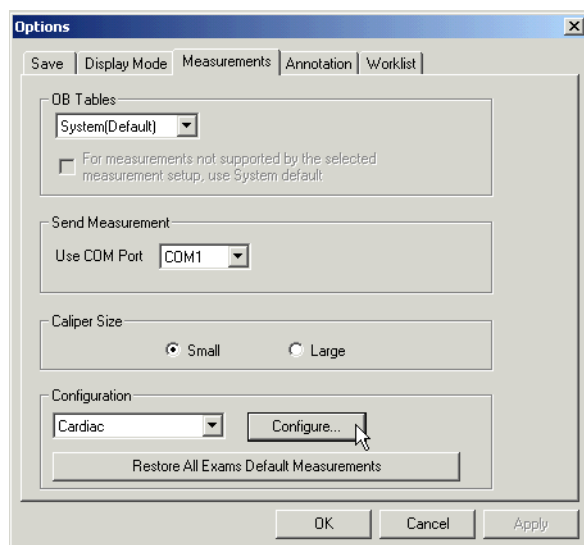
## Measurement Groups

The Terason software includes default groups of commonly-used cardiac measurements that are available in the Measurement pull-down menu when an image is frozen, and the measurements included in the selected group display in the field below that menu. You can add or remove measurements from groups, and create or delete groups.

### Modifying Groups

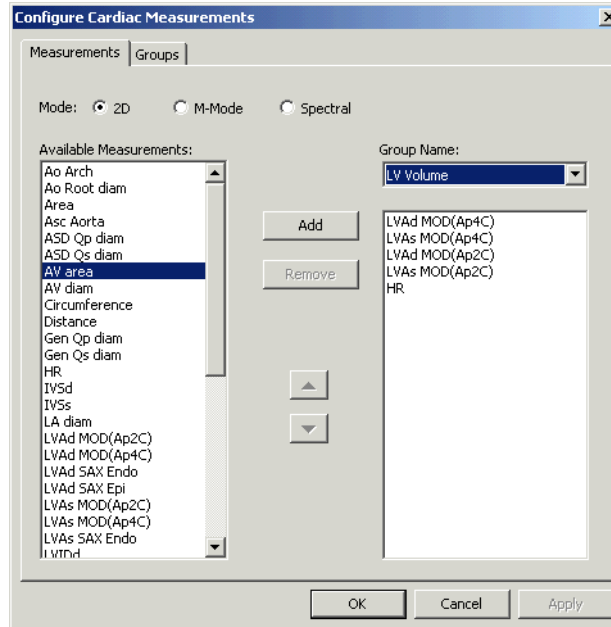
To add or remove measurements in a group:

1. Open the **Options/Measurements** window (Tools > Options > Measurements).
2. In the Configuration pull-down menu, select **Cardiac**.
3. Click **Configure....**



**Options/Measurements Window**

The Configure Cardiac Measurements window opens.



**Configure Cardiac Measurements Window**

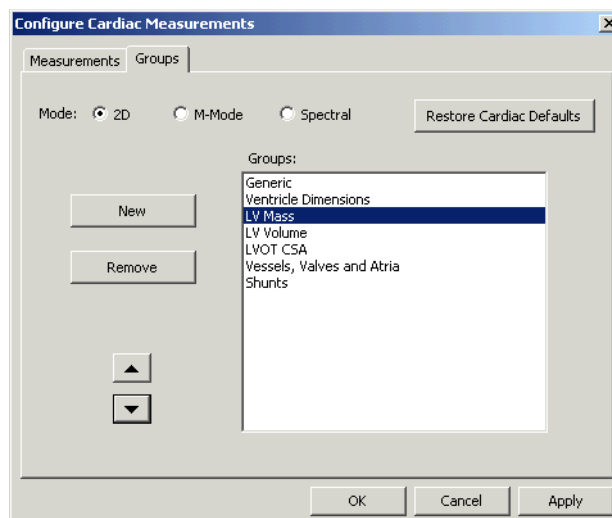
4. To choose a group for modification, select it in the **Group Name:** pull-down menu.
5. To add a measurement to the group, click its name in the list at the left, then click **Add**.
6. To remove a measurement from the group, click its name in the list at the right, then click **Remove**.
7. Click **OK**.

### Creating and Deleting Groups

To create or delete a measurement group:

1. Open the **Options/Measurements** window (Tools > Options > Measurements).
2. In the Configuration pull-down menu, select **Cardiac**.
3. Click **Configure....**
4. On the Configure Cardiac Measurements window, click the **Groups** tab.

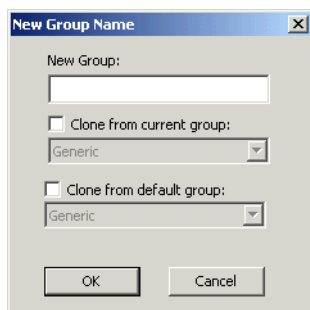
The window changes to allow creation and deletion of groups.



**Configure Cardiac Measurements Groups Window**

5. To delete a group, select it in the list and click **Remove**.
6. To create a new group:
  - a. Click **New**.

The New Group Name window opens.



**New Group Name Window**

- b. If there is an existing group that has some of the measurements you want in the new group, click one of the **Clone from . . .** checkboxes and select that existing group in the associated pull-down menu.

The selected group name displays in the New Group: field.
  - c. Enter or edit the **name** in the New Group: field.
- Each group name must be unique; if you cloned an existing group, you cannot exit the New Group Name window without changing the name in the New Group: field.
- d. Click **OK** to create the new group.
  - e. In the Configure Cardiac Measurements Groups window, click the **Measurements** tab.
  - f. Modify the contents of the **new group**, as described in [Modifying Groups](#) on page 196.
7. Click **OK**.

**Other Measurement Group Options**

The Configure Cardiac Measurements windows include controls for several other configuration options:

- The Mode: radio buttons select which sets of measurements and groups display in the Available Measurements: and Groups: lists.
- The Up and Down arrows move a selected group in the Groups: list up or down the list.
- Under the Groups tab, clicking Restore Cardiac Defaults deletes any groups you have created, and undoes any changes to the default 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	LVA d SAX Epi	Left ventricle short-axis epicardial, in end-diastole	Trace
	LVA d SAX Endo	Left ventricle short-axis endocardial, in end-diastole	Trace
	LVA s SAX Endo	Left ventricle short-axis endocardial, in end-diastole	Trace
	LVLd	Left ventricle length in end-diastole	Caliper
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



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

Measurement Group	Measurement	Definition	Tool Used
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

**Cardiac Measurements in the M-Mode Time Series Window**

Measurement Group	Measurement	Definition	Tool Used
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	
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
	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

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

Measurement Group	Measurement	Definition	Tool Used
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

## Formulas Used in Echocardiography Measurements

### Formulas Used for Measurements in the 2D Window

#### 2D Formulas

Name	Variables	Formula	Units
LV Volume: Method of Disks, Biplane	$a_{di}$ : $i^{\text{th}}$ disk diameter of LV apical 2-chamber (cm) $b_{di}$ : $i^{\text{th}}$ disk diameter of LV apical 4-chamber (cm) L: chamber length from the longer of A4c or A2c (cm) 20: number of disk segments in ventricle	$V = \frac{\pi}{4} \sum_{i=1}^{20} a_{di} b_{di} \cdot \frac{L}{20}$	ml
LV Volume: Method of Disks, Single Plane	$a_{di}$ : $i^{\text{th}}$ disk diameter of LV apical 2- or 4-chamber (cm) L: chamber length of cavity	$V = \frac{\pi}{4} \sum_{i=1}^{20} a_{di}^2 \cdot \frac{L}{20}$	ml
Ejection Fraction	Vs: LV volume systolic (ml) Vd: LV volume diastolic (ml)	$EF = \left( \frac{Vd \angle Vs}{Vd} \right) \cdot 100$	%
Stroke Volume	V: LV volume (ml) s: systole d: diastole	$SV = Vd \angle Vs$	ml
Cardiac Output	SV: stroke volume (ml) HR: heart rate (bpm)	$CO = \frac{(SV \cdot HR)}{1000}$	l/min
Cardiac Index	CO: Cardiac Output BSA: body surface area (m <sup>2</sup> )	$CI = \frac{CO}{BSA}$	l/min/m <sup>2</sup>
LV Mass	$A_1$ : SAX epicardial diastolic area (cm <sup>2</sup> ) $A_2$ : SAX endocardial diastolic area (cm <sup>2</sup> ) L: apical length in diastole (cm) t: mean myocardial thickness	$VMass = 1.05 \left( \frac{5}{6} (A_1(L+t)) \angle \frac{5}{6} (A_2 \cdot L) \right)$ $t = \left( \left( \sqrt{\frac{A_1}{\pi}} \right) \angle \left( \sqrt{\frac{A_2}{\pi}} \right) \right)$	g cm
LV Mass Index	LV: (g) BSA: body surface area	$LVMI = \frac{LVMass}{BSA}$	m <sup>2</sup>
Body Surface Area	W: weight (range: 0.5–160 kg) H: height (range: 150–204 cm)	$BSA = 0.007184 (W_{kg}^{0.425} H_{cm}^{0.725})$	m <sup>2</sup>
Fractional Area Change%	LVd: LV diastolic area (cm <sup>2</sup> ) LVs: LV systolic area (cm <sup>2</sup> )	$\%FAC = \left( \frac{LVd \angle LVs}{LVd} \right) \cdot 100$	%
Flow Area	d: diameter (cm)	$FlowArea = \pi \cdot \left( \frac{d^2}{4} \right)$	cm <sup>2</sup>

**2D Formulas (Continued)**

Name	Variables	Formula	Units
Fractional Shortening%	LVd: diastolic dimension (cm) LVs: systolic dimension (cm)	$\%FS = \left( \frac{LVd \angle LVs}{LVd} \right) \bullet 100$	%
Fractional Thickening% - Interventricular Septum	IVSs: interventricular septum in systole IVSd: interventricular septum in diastole	$\%FT = \left( \frac{IVSs \angle IVSd}{IVSd} \right) \bullet 100$	%
Fractional Thickening% - Left Ventricular Posterior Wall	LVPWs: left ventricular posterior wall in systole LVPWd: left ventricular posterior wall in diastole	$\%FT = \left( \frac{LVPWs \angle LVPWd}{LVPWd} \right) \bullet 100$	%

**Formulas Used for Measurements in the M-Mode Window****M-Mode Formulas**

Name	Variables	Formula	Units
Fractional Shortening%	LVd: diastolic dimension (cm) LVs: systolic dimension (cm)	$\%FS = \left( \frac{LVd \angle LVs}{LVd} \right) \bullet 100$	%
Fractional Thickening% - Interventricular Septum	IVSs: interventricular septum in systole IVSd: interventricular septum in diastole	$\%FT = \left( \frac{IVSs \angle IVSd}{IVSd} \right) \bullet 100$	%
Fractional Thickening% - Left Ventricular Posterior Wall	LVPWs: left ventricular posterior wall in systole LVPWd: left ventricular posterior wall in diastole	$\%FT = \left( \frac{LVPWs \angle LVPWd}{LVPWd} \right) \bullet 100$	%
Volume Cubed	LVID: left ventricle inside diameter	$V = LVID^2$	ml
Volume Teichholz	LVID: left ventricle inside diameter	$V = \left( \frac{7}{2.4 + LVID} (LVID^3) \right)$	ml
Ejection Fraction Cubed	Vs: systolic volume cubed (ml) Vd: diastolic volume cubed (ml)	$EF = \left( \frac{Vd \angle Vs}{Vd} \right) \bullet 100$	%
Ejection Fraction Teichholz	Vs: systolic volume Teichholz (ml) Vd: diastolic volume Teichholz (ml)	$EF = \left( \frac{Vd \angle Vs}{Vd} \right) \bullet 100$	%

**M-Mode Formulas (Continued)**

Name	Variables	Formula	Units
Stroke Volume Cubed	Vs: systolic volume cubed (ml) Vd: diastolic volume cubed (ml)	$SV = Vd \angle Vs$	ml
Stroke Volume Teichholz	Vs: systolic volume Teichholz (ml) Vd: diastolic volume Teichholz (ml)	$SV = Vd \angle Vs$	ml
Cardiac Output Cubed	SV: stroke volume cubed (ml) HR: heart rate (bpm)	$CO = \frac{(SV \bullet HR)}{1000}$	l/min
Cardiac Output Teichholz	SV: stroke volume Teichholz (ml) HR: heart rate (bpm)	$CO = \frac{(SV \bullet HR)}{1000}$	l/min
Cardiac Index Cubed	CO: Cardiac Output cubed (l/min) BSA: body surface area (m <sup>2</sup> )	$CI = \frac{CO}{BSA}$	l/min/m <sup>2</sup>
Cardiac Index Teichholz	CO: Cardiac Output Teichholz (l/min) BSA: body surface area (m <sup>2</sup> )	$CI = \frac{CO}{BSA}$	l/min/m <sup>2</sup>
LV Mass	IVSd: interventricular septum diastole (cm) LVIDd: left ventricle inside diameter diastole LVPWd: left ventricle posterior wall diastole	$LVMass = 0.8(1.04) ((IVSd + LVIDd + LVPWd)^3 \angle LVIDd^3) + 0.6$	g
LV Mass Index	LV Mass: (g) BSA: body surface area	$LVMl = \frac{LVMass}{BSA}$	g/m <sup>2</sup>
Body Surface Area	W: weight (range: 0.5–160 kg) H: height (range: 150–204 cm)	$BSA = 0.007184(W_{kg}^{0.425} H_{cm}^{0.725})$	m <sup>2</sup>

## Formulas Used for Measurements in Doppler Windows

### Doppler Formulas

Name	Variables	Formula	Units
Pressure Gradient	V: velocity	$PG = 4V^2$	mmHg
Mean Velocity	V: average velocity between two successive velocity trace points (m/s) N: number of velocity trace points $\Delta t_i$ : time between two successive velocity trace points (sec)	$V_{mean} = \frac{\sum_{i=1}^{N-1} V_i \Delta t_i}{\sum_{i=1}^{N-1} \Delta t_i}$	m/s
Mean Pressure Gradient	V: average velocity between two successive velocity trace points (m/s) N: number of velocity trace points $\Delta t_i$ : time between two successive velocity trace points (sec)	$P_{mean} = \frac{\sum_{i=1}^{N-1} 4V_i^2 \Delta t_i}{\sum_{i=1}^{N-1} \Delta t_i}$	mmHg
Time Velocity Integral		$TVI = \text{area under curve}$	cm
Stroke Volume	TVI: time velocity integral (cm) Flow Area: derived from the flow diameter (cm <sup>2</sup> )	$SV = TVI \cdot \text{Flow Area}$  <div style="display: flex; justify-content: space-between;"> <div> Aortic: AoV TVI  Mitral: MV TVI  Pulmonic: PV TVI  Tricuspid: TV TVI </div> <div> LVOT FA  Mitral FA  Pulmonic FA  Tricuspid FA </div> </div>	ml
Cardiac Output	SV: stroke volume (ml) HR: heart rate (bpm)	$CO = \frac{SV \cdot HR}{1000}$	l/min
Cardiac Index	CO: Cardiac Output BSA: body surface area (m <sup>2</sup> )	$CI = \frac{CO}{BSA}$	l/min/ m <sup>2</sup>
Pressure Half Time	Vmax: Maximum velocity (m/s) Deceleration Slope (ms <sup>2</sup> )	$PHT = \left( \frac{V_{max} \cdot \left(1 \pm \frac{1}{\sqrt{2}}\right)}{\text{Deceleration Slope}} \right) \cdot 1000$	ms
Valve Area by PHT	PHT: Pressure half time (msec)	$VA = \frac{220}{PHT}$	cm <sup>2</sup>

## Doppler Formulas (Continued)

Name	Variables	Formula	Units
Aortic Valve Area by Continuity Equation Using Vmax	AVA: aortic valve area (cm <sup>2</sup> ) CSA <sub>LVOT</sub> : cross-section area of LVOT (cm <sup>2</sup> ) Vmax <sub>LVOT</sub> : maximum velocity in LVOT (m/s) Vmax <sub>AoV</sub> : maximum velocity across aortic valve (m/s) LVOT: left ventricular outflow tract	$AVA = CSA_{LVOT} \cdot \frac{Vmax_{LVOT}}{Vmax_{AoV}}$	cm <sup>2</sup>
Aortic Valve Area by Continuity Equation Using TVI	AVA: aortic valve area (cm <sup>2</sup> ) CSA <sub>LVOT</sub> : cross-section area of LVOT (cm <sup>2</sup> ) TVI <sub>LVOT</sub> : time velocity integral in LVOT (m) TVI <sub>AoV</sub> : time velocity integral across aortic valve (m) LVOT: left ventricular outflow tract	$AVA = CSA_{LVOT} \cdot \frac{TVI_{LVOT}}{TVI_{AoV}}$	cm <sup>2</sup>
Flow Area	d: diameter (cm)	$FlowArea = \pi \cdot \left(\frac{d^2}{4}\right)$	cm <sup>2</sup>
Mitral Valve Area by Continuity Equation Using Aorta	MVA: mitral valve area (cm <sup>2</sup> ) CSA <sub>LVOT</sub> : cross-section area of LVOT (cm <sup>2</sup> ) TVI <sub>LVOT</sub> : time velocity integral in LVOT (m) TVI <sub>MV</sub> : time velocity integral of mitral valve (m) LVOT: left ventricular outflow tract	$MVA = CSA_{LVOT} \cdot \frac{TVI_{LVOT}}{TVI_{MV}}$	cm <sup>2</sup>
Mitral Valve Area by Continuity Equation Using Pulmonary Artery	MVA: mitral valve area (cm <sup>2</sup> ) CSA <sub>PA</sub> : cross-section area of pulmonary artery (cm <sup>2</sup> ) TVI <sub>PA</sub> : time velocity integral of pulmonary artery (m) TVI <sub>MV</sub> : time velocity integral of mitral valve (m)	$MVA = CSA_{PA} \cdot \frac{TVI_{PA}}{TVI_{MV}}$	cm <sup>2</sup>
Right Ventricular Systolic Pressure from Tricuspid Regurgitation	P <sub>RA</sub> : estimated right arterial pressure (mmHg) V <sub>max</sub> : regurgitant velocity of tricuspid valve (m/s)	$RVSP = P_{RA} + 4V_{max}^2$	mmHg



**Doppler Formulas (Continued)**

Name	Variables	Formula	Units
Right Ventricular Systolic Pressure from Ventricular Septal Defect	BP <sub>sys</sub> : systolic blood pressure (mmHg) V <sub>max</sub> : maximum velocity of ventricular septal defect (m/s)	$RVSP = BP_{sys} \angle 4V_{max}^2$	mmHg
Shunt Ratio	CO <sub>Qp</sub> : pulmonic cardiac output (l/min) CO <sub>Qs</sub> : systemic cardiac output (l/min)	$\frac{Qp}{Qs} = \frac{CO_{Qp}}{CO_{Qs}}$	—
Shunt Difference	CO <sub>Qp</sub> : pulmonic cardiac output (l/min) CO <sub>Qs</sub> : systemic cardiac output (l/min)	$Qp \angle Qs = CO_{Qp} \angle CO_{Qs}$	l/min

**Cardiac Reports**

After making the appropriate measurements, you can generate a report. The report includes several calculations based on the measurements. The following pages show the format for the cardiac report. The x's represent data either measured in the scan, or calculated from those measurements.

**Example Echocardiography Report**

Exam Type:			
Report Date:			
<b>Patient Information</b>			
Patient:			
Patient Id:			
Sex:		Height:	
Birth Date:		Weight:	
BP:		BSA:	
<b>Study Information</b>			
Study Date:			
Accession Number:			
Referring Physician:			
Interpreting Physician:			
Indications	[Freeform text entered on worksheet]		
Comments	[Freeform text entered on worksheet]		
<b>2D &amp; M-Mode Measurements</b>			
<u>Ventricle Dimensions</u>			
	Diastole	Systole	
RVAW:	x.xx cm	x.xx cm	
RVID:	x.xx cm	x.xx cm	
IVS:	x.xx cm	x.xx cm	
LVID:	x.xx cm	x.xx cm	xx % FT
LVPW:	x.xx cm	x.xx cm	xx % FS
RVAW:	x.xx cm	x.xx cm	xx % FT

## Example Echocardiography Report (Continued)

	Cubed	Teichholz	
EDV	x.x ml	x.x ml	
ESV	x.x ml	x.x ml	
EF:	xx %	xx %	
SV:	x.x ml	x.x ml	
CO:	x.xx l/min	x.xx l/min	
CI:	x.xx l/min/m <sup>2</sup>	x.xx l/min/m <sup>2</sup>	
HR:	xx bpm		
LV Mass:	x.x g	LVMI: x.x	g/m <sup>2</sup>
<u>Left Ventricle Volume</u>			
	Area	Length	Volume
Ap4c (Dias):	x.xx cm <sup>2</sup>	x.xx cm	x.x ml
Ap4c(Sys):	x.xx cm <sup>2</sup>	x.xx cm	x.x ml
Ap2c (Dias):	x.xx cm <sup>2</sup>	x.xx cm	x.x ml
Ap2c (Sys):	x.xx cm <sup>2</sup>	x.xx cm	x.x ml
Biplane (Dias):			x.x ml
Biplane (Sys):			x.x ml
Ap4c FAC:	xx %	Ap2c FAC:	xx %
HR:	xx bpm		
EF:	xx %	SV: x.x	ml
CO:	x.xx l/min	CI: x.xx	l/min/m <sup>2</sup>
<u>Left Ventricle Mass</u>			
SAX Epi (Dias):	x.xx cm <sup>2</sup>		
SAX Endo (Dias):	x.xx cm <sup>2</sup>		
SAX Endo (Sys):	x.xx cm <sup>2</sup>		
FAC:	xx%		
Apical Length:	x.xx cm		
LV Mass:	x.x g	LVMI	x.x g/m <sup>2</sup>
<u>Valves and Atria</u>			
2D			
	Diameter	Area	
LVOT:	x.xx cm		
Ao Root:	x.xx cm		
RVOT:	x.xx cm		
PA:	x.xx cm		
AV:	x.xx cm	x.xx cm <sup>2</sup>	
MV:	x.xx cm	x.xx cm <sup>2</sup>	
PV:	x.xx cm		
TV:	x.xx cm		
LA:	x.xx cm		
RA:	x.xx cm		

**Example Echocardiography Report (Continued)**

<b>M-Mode</b>				
MM R-R interval	xxx ms			
Aortic Root Diameter:	x.xx cm			
Left Atrium Diameter:	x.xx cm			
Ao / LA:	x.xx			
AV R-R interval	xxx ms			
AV Cusp Sep:	x.xx cm			
Mitral Valve D-E:	xxx mm			
Tricuspid Valve D-E:	xxx mm			
Mitral Valve EPSS	xxx mm			
Mitral Valve E-F slope:	x.xx cm/s			
Mitral Valve E-F excursion:	x.xx cm			
<b>Spectral Measurements</b>				
<u><b>Aortic Valve</b></u>				
	Velocity	Gradient	TVI	Time
AV Mean:	x.xx m/s	x.x mmHg	x.xx m	xxx ms
AV Peak:	x.xx m/s	x.x mmHg		
AI Peak:	x.xx m/s	x.x mmHg		
PHT:	xxx ms			
LVOT Diameter:	x.xx cm	LVOT CSA:	x.xx cm <sup>2</sup>	
Mitral SV:	x.x ml			
Stroke Volume:	x.x ml			
Regurg Fraction:	xx %			
HR:	xx bpm			
Cardiac Output:	x.xx l/min	Cardiac Index:	x.xx l/min/m <sup>2</sup>	
	Velocity	Gradient	TVI	Time
LVOT Mean:	x.xx m/s	x.x mmHg	x.xx m	xxx ms
LVOT Peak:	x.xx m/s	x.x mmHg		
AV Area (TVI):	x.xx cm <sup>2</sup>	AV Area (Peak):	x.xx cm <sup>2</sup>	
<u><b>Mitral Valve</b></u>				
	Velocity	Gradient	TVI	Time
MV Mean:	x.xx m/s	x.x mmHg	x.xx m	xxx ms
MV Peak E:	x.xx m/s	x.x mmHg		
MV Peak A:	x.xx m/s	x.x mmHg		
MR Peak:	x.xx m/s	x.x mmHg		
E/A Ratio:	x.xx			
Decel. Time:	xxx ms	IVRT:	xxx ms	
PHT:	xxx ms	PHT Area:	x.xx cm <sup>2</sup>	
MV Diameter:	x.xx cm	MV CSA:	x.xx cm <sup>2</sup>	
Stroke Volume:	x.x ml			

**Example Echocardiography Report (Continued)**

HR:	xx bpm				
Cardiac Output:	x.xx l/min			Cardiac Index:	x.xx l/min/m <sup>2</sup>
	Velocity	Gradient	TVI	Time	
LVOT Mean:	x.xx m/s	x.x mmHg	x.xx m	xxx ms	
PA Mean:	x.xx m/s	x.x mmHg	x.xx m	xxx ms	
MV Mean:	x.xx m/s	x.x mmHg	x.xx m	xxx ms	
LVOT Diameter:	x.xx cm	LVOT CSA:		x.xx cm <sup>2</sup>	
PA Diameter:	x.xx cm	PA CSA:		x.xx cm <sup>2</sup>	
MV Area (LVOT):	x.xx cm <sup>2</sup>	MV Area (PA):		x.xx cm <sup>2</sup>	
<u>Pulmonic Valve</u>					
	Velocity	Gradient	TVI	Time	
PV Mean:	x.xx m/s	x.x mmHg	x.xx m	xxx ms	
PV Peak:	x.xx m/s	x.x mmHg			
PI Peak:	x.xx m/s	x.x mmHg			
PV Diameter:	x.xx cm	PV CSA:		x.xx cm <sup>2</sup>	
Stroke Volume:	x.x ml				
HR:	xx bpm				
Cardiac Output:	x.xx l/min			Cardiac Index:	x.xx l/min/m <sup>2</sup>
<u>Tricuspid Valve</u>					
	Velocity	Gradient	TVI	Time	
TV Mean:	x.xx m/s	x.x mmHg	x.xx m	xxx ms	
TV Peak E:	x.xx m/s	x.x mmHg			
TV Peak A:	x.xx m/s	x.x mmHg			
E/A Ratio:					
TR Peak:	x.xx m/s	x.x mmHg			
PHT:	xxx ms				
TV Diameter:	x.xx cm	TV CSA:		x.xx cm <sup>2</sup>	
Stroke Volume:	x.x ml				
HR:	xx bpm				
Cardiac Output:	x.xx l/min			Cardiac Index:	x.xx l/min/m <sup>2</sup>
<u>RVSP</u>					
TR Peak:	x.xx m/s	x.x mmHg			
RA Pressure:	xx.x mmHg				
RVSP (TR):	xx.x mmHg				
VSD Peak:	x.xx m/s	x.x mmHg			
Sys BP:	xx.x mmHg				
RVSP (VSD):	xx.x mmHg				
<u>Shunts</u>					
	ASD Qp	ASD Qs			

**Example Echocardiography Report (Continued)**



TVI:	x.xx m	x.xx m
HR:	xx bpm	xx bpm
Diameter:	x.xx cm	x.xx cm
CSA:	x.xx cm <sup>2</sup>	x.xx cm <sup>2</sup>
Stroke Volume:	x.x ml	x.x ml
Cardiac Output:	x.xx l/min	x.xx l/min
Cardiac Index:	x.xx l/min/m <sup>2</sup>	x.xx l/min/m <sup>2</sup>
Qp / Qs:	x.xx	
Qp - Qs:	x.xx l/min	
	VSD Qp	VSD Qs
TVI:	x.xx m	x.xx m
HR:	xx bpm	xx bpm
Diameter:	x.xx cm	x.xx cm
CSA:	x.xx cm <sup>2</sup>	x.xx cm <sup>2</sup>
Stroke Volume:	x.x ml	x.x ml
Cardiac Output:	x.xx l/min	x.xx l/min
Cardiac Index:	x.xx l/min/m <sup>2</sup>	x.xx l/min/m <sup>2</sup>
Qp / Qs:	x.xx	
Qp - Qs:	x.xx l/min	
	Gen Qp	Gen Qs
TVI:	x.xx m	x.xx m
HR:	xx bpm	xx bpm
Diameter:	x.xx cm	x.xx cm
CSA:	x.xx cm <sup>2</sup>	x.xx cm <sup>2</sup>
Stroke Volume:	x.x ml	x.x ml
Cardiac Output:	x.xx l/min	x.xx l/min
Cardiac Index:	x.xx l/min/m <sup>2</sup>	x.xx l/min/m <sup>2</sup>
Qp / Qs:	x.xx	
Qp - Qs:	x.xx l/min	
Qp / Qs:	x.xx	

If you want to review the formulas used to make the calculations for this report, refer to Appendix G, “Formulas used to Calculate Values for the Cardiac Report,” on page 368.

## Selecting Measurements


If you have multiple measurements in the 2D or Time Series window, the Terason software provides tools to help you select a specific measurement. Selecting a measurement highlights both the measurement and the value.



To select a measurement, you can:

- Click  or  until the desired measurement is highlighted
- Click the measurement
- Click the value

## Deleting Measurements

You can use any of the following methods to delete a highlighted measurement:

- Click  on a Measure tab
- Press the Del key on the keyboard
- Right-click a 2D measurement and click **Delete Measurement**

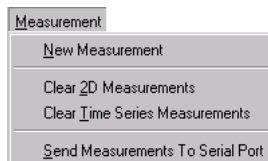
To delete a measurement other than the highlighted one, click  or  until the measurement is highlighted. These buttons cycle through the measurements in the same sequence that they were created in the active window.

You can also right-click and select:

- **Clear Time Series Measurements** to delete all measurements in the Time Series window
- **Clear 2D Measurements** to delete all measurements in the 2D window
- **Clear All** to delete all measurements in the 2D and Time Series windows

**Clear All** on the Edit menu deletes all text and measurements in both Image Display windows.

The **Measurement** menu lets you clear all measurements made in the specified window (2D or Time Series):



### Measurements Menu

**Send Measurements To Serial Port** on the Measurement menu works with Obstetrical and Gynecological exams as described in [Working with Measurements on an Obstetrical Exam](#) on page 177.

## Working with Reports

After making the appropriate vascular measurements, you can generate a worksheet. The worksheet includes all Stenosis measurements with text annotation and all spectral measurements that have an anatomy. Up to three measurements can be stored per vessel or location. If RT or LT are not selected, the measurement is categorized as “Other”. If more than three are saved, the first is deleted and the last is added to the worksheet. The user can edit by checking or unchecking a measurement from the worksheet. Measurements cannot be deleted. The report is not editable.

The highest velocity of each vessel/location is displayed in the report and the highest velocity of each vessel is used for ratios. The only exception would be if Always use mid CCA for ICA/CCA ratio is checked on the worksheet.

You can enter pertinent vascular history to the worksheet in the Blood pressure, Indications and Comments fields.

The following page shows an example of a worksheet.

To produce a report you must:

1. Enter or load **Patient information**
2. Make the needed **measurements**.
3. With Stenosis measurements, text annotation must be added to the image for the measurement to appear on the report, see [Working with Annotations](#) on page 82. With all Spectral measurements, anatomy must be applied to the measurement, see [Measuring Vessel Blood Velocities](#) on page 190.
4. Save the image with the measurements to store them to the worksheet.

Institution:   
 Select Exam Type:   
 Patient:   
 Patient ID:   
 Date:   
 Accession Number:   
 Referring Physician:   
 Interpreting Physician:   
 Blood Pressure:  /  mm Hg

Indications:

Comments:

### Vascular Measurements

☐ Always use Mid CCA for ICA/CCA ratio

Spectral Measurements		Units	Value	Inc M1	Inc M2	Inc M3
Rt Prox ICA	PS	cm/s	-72.4	<input checked="" type="checkbox"/> -72.4 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-20.7	<input type="checkbox"/> -20.7 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		3.50			
	RI		0.78			
Lt Prox ICA	PS	cm/s	-64.3	<input checked="" type="checkbox"/> -64.3 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-20.2	<input type="checkbox"/> -20.2 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		3.19			
	RI		0.69			
Rt Mid ICA	PS	cm/s	-72.4	<input checked="" type="checkbox"/> -72.4 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-27.2	<input type="checkbox"/> -27.2 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		2.66			
	RI		0.62			
Lt Mid ICA	PS	cm/s	-64.8	<input checked="" type="checkbox"/> -64.8 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-20.2	<input type="checkbox"/> -20.2 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		3.21			
	RI		0.69			
Rt Distal ICA	PS	cm/s	-72.4	<input checked="" type="checkbox"/> -72.4 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-25.6	<input type="checkbox"/> -25.6 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		2.83			
	RI		0.65			
Lt Distal ICA	PS	cm/s	-66.5	<input checked="" type="checkbox"/> -66.5 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-20.7	<input type="checkbox"/> -20.7 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		3.21			
	RI		0.69			
Rt Mid CCA	PS	cm/s	-64.8	<input checked="" type="checkbox"/> -64.8 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-20.7	<input type="checkbox"/> -20.7 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		3.13			
	RI		0.68			
Lt Mid CCA	PS	cm/s	-59.7	<input checked="" type="checkbox"/> -59.7 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-21.3	<input type="checkbox"/> -21.3 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		2.81			
	RI		0.64			
Rt CCA	PS	cm/s	-60.8	<input checked="" type="checkbox"/> -60.8 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-24.0	<input type="checkbox"/> -24.0 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		2.54			
	RI		0.61			
Lt CCA	PS	cm/s	-44.3	<input checked="" type="checkbox"/> -44.3 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-15.3	<input type="checkbox"/> -15.3 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		2.89			
	RI		0.65			
Rt ECA	PS	cm/s	-49.9	<input checked="" type="checkbox"/> -49.9 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-13.1	<input type="checkbox"/> -13.1 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		3.80			
	RI		0.74			
Lt ECA	PS	cm/s	-43.7	<input checked="" type="checkbox"/> -43.7 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-18.0	<input type="checkbox"/> -18.0 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		2.43			
	RI		0.59			
Rt Vertebral A	PS	cm/s	-34.0	<input checked="" type="checkbox"/> -34.0 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-14.2	<input type="checkbox"/> -14.2 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D		2.39			
	RI		0.58			
Lt Vertebral A	PS	cm/s	-31.8	<input checked="" type="checkbox"/> -31.8 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	ED	cm/s	-13.7	<input type="checkbox"/> -13.7 (60°)	<input type="checkbox"/>	<input type="checkbox"/>
	S/D					
	RI					

Film: 0001 Date: Monday, November 21, 2005 Hour: 02:21:26 PM

### Vascular Worksheet

On the worksheet, the INC column lets you select which measurements you wish to include on the report. If there is a measurement that you do not wish to include, remove the checkmark for that particular measurement.



When you have examined the information on the worksheet, click the report button at the top of the worksheet to display the report.

Institution: Pasadena Vascular Lab Report Date: 2005-11-5			
<b>Patient Information</b>			
Patient:	Carotid Report		
<b>Study Information</b>			
Study Date:	2005-11-05		
Referring Physician:	Dr. Steve Smith		
Interpreting Physician:	Dr. John Jones		
Indications:	High cholesterol Possible TIA - episode of being unable to speak/say the right words		
<b>Vascular Summary</b>			
<b>Vessel</b>	<b>Right</b>	<b>Left</b>	<b>Other</b>
Prox ICA			
PS(cm/s):	-72.4 (60°)	-64.3 (60°)	
ED(cm/s):	-20.7 (60°)	-20.2 (60°)	
S/D:	3.50	3.19	
RI:	0.71	0.69	
Mid ICA			
PS(cm/s):	-72.4 (60°)	-64.8 (60°)	
ED(cm/s):	-27.2 (60°)	-20.2 (60°)	
S/D:	2.66	3.21	
RI:	0.62	0.69	
Distal ICA			
PS(cm/s):	-72.4 (60°)	-66.5 (60°)	
ED(cm/s):	-25.6 (60°)	-20.7 (60°)	
S/D:	2.83	3.21	
RI:	0.65	0.69	
Mid CCA			
PS(cm/s):	-64.8 (60°)	-59.7 (60°)	
ED(cm/s):	-20.7 (60°)	-21.3 (60°)	
S/D:	3.13	2.81	
RI:	0.68	0.64	
CCA			
PS(cm/s):	-60.8 (60°)	-44.3 (60°)	
ED(cm/s):	-24.0 (60°)	-15.3 (60°)	
S/D:	2.54	2.89	
RI:	0.61	0.65	
ECA			
PS(cm/s):	-49.9 (60°)	-43.7 (60°)	
ED(cm/s):	-13.1 (60°)	-18.0 (60°)	
S/D:	3.80	2.43	
RI:	0.74	0.59	
Vertebral A			
PS(cm/s):	-34.0 (60°)	-31.8 (60°)	
ED(cm/s):	-14.2 (60°)	-13.7 (60°)	
S/D:	2.39	2.33	
RI:	0.58	0.57	
<b>Vascular Ratios</b>			
	<b>Right</b>	<b>Left</b>	
Systolic			
Distal ICA / CCA	1.19	1.45	
Diastolic			

Film: 0001 Date: Monday, November 21, 2005 Hour: 02:59:00 PM

### Vascular Report

After viewing the report, you can save the report or worksheet to a Bitmap, JPEG or DICOM file. To save a report or worksheet to a file, click the Save button and select the type of file you wish to save.

## 9 Working with Exams

Exams contain optimized preset values for many image control settings based on the anatomy to be scanned, the transducer used, the patient size, and the scanning mode. The exam presets also specify the measurements appropriate for the exam. You can use these optimized preset exams 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 exams to store sets of image control settings for specific kinds of exams. Customized exams let you 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](#); see page 218
- [Opening an Exam](#); see page 220
- [Creating Custom Exams](#); see page 221
- [Deleting Custom Exams](#); see page 222

### About Exams

The Terason Ultrasound System provides pre-defined exams for all supported transducers. Although several transducer models may support the same exam, the preset image control parameters are unique to each transducer model.

An exam includes predefined image control settings used for small, medium, and large patients, or for superficial, moderately deep, and deep areas of interest. When you select a size on the 2D image control tab, the Terason software loads presets of other exam parameters for that size. When you select a different size, you need not reload the exam or load a different exam; the Terason software automatically updates the preset values for the selected size.

The following table lists the preset exams available for each transducer.

**Terason Transducers and Preset Exams**

Transducer	Exams		
4V2	Abdominal Cardiac Gynecological	Obstetrical Pelvic	Prostate Renal
5C2A	Abdominal Fetal Cardiac Gynecological	Obstetrical Obstetrical 3D	Prostate Renal
7L3	Arterial Breast Carotid	Dialysis Access Musculoskeletal Testes	Thyroid Vascular Access Venous
12L5	Arterial Breast Carotid	Dialysis Access Musculoskeletal Testes	Thyroid Vascular Access Venous

The following table lists the image control settings that are preset in an exam.

**Exam Presets Provided with Scan Modes**

Image Control Tab	Image Control Settings		
2D	Size Frequency Depth Focus	Gain TGC Curve Sector Width THI (on/off)	
I.Q.	Left/Right invert Up/Down invert Colorization	Smoothing Persistence Map Needle guide (when supported)	Compress Noise rejection
M-Mode	Sweep Speed	Scan line position	
PWD	Sweep Speed Velocity display PRF Wall filter	Invert Correction angle Sample volume size Gain Compress	Noise Rejection Baseline Sound volume Update
CD	Scan area PRF Wall filter Color Invert	Color Gain Color Priority Color Persistence Color Baseline	Color Threshold Spatial Resolution and Frame Rate
Pwr and DirPwr	Scan area PRF Wall filter Directional Power (on/off)	Color invert Color Baseline Color Gain Color Priority	Color Persistence Spatial Resolution and Frame Rate

When you use the Save or Save Loop buttons (see [Saving Images and Loops](#) on page 148), the Terason software uses a default file name based on the selected exam. The following table shows the abbreviation used for each exam.

**Exam Abbreviations Used in File Names**

Exam Name	Abbreviation	Exam Name	Abbreviation
Abdominal	ABD	Musculoskeletal	MUS
Arterial	ART	Obstetrical	OB
Breast	BRT	Prostate	PRO
Cardiac	CAR	Renal	REN
Carotid	CRD	Testes	TES
Dialysis Access	DIA	Thyroid	THY
Fetal Cardiac	FET	Vascular Access	VAS
Gynecological	GYN	Venous	VEN
Laparoscopic	LAP		

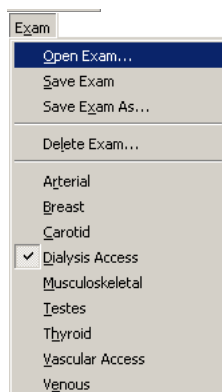
## Opening an Exam

When you select an exam, the Terason software loads the preset values for that exam, determined by the transducer, the patient size, and the selected scan mode. If you select a different patient size or scan mode, the Terason software updates the preset values.

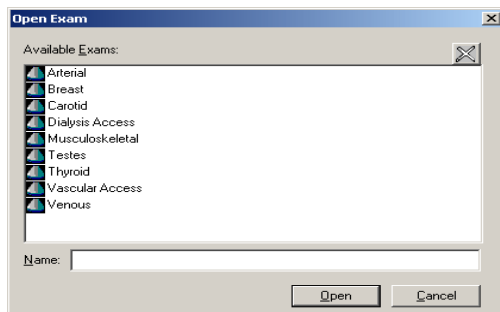
You cannot open an exam when viewing a frozen or saved image. If the Image Display window is frozen, you must click Live before you can change the exam.

You can open an exam using any of these methods:

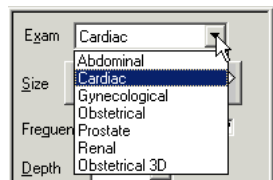
- Select the exam from the Exam menu (the checked exam indicates the open exam).



- Select **Exam > Open Exam**, click an exam, and click **Open**.



- Select an exam type from the pull-down menu on the 2D Image Control tab.



## Creating Custom Exams

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

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

### Creating a New Exam

Before you start, make sure that the transducer you want to use for the new exam is connected. (If a different transducer is connected, see [Switching Transducers](#) on page 89 for instructions.)

To create an exam, complete these steps:

1. Select the **system exam** or custom exam that has settings close to the one you want to create. See [Opening an Exam](#) on page 220.

2. Modify the Image Control **settings** as needed. See [Working with Scan Modes](#) on page 90 for instructions.
3. To overwrite the settings for a *custom* exam, select **Exam > Save Exam**. The Terason software saves the image control settings, and you can skip the rest of this procedure.  
To create a *new* exam, select **Exam > Save Exam As**.
4. Enter the **filename** for the new exam. You can use up to 15 alphanumeric characters for the filename.
5. Click **Save**.

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

## Creating Size-Specific Versions

When you create a custom exam for a specific size, a preset exam is created for the size that is selected when the exam is saved. To use the parameters you defined in the preset for other sizes, you must create customized exams for each size.

Use the same name for each size you modify, when saving the exam. The Terason software saves the presets as part of the same exam, so when you load an exam, the Terason software can use the correct preset values for the selected size. If you use different names for different size settings in the same exam, you must remember to load the size-specific exam, because the Terason software cannot update the preset values based on the size setting.

To create size-specific versions of an exam, complete these steps:

1. Click the **2D** tab in the Image Control window.
2. Choose a different **Size** button.
3. Adjust all Image Control **settings** as necessary.
4. Select **Exam > Save Exam**.

Do not use the Save Exam As item.

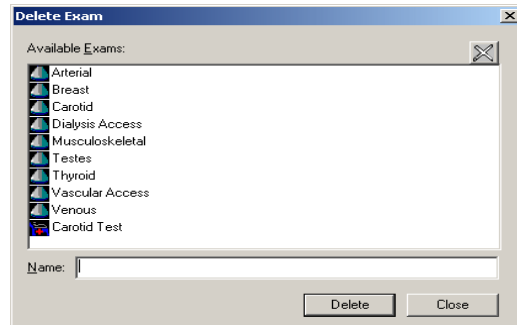
## Deleting Custom Exams

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

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

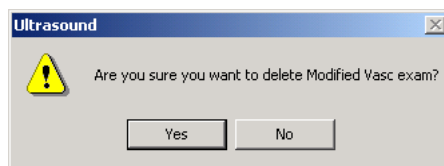
To delete an exam, complete these steps:

1. Select **Exam > Delete Exam**. The Terason software opens the Delete Exam dialog box.



### Deleting an Exam

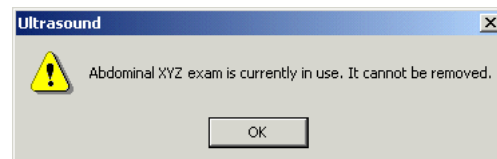
2. Click the exam that you want to delete from the list, and click **Delete**. The Terason software prompts you to confirm that you want to delete this exam.



### Confirm Delete Dialog Box

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

If you select the active exam, the following message displays:



### Error Message If Delete Active Exam

Click **OK**, then open a different exam. Now you can delete the previous exam.


## 10 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 utility installed on your Terason Ultrasound System, you can:

- Print images on a DICOM printer
- Send images or loops to a DICOM server where they can be used by other applications that support DICOM files
- Search the archive of patient information sets 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 utility, you must install the software and a dongle, and configure the DICOM utility. See [Installing the Terason DICOM Utility](#) on page 47 for installation and configuration instructions. If the DICOM utility is not installed, the DICOM menu items are not accessible.

The DICOM utility requires the presence of a dongle (also called a key). If the dongle is not connected to the computer, you cannot use the DICOM utility. The DICOM utility starts when the computer is powered on, and is added to the controls section of the task bar using this icon: .



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**Note:** Do not remove the dongle after installing it. If you see the message HASP not connected when you start up your computer, the dongle is removed or is not securely seated in the port.

---

### Using Images with a DICOM Printer or Server

When you send or print a DICOM image, the Terason software saves the image in a temporary location on your computer. The images are then sent to the server.

To view log messages about images exported to a DICOM server or printed to a DICOM printer, open the DICOM utility (select Start > Programs > TerasonDICOM > Terason) and click the Communications Log tab.

You can change the default button for Save Image to Send DICOM Image, the default button for Save Image Loop to Send DICOM Loop, and the default button for Print to Print DICOM Image. See [Setting Image Save and Print Defaults](#) on page 242 for instructions.



## Printing Files to a DICOM Printer

You can configure your Print button to automatically send an image file to the DICOM printer. To change any configuration options, see [Installing the Terason DICOM Utility](#) on page 47 for instructions.

To send an image to a DICOM printer, complete these steps:

1. Load the **image** (if it was previously saved) or acquire a new scan.
2. Select **File > Print DICOM Image**.

If the dongle is not connected, the print file remains in the temporary directory and is not sent to the printer.

## Sending Files to a DICOM Server

To send an image or loop to a DICOM server, complete these steps:

1. Load the **image** (if it was previously saved) or obtain a new scan.
2. Select either:
  - **File > Send DICOM Image**
  - or
  - **File > Send DICOM Loop**

The Terason software uses the configuration settings in the DICOM utility to locate the DICOM server and transfer the file. See [Installing the Terason DICOM Utility](#) on page 47 for information on configuring the DICOM utility for your server.

If the dongle is not connected, the image or loop file remains in the temporary directory and is not sent to the DICOM server.

To send a saved DICOM file or loop to the server, complete these steps:

1. In the Terason Explorer, click the **folder** (either in the Patient folder or in the Image folder) that contains the needed DICOM files.
2. Click the **Image Sorter** tab.
3. Select the **files** to send.
4. Select **File > Send DICOM File(s)**.

The Terason application sends the files to the configured DICOM server.

## 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 Tools > Options 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. Worklist cannot attach patient information to a saved exam.

This section discusses the following topics:

- [Worklist Queries](#); see page 226
- [Configuring Worklist](#); see page 226
- [Configuring Broad Queries](#); see page 227
- [Making a Query](#); see page 229
- [Applying a Patient Info Set](#); see page 231
- [Customizing the Worklist](#); see page 231
- [DICOM Network Service](#); see page 233

## 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 227.) 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 227, and [Making a Broad Query](#) on page 229.

Patient-based queries search the records using a patient name, access number, date of birth, or other patient-specific parameter. They can be further limited to the parameters in a broad query. See [Making a Patient-Specific Query](#) on page 230.

## Configuring Worklist

To configure Worklist to communicate with a DICOM server:

1. With the Terason software running, click **Tools** in the menubar, and select **Options**.  
The Options window opens.
2. Click the **Worklist tab**.  
The Options window shows the Worklist options.

#### Options > Worklist Window

3. Enter the DICOM server name in the **Name:** field.
4. Enter the other relevant information in the **AE Title:**, **IP Address:**, and **Port:** fields.  
The site system administrator can supply these values.



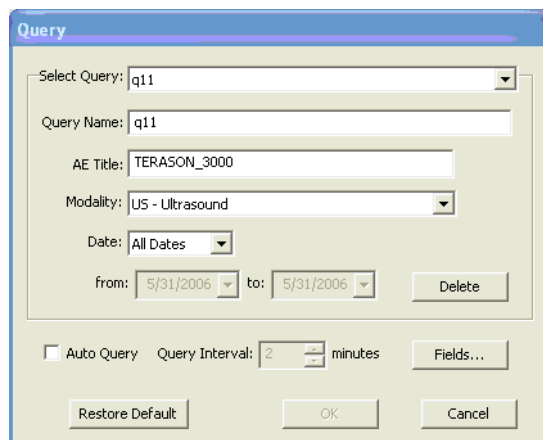
**Note:** The software can find the IP address automatically. To make it search for the IP address, leave the IP Address: field blank.

5. When all the values are entered, click **Verify**.  
The software runs a test that checks whether the entered values enable communication with the DICOM server, then opens a message box that says whether the configuration passed or failed the test.
6. To make the Query window open whenever the Patient Info screen displays, click **Auto-Popup Worklist** so the box is checked.
7. Click **OK** to save the entered values.  
The Options window closes.

## Configuring Broad Queries

To configure a query so that it is available in the Broad Query menu on the Worklist window:

1. In the Options > Worklist window, click **Query**.  
The Query window opens.



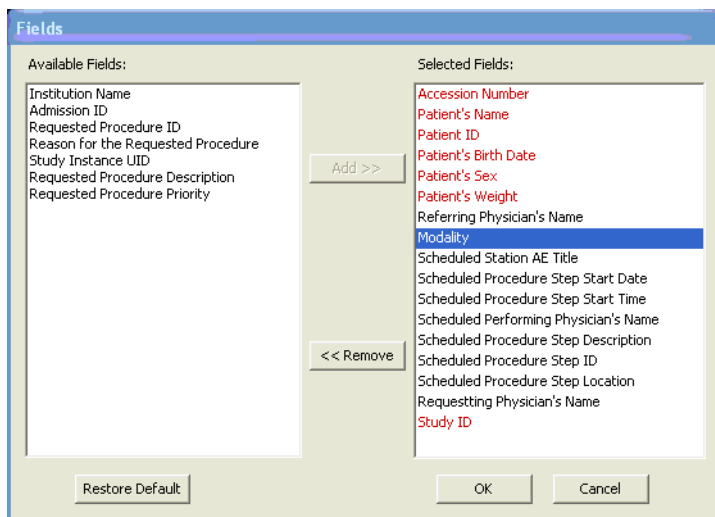
The Query Window dialog box contains the following fields and controls:

- Select Query:** A dropdown menu currently showing 'q11'.
- Query Name:** A text field containing 'q11'.
- AE Title:** A text field containing 'TERASON\_3000'.
- Modality:** A dropdown menu currently showing 'US - Ultrasound'.
- Date:** A dropdown menu currently showing 'All Dates'.
- from:** A date field showing '5/31/2006'.
- to:** A date field showing '5/31/2006'.
- Delete:** A button located next to the 'to' date field.
- Auto Query:** An unchecked checkbox.
- Query Interval:** A spin box set to '2' minutes.
- Fields...:** A button to open the Fields window.
- Restore Default:** A button at the bottom left.
- OK:** A button at the bottom center.
- Cancel:** A button at the bottom right.

### Query Window

2. To create a new query, enter a descriptive name for the query in the **Query Name:** field.  
The name must be unique.
3. To modify an existing query, pull down the **Select Query:** menu and select the query name.
4. Enter the **AE title** of the Terason ultrasound computer in the AE Title: field.
5. To search for info sets of patients who have not had an ultrasound exam before, pull down the **Modality:** menu and choose a different exam type.
6. In the **Date:** menu, choose All Dates, Today, or a range of dates to search.
7. To make the query repeat at intervals, click **Auto Query** so the box is checked, and select a Query Interval: using the up and down arrows.
8. To change the parameters that are selectable for queries:
  - a. Click **Fields....**

The Fields window opens.



The Fields Window dialog box is divided into two main sections:

- Available Fields:** A list of fields that can be added to the query. The list includes: Institution Name, Admission ID, Requested Procedure ID, Reason for the Requested Procedure, Study Instance UID, Requested Procedure Description, and Requested Procedure Priority.
- Selected Fields:** A list of fields that are currently selected for the query. The list includes: Accession Number, Patient's Name, Patient ID, Patient's Birth Date, Patient's Sex, Patient's Weight, Referring Physician's Name, Modality (highlighted in blue), Scheduled Station AE Title, Scheduled Procedure Step Start Date, Scheduled Procedure Step Start Time, Scheduled Performing Physician's Name, Scheduled Procedure Step Description, Scheduled Procedure Step ID, Scheduled Procedure Step Location, Requesting Physician's Name, and Study ID.

Between the two lists are two buttons: **Add >>** and **<< Remove**. At the bottom of the window are three buttons: **Restore Default**, **OK**, and **Cancel**.

### 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 listed in red are defaults that cannot be removed from the Selected Fields: list.

- d. Click **OK**.

9. When all the fields are populated with the correct data, 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:

#### Patient Info Window

1. In the Patient Info window, click **Worklist**.

The Worklist window opens.

The screenshot shows the 'Worklist' window. At the top is a table with columns: Accession Num..., Patient's..., Patient ID, Patient's Birth Date, Patient's Sex, and Patient's Weight. The table contains three rows of data:

Accession Num...	Patient's...	Patient ID	Patient's Birth Date	Patient's Sex	Patient's Weight
3016	EDWARD MI...	678	09/16/1976	F	144
244	KEARNEY N...	PID52132	06/23/1968	M	152.5
235	OLIVER THO...	PID00100	09/02/1970	M	140

Below the table are query options. The 'Broad Query:' dropdown is set to 'All Date match with US modality for TERASON\_3000'. The 'AE Title:' field is 'TERASON\_3000'. The 'Modality:' dropdown is 'US - Ultrasound'. The 'Date Type:' dropdown is 'All Dates', with 'from:' and 'to:' date pickers both set to '5/31/2006'. There is a 'Query' button. Below this is the 'Patient Based Query' section with 'Patient Name:', 'Accession Number:', and 'Patient ID:' fields, a 'Query' button, and a checked checkbox for 'Use Broad Query Criteria'. At the bottom are 'Customize List...', 'Select', and 'Cancel' buttons.

### Worklist Window

2. 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 227.

3. 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.

4. To limit the search to specific dates, pull down the **Date:** menu, and choose Today or a range of dates to search.
5. 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 Info window, click **Worklist**.  
The Worklist window opens.
2. Enter the patient's name, or 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 227.

- c. You can also search using different **modality and date** parameters, using those functions in the Broad Query section.

4. 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. In the top part of the Worklist window, click the appropriate **patient info set** to select it.
2. 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.

If a query returns a large number of patient info sets, you must use the scroll bar at the right side of the list area to see them all. You can sort the listed results by field (sort by Patient ID, or sort by Patient's Name, for instance), so the ones you're most interested in are at the top. See [Sorting the Results](#) on page 232.

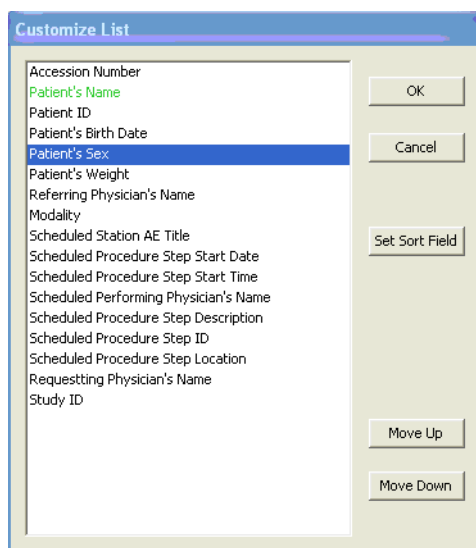
Changes you make to the listing order and result sorting become the defaults; new lists will use those parameters when displaying the results of queries.

### 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.

## Sorting the Results

To sort the list of results using a specific value type:

1. On the Worklist window, click **Customize List...**  
The Customize List window opens. (See [Customize List Window](#), above.)
2. Click to select the **field name** you want to use for sorting the results.  
In the figure, Patient's Sex is selected.
3. Click **Set Sort Field**.
4. Click **OK**.

Worklist sorts the patient info sets in its list using the value type you selected. It sorts alphabetically starting with A, or numerically starting with 0. When you make a new query, the worklist uses the value type you set with this procedure to sort the results.



## 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. Open Windows Explorer and navigate to the **Terason** directory.
2. 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. Right-click the **network service icon** on the Windows status bar at the lower right corner of the screen.



**Network Service Icon**

A dialog box opens.

2. Click **Exit** in the dialog box.

The network service stops.

### Checking the Connection Status

When you hover the mouse cursor 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.

## 11 Using System Tools

The **Tools** menu provides utilities that support various functions of the Terason software.



### Tools Menu

The tools control the following operations:

- [Testing the Monitor Display](#), see page 234
- [Running a Probe Verification Test](#), see page 238
- [Correcting the Position of the Needle Guides](#), see page 240
- [Restoring the Default Layout](#), see page 240
- [Keeping the Terason Software on Top](#), see page 240
- [Setting a Time-Out Value](#), see page 241
- [Enabling or Disabling the Color Doppler Warning](#), see page 241
- [Specifying Optional Settings](#), see page 242

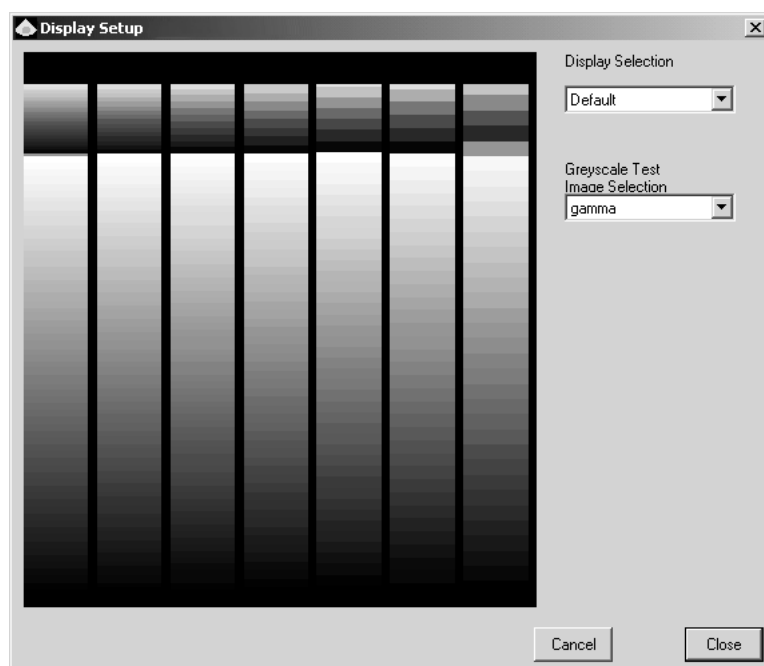
## Testing the Monitor Display

When you purchase a laptop from Terason as part of the Terason Ultrasound System, the monitor is already adjusted for proper display.

*Gamma* refers to the monitor's ability to display accurate colors. If you think the colors on your monitor are no longer accurate, you can perform the tests in this section to verify that the display is correct. The Display Setup window includes four industry-standard tests. You can use any combination of these tests to test your monitor's display. The procedure shows you how to use all of the tests; you can skip any of them.

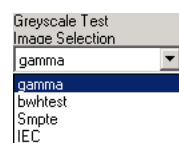
To test the gamma for your display, complete these steps:

1. In the I.Q. Image Control window, select **Gray** from the Colorization menu.
2. Select **Tools > Display Setup**. The Display Setup window opens.



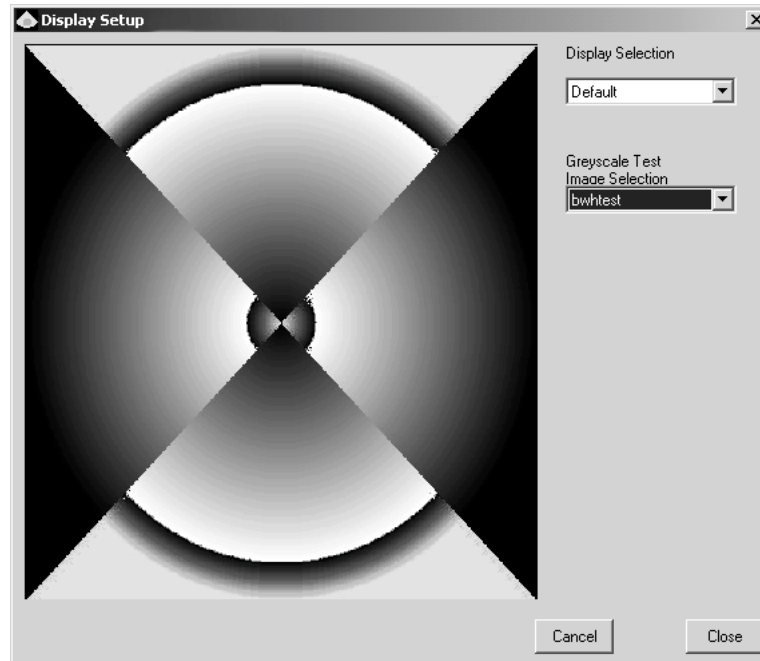
**Gamma Correction Dialog Box - Gamma Test**

3. From the Display Selection menu, select your **monitor**. If you do not see any monitors listed, select Default.
4. Verify that the **gray bars** in each column are increasingly difficult to distinguish as you look from right to left.
5. Select **bwhtest** from the Greyscale Test Image Selection menu.



#### **Greyscale Tests**

The following figure shows the BWHtest:



**Gamma Correction Dialog Box - BWHTest**  
(BWH: Brigham and Women's Hospital)

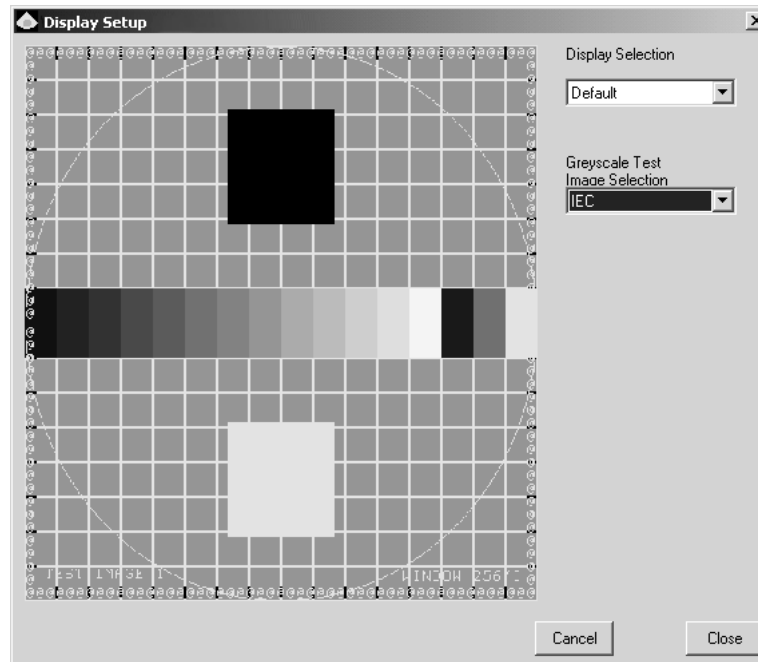
6. Verify that the test pattern shows a **continuous grayscale image** from the center of the pattern. You should not see any concentric ring-like features.
7. Select **SMPTE**.



#### Gamma Correction Dialog Box - SMPTE Test

(SMPTE: Society of Motion Picture and Television Engineers)

- a. Verify that the 0% and 100% squares contain smaller squares that represent signal level steps of 5% (in the 0% square) and 95% (in the 100% square). You should be able to differentiate the inner square from the larger square that contains it.
  - b. Verify that the high-contrast bar patterns in the test image are distinct, simple patterns of black and white bars. In each corner and the center of the image, inspect the lines, from fat to narrow, horizontally and vertically, and make sure you can see all the lines.
8. Select **IEC**.



**Gamma Correction Dialog Box - IEC Test**

You should be able to differentiate between the gray bars along the center of the image. The large black square (top) should be black, and the large white square (bottom) should be white.

9. Click **Close**.

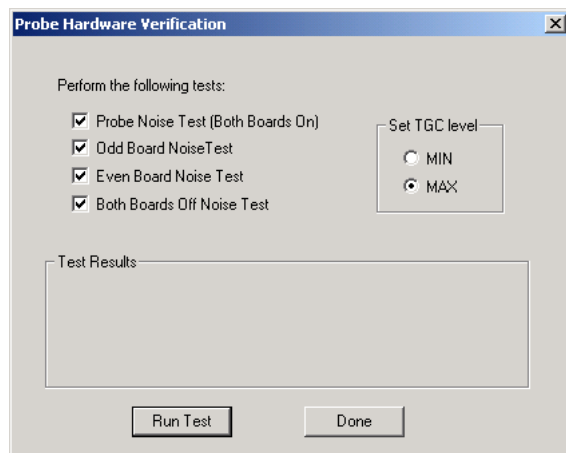
## Running a Probe Verification Test

The Terason software automatically verifies transducer operation each time you start the software. In addition, the Tools menu includes a probe verification test that you can run at any time.



**Note:** You may never need to use this tool. However, if you have a problem with the Terason Ultrasound System and a Terason Technical Support Representative asks you to run this test, complete these steps:

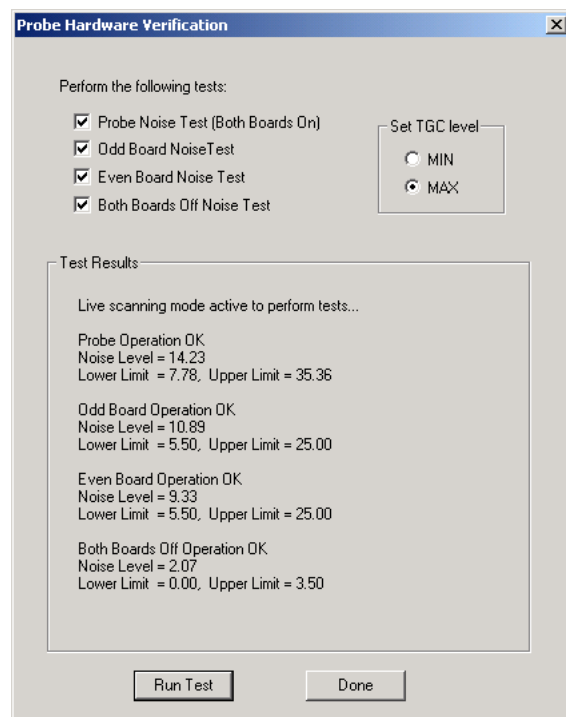
1. Select **Tools > Probe Verification Test**. The Probe Hardware Verification window opens.



### Probe Verification Test

2. Make sure all of the check boxes are checked, unless the Terason Technical Support Representative asks you to clear one or more of them, then click **Run Test**.

The Terason software runs several tests and displays the results in the Test Results section of the window.



### Verification Results

3. Report the **results** to the Terason Technical Representative.
4. Click **Done**.

## Correcting the Position of the Needle Guides

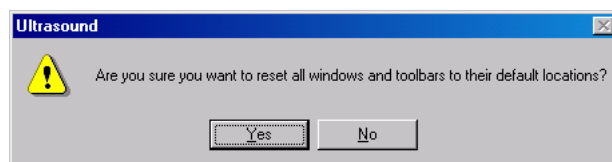
Needle Guide Error Correction in the Tools menu is used exclusively with the biopsy/medical procedures options.

## Restoring the Default Layout

You can easily reset the layout of the toolbars and windows to their default locations. To do so, complete these steps:

1. Select **Tools > Restore Default Window Layout**.

The Terason software prompts you to confirm this choice.



### Confirmation Before Resetting the Layout

2. Click **Yes**.

The Terason software opens the Terason Explorer and Image Control windows (if they were closed), and shows only the default toolbars. You can use the toolbars shortcut menu (right-click in the toolbar area) to hide any of the toolbars or to show other toolbars.

## Keeping the Terason Software on Top

Terason recommends that you not use other applications while the Terason software is running. Although computer systems can simultaneously run multiple applications, you get the best performance if the Terason software does not share resources with other applications.


If you use more than one application on your computer, Windows automatically places the active application at the front in the desktop. Depending on the size of that application's window, you may not be able to see windows for other applications, such as the Terason window.

To make sure that the Terason window is never hidden beneath another application, select **Tools > Always on Top** from the Terason menu bar. This menu item shows a check mark when it is selected.

When **Always on Top** is selected, no other application blocks your view of the Terason application.

To view a different application window:

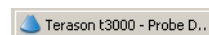
1. Minimize the **Terason window** (click  at the top right of the Terason window).

Windows adds a  Terason t3000 - Probe D... button on the taskbar at the bottom of the screen, and displays another application on the desktop.

2. Use **other applications** as needed.



- When you are ready to use the **Terason software** again, click the button.



Windows displays the Terason window.



**Note:** The usual Windows method of pressing Alt-Tab to change views does not work when Always on Top is selected.

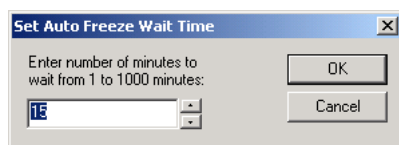
## Setting a Time-Out Value

The Terason software lets you set a time-out value that shuts off power to the transducer if it has been inactive for a specified period. This feature is especially useful when you run a laptop on battery power.

To enable this feature, select Tools > Auto Freeze. The menu shows a check mark when this feature is enabled. The default time-out value is 15 minutes, but you can change it to any value between 1 and 1000 minutes.

To set the time-out value, complete these steps:

- Select **Tools > Set Auto Freeze Wait Time**. The Terason software opens the Set Auto Freeze Wait Time dialog box.



### Setting the Time Out Value

- 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.
- Click **OK**.

When the specified number of minutes elapses, the computer shuts off power to the transducer and displays the following message:

Terason has automatically suspended. Hit any key or move mouse to resume.

The Terason title bar changes to Terason - Suspended, to indicate that transducer power is shut down. When you move the mouse or press any key on the keyboard, the Terason software sends power to the transducer and removes the message box.

## Enabling or Disabling the Color Doppler Warning

The Show Color Doppler Warning Message item in the Tools menu lets you control whether or not the application displays a warning message when you try to save an image file with a high color persistence setting. See [Adjusting the Color Persistence](#) on page 122 for information on the color persistence setting.

You can use the Tools > Show Color Doppler Save Warning menu item to enable or disable the warning. Click the menu item to toggle its setting between enabled (check mark) and disabled (no check mark).

## Specifying Optional Settings

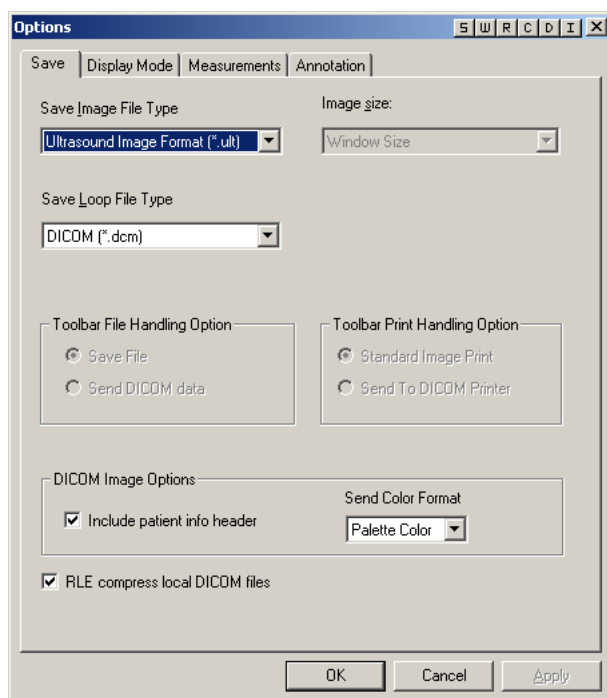
The Terason software lets you specify several optional settings. You can change defaults that affect:

- [Setting Image Save and Print Defaults](#), see page 242 Setting Image Save and Print Defaults
- [Changing the Display Mode Defaults](#), see page 244 Changing the Display Mode Defaults
- [Setting Measurement Defaults](#), see page 248 Setting Measurement Defaults

The following sections describe the defaults you can set. To change options, select **Tools > Options**, then make any changes necessary to the tabs and click OK.

### Setting Image Save and Print Defaults

When you select **Tools > Options**, the Options window opens showing the Save tab.



**Options Dialog Box**

These options let you set defaults for:









- [Save Image File Type](#), see page 242
- [Toolbar File and Print Handling Options](#), see page 243
- [DICOM Image Format](#), see page 244

### Save Image File Type

By default, the Terason software uses its own file format when saving image files and loops. You can choose a different format as the default for images or loops

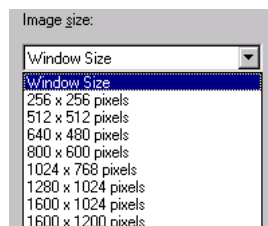
When you set a different file type as the default, the Terason software changes the Save Image and Save Loop buttons to show the file type that will be used. You can select a different default file type for images and loops. The following table shows the icons for all file types.

**Available File Types for Saving Images and Loops**

Image Format	Save Image Button	Save Loop Button
Terason (.ult)		
AVI	Not available	
Bitmap		Not Available
DICOM		
JPEG		Not Available
TIFF		Not Available

If you change the default file type, you can use Export on the File menu to select the Terason Image Type (or any other format) to save the file.

When you select a file type for image files other than ULT, you can choose the default Image size from the Window Size menu.



#### Image Sizes for non-ULT File Types

Your choice becomes the new default. You can change the image size when you save the file by using Export on the File menu instead of the **Save** button.

#### Toolbar File and Print Handling Options

If you use the DICOM utility, you can replace the Save Image and Save Image Loop buttons on the File toolbar with Send DICOM Image and Send DICOM Loop buttons, and the Print button with a Print DICOM button. To save an image or loop to your computer in a format other than DICOM or to print to a printer other than the DICOM printer when the DICOM options are selected, use the File menu. The Toolbar File and Print handling options are enabled only if the DICOM utility is installed on the computer.

If you choose to use the DICOM file and print buttons, the File toolbar shows the DICOM buttons.



### File Toolbar Setup with DICOM Buttons

See [Using Images with a DICOM Printer or Server](#) on page 224 for information on using these buttons.

## DICOM Image Format

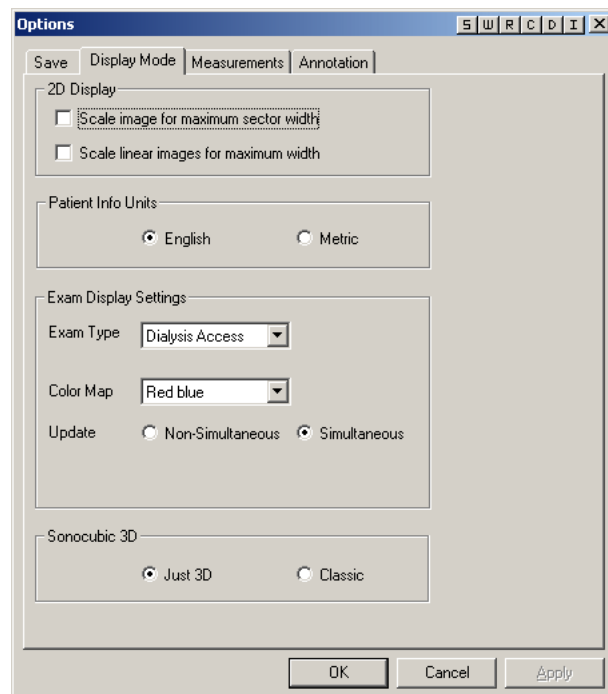
You can choose whether or not patient data is sent with the DICOM image, and can choose the color format used for sending a DICOM image. You can choose Palette (8-bit color) or RGB (24-bit) color. This setting only affects files sent to a DICOM server; DICOM files saved on the laptop always use the Palette color format.

The RLE compress local DICOM files checkbox lets you choose whether or not to compress DICOM files when saving them on the laptop. By default, DICOM files are compressed using the DICOM RLE syntax, and then uncompressed when exported or sent to a DICOM server.

If you need to access the DICOM files using an application that cannot read the DICOM RLE syntax, you can disable compression by clearing the RLE compress local DICOM files checkbox. Changing the default causes longer image save and load times and larger image files.

## Changing the Display Mode Defaults

The Display Mode options are shown in the Options/Display Mode window.



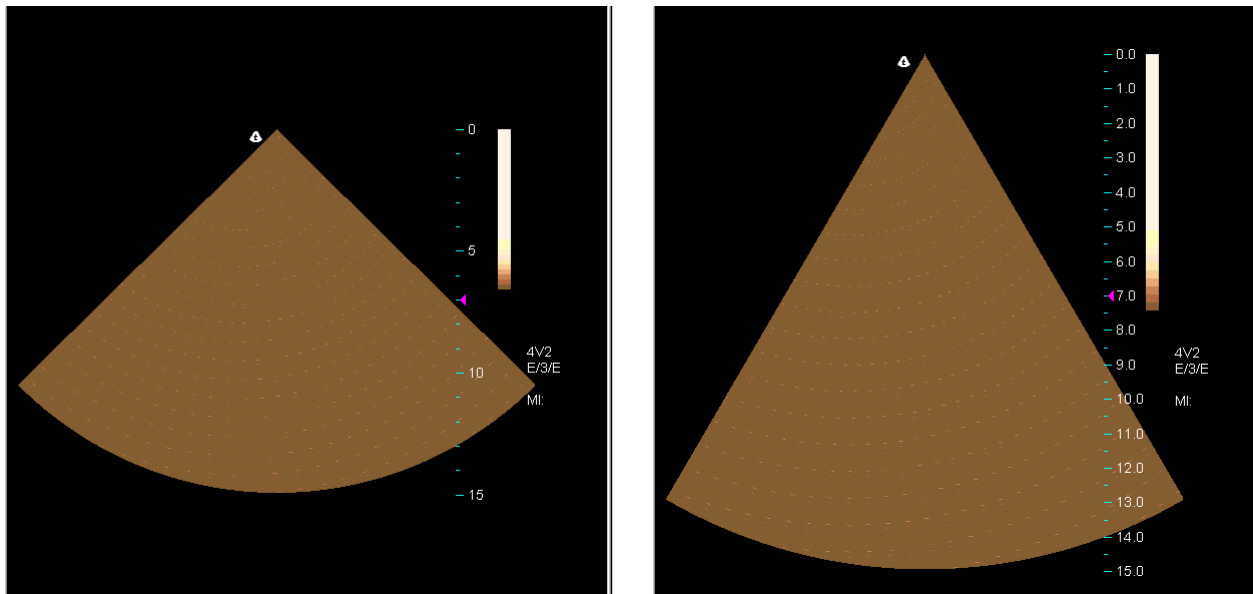
Options: Display Mode Options

The Display Mode window controls the following operations:

- [Scaling Curved Transducers](#) on page 245
- [Scaling Linear Transducers](#) on page 246
- [Setting the Units for Patient Measurements](#) on page 247
- [Choosing Color Maps for Exams](#) on page 247
- [Scanning in Non-Simultaneous or Simultaneous Mode](#) on page 247

### Scaling Curved Transducers

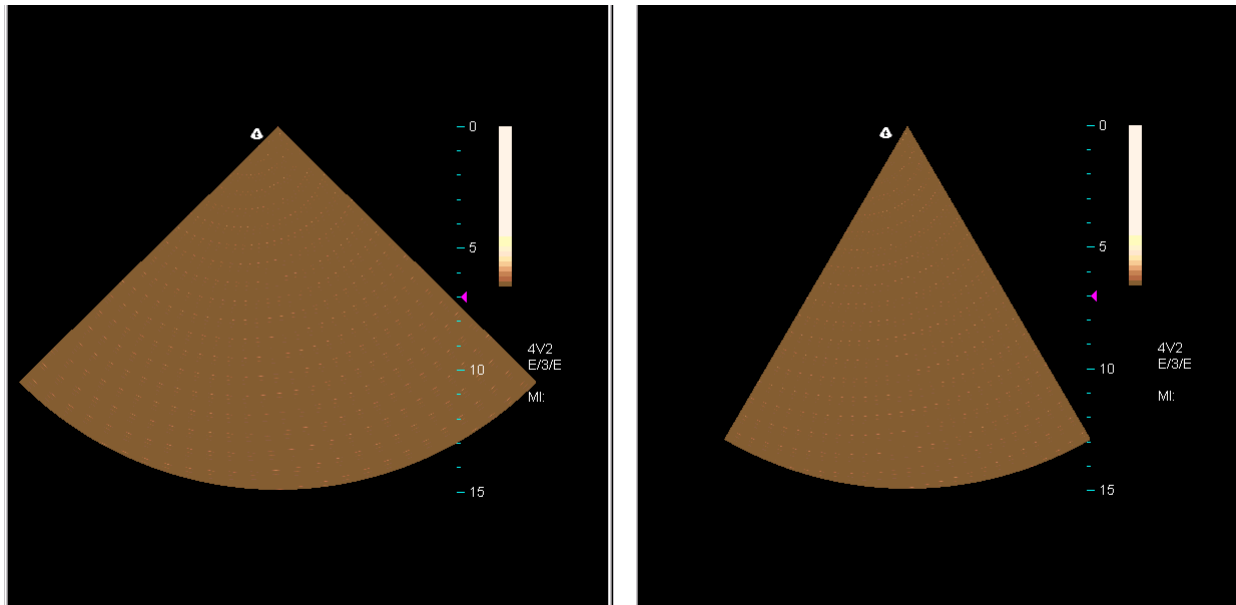
This option works with curved array transducers; it does not work with linear array transducers. You can choose whether the Terason software scales the image when you choose the narrow sector width, or expands it to fill the entire available area. By default, the Terason software expands the 2D scan data to fill the available space. Perceptually, if you change from a wide sector width to a narrow sector width, it looks like the narrow sector width is larger than the wide sector width, as shown in the following figure.



**Wide Sector Width vs. Narrow Sector Width**

If you compare the scale, you can see that the scales are different. The Terason software expanded the narrow sector image to fill the available space.

To retain the same scale when you switch sector widths, you can set the default to scale the narrow image. You can then see the affect of switching sector widths, as shown in the following figure.



**Wide Sector vs. Scaled Narrow Sector**

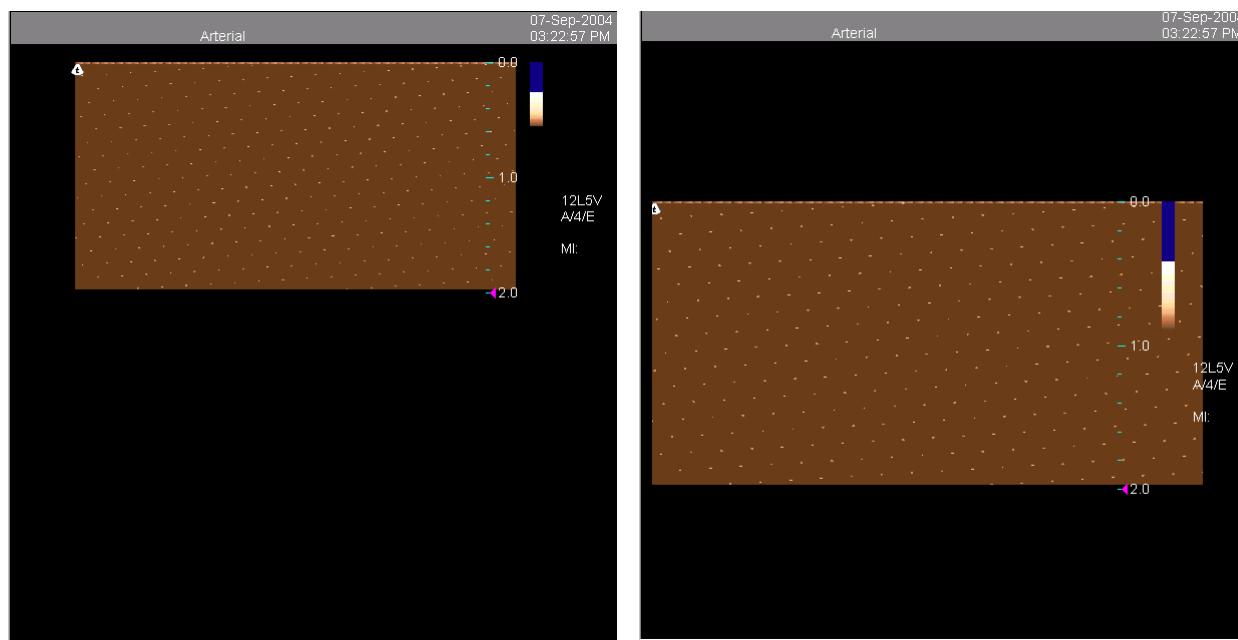
The scales are the same, and you can see that the narrow width really is narrower than the wide width. However, the window contains unused space that could be used to show image data.

### **Scaling Linear Transducers**

This option works with linear transducers; it does not work with curved transducers. When you select a small depth, the Terason software retains the same width as the original scan, and removes the scan data from greater depths.

To scale the image to take advantage of the full width of the Image Display tab, you can select the Scale linear images for maximum width checkbox. When you do, the Terason software scales the image (while maintaining the same aspect ratio) to fill as much of the window as possible.

The following figure shows the difference between unscaled and scaled linear arrays.



Unscaled (Left) and Scaled (Right) Linear Scan Images

### Setting the Units for Patient Measurements

When entering a patient's height and weight, you can choose English units (feet, inches, and pounds), or metric units (meters and kilograms).

### Choosing Color Maps for Exams

For Color Doppler mode, you can choose whether Color Doppler data is shown in the standard Rainbow color map, or a Red-Blue color map. You can configure the color map independently for each exam by selecting an exam, then a color map. You do not need to click Save or Apply to set the color map. When you select a different exam, the Terason software loads the color map for the selected exam.

The Dialysis Access exam uses the Red-Blue color map as its default; all other exams use the Rainbow color map as the default.

### Scanning in Non-Simultaneous or Simultaneous Mode

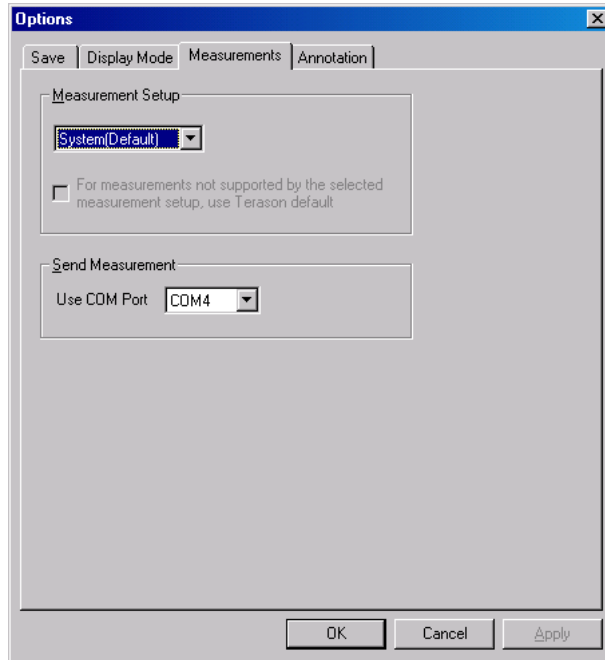
With PWD and Triplex modes, you can choose whether to scan in non-simultaneous mode. When you are scanning in non-simultaneous mode either the 2D or the time series window receives data. This lets you independently change the PW and Color Doppler PRFs. When scanning in simultaneous mode, both the 2D and the time series window receive data. This feature lets you define which method is used, based on the exam type.

### Starting the System with TeraVision Off

Terason ultrasound systems that have the optional TeraVision image-enhancement package normally start TeraVision when the system starts. To change this default so that clicking the I.P. Filter button on the IQ tab is required for TeraVision to run, go to Tools > Options > Display Mode, and uncheck the box next to TeraVision ON by Default.

## Setting Measurement Defaults

The measurement defaults include the system used to make obstetrical calculations, and the COM port used to export obstetrical measurements to another computer.



**Options: Measurements Tab**

The Terason Ultrasound System uses the Hadlock measurement setup as the system default to make obstetrical calculations. If needed, you can use a different measurement setup. Not all measurement setups provide the full list of measurements included with the Hadlock setup. If you choose a different setup, you can also choose to use the default setup for measurements not included in the one you selected.

See [Working with Measurements on an Obstetrical Exam](#) on page 177 for more information.

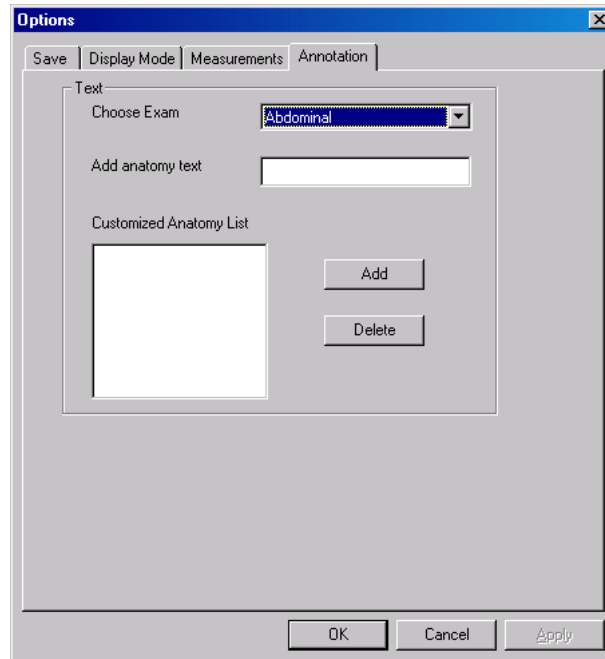
## Adding Custom Text to the Annotation Window

The Text tab in the Annotation window provides text you can quickly add to an image without having to type it. You can add additional text to this window. The text displayed in the Annotation window depends on the selected exam. To have a text phrase available for multiple exams, you must add it to each exam.

To add custom text, complete these steps:

1. Select **Tools > Options**.
2. In the Options window, click the **Annotation tab**.



**Options: Annotation Tab**

3. From the Choose Exam menu, choose the **exam** for which you want this text to be available.
4. Type the text into the **Add anatomy field**.
5. Click **Add**. The Terason software adds the text to the list.
6. Repeat **steps 3 to 5** for all exams and text you want to enter.
7. Click **OK**.

The text you add shows at the bottom of the list in the Text tab of the Annotation window. For instructions on using this text, see [Adding Text to an Image](#) on page 82.

## 12 System Safety and Maintenance

To use the Terason Ultrasound System successfully and safely, Terason provides the following information:

- [Safety Standards](#), see page 250
- [Acoustic Output Indices](#), see page 259
- [Relationship of Index to Display Accuracy](#), see page 268
- [Acoustic Output Tables](#), see page 270
- [Accuracy Measures](#), see page 271
- [Between-Use Processing of Terason Transducers](#), see page 272
- [Compliance and Approvals](#), see page 275
- [System Warranty](#), see page 275
- [Recommended Maintenance](#), see page 275
- [Equipment List](#), see page 276
- [System Specifications](#), see page 277

### Safety Standards

According to the American Institute of Ultrasound in Medicine (AIUM) *Official Statement of the Clinical Safety of Diagnostic Ultrasound* (March 1993):

Diagnostic ultrasound has been in use since the late 1950s. Given its known benefits and recognized efficacy for medical diagnosis, including use during human pregnancy, the American Institute of Ultrasound in Medicine herein addresses the clinical safety of such use: No confirmed biological effects on patients or instrument operators caused by exposure at intensities typical of present diagnostic ultrasound instruments have ever been reported. Although the possibility exists that such biological effects may be identified in the future, current data indicate that the benefits to patients of the prudent use of diagnostic ultrasound outweigh the risks, if any, that may be present.

### 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.

## Electrical Safety

The Terason Ultrasound System conforms to the UL 60601-1 electrical safety standard.

Each transducer is insulated from the patient to minimize patient exposure in the presence of a system fault or a fault in other patient-connected equipment. The type of protection against electric shock is Class I. The degree of protection is Type BF, per safety standard IEC 60601-1.

To maintain compliance with electrical safety and emissions standards, the Terason Ultrasound System must be used *only* with the supplied Medical Grade Power Adapters.

## Surface Heating of Invasive Transducers

The average and peak radiated acoustic powers of all Terason transducers are limited by detection circuitry, to insure that the surface heating of the transducer array is less than 43°C.

To limit the average acoustic power output, the maximum pulse repetition frequency (PRF) is tested in hardware by comparing a PRF counter to a preset value. Exceeding the maximum allowable PRF triggers an error message that displays on the host computer, and the Terason Ultrasound System acoustic output is disabled. The preset maximum PRF is chosen to limit the transducer case temperature to less than 43°C.

The peak acoustic power is constrained by the maximum voltage applied to the transducer-array elements. In hardware, peak power is monitored by a watchdog device that measures instantaneous power and compares it to two thresholds. The first threshold is a non-programmable four-watt limit. The second threshold is a programmable limit that Terason has set in accordance with IEC 60601-2-37 and AIUM Nema UD2 and UD3 (1998 and 2004).

## Indications For Use

This section provides Diagnostic Ultrasound Indications for Use forms for the transducers that Terason offers with its ultrasound system. The first table provides indications for use for all of the transducers. The remaining tables list the indications for use for the system (see [Indications for use - Diagnostic Ultrasound System](#) on page 252), and for the following transducers:

- [Indications for Use - 4V2 Transducer](#), see page 253
- [Indications for Use - 5C2A Transducer](#), see page 254
- [Indications for Use - 7L3 Transducer](#), see page 255
- [Indications for Use - 8EC4 Transducer](#), see page 256
- [Indications for Use - 12HL7 Transducer](#), see page 257
- [Indications for Use - 12L5 Transducer](#), see page 258

## Indications for use - Diagnostic Ultrasound System

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM								
System: Terason Ultrasound System								
Transducer: See Comments								
Intended Use: Diagnostic ultrasound imaging or fluid flow analysis of the human body as follows:								
Clinical Application		Mode of Operation						
General (Track 1 Only)	Specific (Tracks 1 and 3)	B	M	PWD	CWD	Color Dopp <sup>a</sup>	Comb. Modes <sup>b</sup>	Other <sup>c</sup>
<b>Ophthalmic</b>	Ophthalmic							
<b>Fetal Imaging and Other</b>	Fetal	X <sup>h</sup>	X <sup>h</sup>	X <sup>h</sup>		X <sup>h</sup>	X <sup>h</sup>	X <sup>h</sup>
	Abdominal <sup>k</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Intra-operative <sup>e</sup>	X	X	X		X	X	X
	Intra-operative (Neuro)	X	X	X		X	X	X
	Laparoscopic	X	X	X		X	X	X
	Pediatric	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Small Organ (Thyroid, Breast, Testes, etc.)	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>		X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Neonatal Cephalic	X	X	X	X	X	X	X
	Adult Cephalic	X	X	X	X	X	X	X
	Trans-rectal	X <sup>f</sup>	X <sup>f</sup>	X <sup>f</sup>		X <sup>f</sup>	X <sup>f</sup>	X <sup>f</sup>
	Trans-vaginal	X <sup>g</sup>	X <sup>g</sup>	X <sup>g</sup>		X <sup>g</sup>	X <sup>g</sup>	X <sup>g</sup>
	Trans-urethral							
	Trans-esoph. (non-Cardiac)							
	Musculo-skel. (Conventional)	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>		X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Musculo-skel. (Superficial)	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>		X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Intra-luminal							
	Other (Specify)							
<b>Cardiac</b>	Cardiac Adult	X	X	X	X	X	X	X
	Cardiac Pediatric	X	X	X	X	X	X	X
	Trans-esoph. (Cardiac)							
	Other (specify)							
<b>Peripheral Vessel</b>	Peripheral vessel	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>		X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Other (specify)							

<sup>a</sup>Includes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

<sup>b</sup>B+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

<sup>c</sup>Tissue Harmonic Imaging (THI), Tissue Doppler Imaging (TDI).

<sup>d</sup>Includes ultrasound guidance for placement of needles, catheters.

<sup>e</sup>Abdominal organs and peripheral vessels.

<sup>f</sup>Includes ultrasound guidance for placement of needles, catheters, cryosurgery, and brachytherapy.

<sup>g</sup>Includes ultrasound guidance of transvaginal biopsy.

<sup>h</sup>Includes ultrasound guidance of amniocentesis, infertility monitoring of follicle development.

<sup>j</sup>Includes ultrasound guidance for placement of needles.

<sup>k</sup>Abdominal includes GYN/Pelvic.

<sup>l</sup>Other use includes Urology/Prostate.

Includes uses in military field settings in addition to hospital/clinic settings.

## Indications for Use - 4V2 Transducer

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM								
System: Terason Ultrasound System								
Transducer: 4V2								
Intended Use: Diagnostic ultrasound imaging or fluid flow analysis of the human body as follows:								
Clinical Application		Mode of Operation						
General (Track 1 Only)	Specific (Tracks 1 and 3)	B	M	PWD	CWD	Color Dopp <sup>a</sup>	Comb. Modes <sup>b</sup>	Other <sup>c</sup>
<b>Ophthalmic</b>	<b>Ophthalmic</b>							
<b>Fetal Imaging and Other</b>	Fetal	X <sup>h</sup>	X <sup>h</sup>	X <sup>h</sup>		X <sup>h</sup>	X <sup>h</sup>	X <sup>h</sup>
	Abdominal	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>		X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Intra-operative (Specify)							
	Intra-operative (Neuro)							
	Laparoscopic							
	Pediatric	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>		X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Small Organ (Thyroid, Breast, Testes, etc.)							
	Neonatal Cephalic	X	X	X		X	X	X
	Adult Cephalic	X	X	X		X	X	X
	Trans-rectal							
	Trans-vaginal							
	Trans-urethral							
	Trans-esoph. (non-Cardiac)							
	Musculo-skel. (Conventional)							
	Musculo-skel. (Superficial)							
	Intra-luminal							
	Other (Specify)							
<b>Cardiac</b>	Cardiac Adult	X	X	X		X	X	X
	Cardiac Pediatric	X	X	X		X	X	X
	Trans-esoph. (Cardiac)							
	Other (Specify)							
<b>Peripheral Vessel</b>	Peripheral vessel							
	Other (Specify)							

<sup>a</sup>Includes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

<sup>b</sup>B+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

<sup>c</sup>Tissue Harmonic Imaging (THI).

<sup>d</sup>Includes ultrasound guidance for placement of needles, catheters.

<sup>e</sup>Abdominal organs and peripheral vessels.

<sup>f</sup>Includes ultrasound guidance for placement of needles, catheters, cryosurgery, and brachytherapy.

<sup>g</sup>Includes ultrasound guidance of transvaginal biopsy.

<sup>h</sup>Includes ultrasound guidance of amniocentesis, infertility monitoring of follicle development.

Includes uses in military field settings in addition to hospital/clinic settings.

## Indications for Use - 5C2A Transducer

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM							
System: Terason Ultrasound System							
Transducer: 5C2A							
Intended Use: Diagnostic ultrasound imaging or fluid flow analysis of the human body as follows:							
Clinical Application		Mode of Operation					
General (Track 1 Only)	Specific (Tracks 1 and 3)	B	M	PWD	Color Dopp <sup>a</sup>	Comb. Modes <sup>b</sup>	Other <sup>c</sup>
Ophthalmic	Ophthalmic						
Fetal Imaging and Other	Fetal	X <sup>h</sup>	X <sup>h</sup>	X <sup>h</sup>	X <sup>h</sup>	X <sup>h</sup>	X <sup>h</sup>
	Abdominal <sup>k</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Intra-operative (Specify)						
	Intra-operative (Neuro)						
	Laparoscopic						
	Pediatric	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Small Organ (Thyroid, Breast, Testes, etc.)						
	Neonatal Cephalic						
	Adult Cephalic						
	Trans-rectal						
	Trans-vaginal						
	Trans-urethral						
	Trans-esoph. (non-Cardiac)						
	Musculo-skel. (Conventional)						
	Musculo-skel. (Superficial)						
	Intra-luminal						
	Other (Specify)						
Cardiac	Cardiac Adult						
	Cardiac Pediatric						
	Trans-esoph. (Cardiac)						
	Other (Specify)						
Peripheral Vessel	Peripheral vessel	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Other (Specify)						

<sup>a</sup>Includes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

<sup>b</sup>B+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

<sup>c</sup>Tissue Harmonic Imaging (THI), Tissue Doppler Imaging (TDI).

<sup>d</sup>Includes ultrasound guidance for placement of needles, catheters.

<sup>e</sup>Abdominal organs and peripheral vessels.

<sup>f</sup>Includes ultrasound guidance for placement of needles, catheters, cryosurgery, and brachytherapy.

<sup>g</sup>Includes ultrasound guidance of transvaginal biopsy.

<sup>h</sup>Includes ultrasound guidance of amniocentesis, infertility monitoring of follicle development.

<sup>k</sup>Abdominal includes GYN/Pelvic.

<sup>l</sup>Other use includes Urology/Prostate.

Includes uses in military field settings in addition to hospital/clinic settings.

## Indications for Use - 7L3 Transducer

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM							
System: Terason Ultrasound System							
Transducer: 7L3							
Intended Use: Diagnostic ultrasound imaging or fluid flow analysis of the human body as follows:							
Clinical Application		Mode of Operation					
General (Track 1 Only)	Specific (Tracks 1 and 3)	B	M	PWD	Color Dopp <sup>a</sup>	Comb. Modes <sup>b</sup>	Other <sup>c</sup>
<b>Ophthalmic</b>	<b>Ophthalmic</b>						
<b>Fetal Imaging and Other</b>	Fetal						
	Abdominal <sup>k</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Intra-operative <sup>e</sup>						
	Intra-operative (Neuro)						
	Laparoscopic						
	Pediatric	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Small Organ (Thyroid, Breast, Testes, etc.)	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Neonatal Cephalic	X	X	X	X	X	X
	Adult Cephalic	X	X	X	X	X	X
	Trans-rectal						
	Trans-vaginal						
	Trans-urethral						
	Trans-esoph. (non-Cardiac)						
	Musculo-skel. (Conventional)	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Musculo-skel. (Superficial)	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Intra-luminal						
	Other (Specify)						
<b>Cardiac</b>	Cardiac Adult						
	Cardiac Pediatric						
	Trans-esoph. (Cardiac)						
	Other (Specify)						
<b>Peripheral Vessel</b>	Peripheral vessel	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>	X <sup>d</sup>
	Other (Specify)						

<sup>a</sup>Includes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

<sup>b</sup>B+M; B+PWD; B+CD; B+DPD; B+PDV

<sup>c</sup>Tissue Harmonic Imaging (THI), Tissue Doppler Imaging (TDI).

<sup>d</sup>Includes ultrasound guidance for placement of needles, catheters.

<sup>e</sup>Abdominal organs and peripheral vessels

<sup>k</sup>Abdominal includes GYN/Pelvic.

<sup>l</sup>Other use includes Urology/Prostate.

## Indications for Use - 8EC4 Transducer

## DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM

System: Terason Ultrasound System

Transducer: 8EC4

Intended Use: Diagnostic ultrasound imaging or fluid flow analysis of the human body as follows:

Clinical Application		Mode of Operation						
General (Track 1 Only)	Specific (Tracks 1 and 3)	B	M	PWD	CWD	Color Dopp <sup>a</sup>	Comb. Modes <sup>b</sup>	Other <sup>c</sup>
<b>Ophthalmic</b>	<b>Ophthalmic</b>							
<b>Fetal Imaging and Other</b>	Fetal	X	X	X		X	X	X
	Abdominal							
	Intra-operative (Specify)							
	Intra-operative (Neuro)							
	Laparoscopic							
	Pediatric							
	Small Organ (Thyroid, Breast, Testes, etc.)							
	Neonatal Cephalic							
	Adult Cephalic							
	Trans-rectal	X <sup>f</sup>	X <sup>f</sup>	X <sup>f</sup>		X <sup>f</sup>	X <sup>f</sup>	X <sup>f</sup>
	Trans-vaginal	X <sup>g</sup>	X <sup>g</sup>	X <sup>g</sup>		X <sup>g</sup>	X <sup>g</sup>	X <sup>g</sup>
	Trans-urethral							
	Trans-esoph. (non-Cardiac)							
	Musculo-skel. (Conventional)							
	Musculo-skel. (Superficial)							
	Intra-luminal							
	Other (Specify)							
<b>Cardiac</b>	Cardiac Adult							
	Cardiac Pediatric							
	Trans-esoph. (Cardiac)							
	Other (Specify)							
<b>Peripheral Vessel</b>	Peripheral vessel							
	Other (Specify)							

<sup>a</sup>Includes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).<sup>b</sup>B+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.<sup>c</sup>Tissue Harmonic Imaging (THI), Tissue Doppler Imaging (TDI).<sup>f</sup>Includes ultrasound guidance for placement of needles, catheters, cryosurgery, and brachytherapy.<sup>g</sup>Includes ultrasound guidance of transvaginal biopsy.<sup>l</sup>Other use includes Urology/Prostate.

Includes uses in military field settings in addition to hospital/clinic settings.



## Indications for Use - 12HL7 Transducer

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM							
System: Terason Ultrasound System							
Transducer: 12HL7							
Intended Use: Diagnostic ultrasound imaging or fluid flow analysis of the human body as follows:							
Clinical Application		Mode of Operation					
General (Track 1 Only)	Specific (Tracks 1 and 3)	B	M	PWD	Color Dopp <sup>a</sup>	Comb. Modes <sup>b</sup>	Other <sup>c</sup>
<b>Ophthalmic</b>	<b>Ophthalmic</b>						
<b>Fetal Imaging and Other</b>	Fetal						
	Abdominal						
	Intra-operative Vascular	X	X	X	X	X	X
	Intra-operative (Neuro)	X	X	X	X	X	X
	Laparoscopic	X	X	X	X	X	X
	Pediatric	X	X	X	X	X	X
	Small Organ (Thyroid, Breast, Testes, etc.)	X	X	X	X	X	X
	Neonatal Cephalic						
	Adult Cephalic						
	Trans-rectal						
	Trans-vaginal						
	Trans-urethral						
	Trans-esoph. (non-Cardiac)						
	Musculo-skel. (Conventional)	X	X	X	X	X	X
	Musculo-skel. (Superficial)	X	X	X	X	X	X
	Intra-luminal						
	Other (Specify)						
<b>Cardiac</b>	Cardiac Adult						
	Cardiac Pediatric						
	Trans-esoph. (Cardiac)						
	Other (Specify)						
<b>Peripheral Vessel</b>	Peripheral vessel	X	X	X	X	X	X
	Other (Specify)						

<sup>a</sup>Includes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

<sup>b</sup>B+M; B+PWD; B+CD; B+DPD; B+PDV

<sup>c</sup>Tissue Harmonic Imaging (THI), Tissue Doppler Imaging (TDI).

<sup>d</sup>Includes ultrasound guidance for placement of needles, catheters.

<sup>e</sup>Abdominal organs and peripheral vessels

<sup>k</sup>Abdominal includes GYN/Pelvic.

<sup>l</sup>Other use includes Urology/Prostate.

## Indications for Use - 12L5 Transducer

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM							
System: Terason Ultrasound System							
Transducer: 12L5							
Intended Use: Diagnostic ultrasound imaging or fluid flow analysis of the human body as follows:							
Clinical Application		Mode of Operation					
General (Track 1 Only)	Specific (Tracks 1 and 3)	B	M	PWD	Color Doppa	Comb. Modes b	Otherc
<b>Ophthalmic</b>	<b>Ophthalmic</b>						
<b>Fetal Imaging and Other</b>	Fetal						
	Abdominalk	Xd	Xd	Xd	Xd	Xd	Xd
	Intra-operativee						
	Intra-operative (Neuro)						
	Laparoscopic						
	Pediatric	Xd	Xd	Xd	Xd	Xd	Xd
	Small Organ (Thyroid, Breast, Testes, etc.)	Xd	Xd	Xd	Xd	Xd	Xd
	Neonatal Cephalic	X	X	X	X	X	X
	Adult Cephalic	X	X	X	X	X	X
	Trans-rectal						
	Trans-vaginal						
	Trans-urethral						
	Trans-esoph. (non-Cardiac)						
	Musculo-skel. (Conventional)	Xd	Xd	Xd	Xd	Xd	Xd
	Musculo-skel. (Superficial)	Xd	Xd	Xd	Xd	Xd	Xd
	Intra-luminal						
	Other (specify)						
<b>Cardiac</b>	Cardiac Adult						
	Cardiac Pediatric						
	Trans-esoph. (Cardiac)						
	Other (specify)						
<b>Peripheral Vessel</b>	Peripheral vessel	Xd	Xd	Xd	Xd	Xd	Xd
	Other (specify)						

<sup>a</sup>Includes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

<sup>b</sup>B+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

<sup>c</sup>Tissue Harmonic Imaging (THI), Tissue Doppler Imaging (TDI).

<sup>d</sup>Includes ultrasound guidance for placement of needles, catheters.

<sup>e</sup>Abdominal organs and peripheral vessels.

<sup>k</sup>Abdominal includes GYN/Pelvic.

<sup>l</sup>Other use includes Urology/Prostate.

## Acoustic Output Indices

The Terason Ultrasound System complies with the *Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment* (UD3-98). When the relevant output index is below 1.0, the index value is not displayed.

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

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

### General Description of Indices

For a detailed explanation of the clinical significance and proper use of the real-time acoustic output indices displayed on the Terason image display, consult relevant literature and educational materials available from industry and professional organizations concerned with medical ultrasound. To help understand how adjustment of the controls may affect the display of indices during an exam, read the following overview.

In general, indexes are described in terms of the following factors.

- **Potential bioeffect of concern:** Mechanical (cavitation or other non-thermal mechanical effects), or thermal (heating of tissue through absorption of the ultrasound energy) -for all indices, an index value less than 1.0 indicates relatively low risk for harm to the patient when the index is applied properly.
- **Type of operating mode:** Generally, mechanical effects are a greater concern during 2D-only operation, while thermal effects are a greater concern during any non-2D operation. Thermal effects of non-scanned modes (M-Mode and Pulsed-Wave Doppler modes) are calculated separately from effects of scanned modes (Color Doppler and Power Doppler modes).
- **Type of and location of tissue of concern:** Bone or soft tissue, located either at the tissue surface nearest the transducer, or at or near the beam focus.
- **Measured acoustic parameters:** Ultrasound power, time average intensity, or instantaneous peak pressure used in calculating the index value. All calculations assume an attenuation (or “derating”) rate of 0.3 dB/cm/MHz.

### MI: The Mechanical Index

MI is of possible clinical interest if the beam focus is close to the surface of lung tissue. This parameter does not exceed 1.0 with the Terason Ultrasound System, and no real-time MI value displays with any transducer. MI has the following characteristics.

- **Potential bioeffect:** Any possible mechanical or non-thermal mechanisms - although the likelihood of adverse consequences from these causes is not well understood, such risk may be highest in the presence of gas-saturated structures such as lung tissue.
- **Mode type:** Calculated for 2D only operation.
- **Tissue type and location:** Soft tissue at all locations in the scan field.

- **Acoustic parameter:** Maximum negative (rarefactional) ultrasound pressure at focus.

## TIS: The Soft Tissue Thermal Index

TIS is of interest in the absence of bone, either at the tissue surface or near the beam focus. Applications of clinical interest include general abdominal examinations, first-trimester scanning before fetal bone has ossified, and cardiology. TIS has the following characteristics.

- **Potential bioeffect:** Thermal heating of soft tissue due to absorption of ultrasound. The TIS value is the ratio of the current transducer power to the reference level that would cause a 1°C temperature rise in soft tissue.
- **Mode type:** Relevant for all non-2D only modes, in both scanned and non-scanned modes.
- **Tissue type and location:** In scanned modes, soft tissue at the surface is of concern. In non-scanned modes, heating of soft tissue along the beam axis between the surface and focus is considered.
- **Acoustic parameters:** For scanned modes, the associated intensity at the surface is usually related to surface tissue heating. For unscanned modes, the maximum derated power through a 1-cm<sup>2</sup> area anywhere along the beam axis is the basis for estimating tissue heating: unscanned beams less than 1cm<sup>2</sup> in area at the surface are assumed to contribute only to surface heating, and the calculated effects are combined with those of scanned modes to estimate total soft-tissue heating at the surface. Unscanned beams larger than 1 cm<sup>2</sup> at the surface are assumed to heat tissue only near the focus. Total heating effects at the surface and focus are compiled separately, and the larger value is reported as TIS.

## TIB: The Bone Tissue Thermal Index

TIB is of concern when bone is near the beam focus. Applications of clinical interest include second- and third-trimester Doppler (when the beam focus is near fetal bone), and Neonatal Cephalic Doppler (when the beam focus is near cranial bone). TIB has the following characteristics.

- **Potential bioeffect:** Thermal heating of bone (and indirect heating of adjacent soft tissue) due to absorption of ultrasound at the bone surface. The TIB value indicates the ratio of the current power level from the transducer to the reference power level that would cause a 1°C steady-state temperature rise in bone located at the beam focus.
- **Mode type:** Calculated for all non-2D only operation, in both scanned and non-scanned modes.
- **Tissue type and location:** In scanned modes, the model for soft tissue at the surface is also used to calculate the maximum possible heating of bone at the beam focus. For non-scanned modes, possible heating of bone near the beam focus is considered directly.
- **Acoustic parameters:** For scanned modes, the time-average intensity at the transducer surface is closely related to estimated heating effects. For unscanned modes, the maximum product along the beam axis of both derated power and intensity is the basis for calculating possible bone heating. Total heating effects for scanned and unscanned modes are compiled separately, and the larger value is reported as TIB.

## TIC: The Cranial (Bone) Thermal Index

TIC is of concern when bone is near the tissue surface and in close proximity to the transducer aperture. Clinical applications of interest are specific to those involving transcranial scanning. This parameter does not exceed 1.0 under any conditions with the Terason Ultrasound System, and therefore is not displayed. General information about the Cranial Thermal Index follows.

- **Potential bioeffect:** Thermal heating of cranial bone (with indirect heating of adjacent brain tissue) due to absorption of ultrasound by the cranial bone. TIC is defined as the ratio of the current transducer power level to the reference power level that would cause a 1°C steady-state temperature rise in cranial bone located at the transducer surface.
- **Mode type:** Calculated for all non-2D only operation, in both scanned and non-scanned modes.
- **Tissue type and location:** Cranial bone, located near the tissue surface and near the transducer aperture.
- **Acoustic parameter:** For each active mode, the product of estimated power and intensity at the transducer surface is the basis for calculating cranial bone heating. Heating effects of all modes are combined to calculate the TIC.

## Relevant Acoustic Output Indices

When operating in any mode with the Freeze function disabled, the window displays the indices relevant to the active transducer and operating mode. The definition of relevant indices is as follows:

Acoustic Output Indices for Modes and Transducers

Mode Type Currently Active	Allowed Transducer Applications	Relevant Indices
2D only	Any	MI
Any mode, other than 2D-only	Include <i>neither</i> Adult Cephalic <i>nor</i> Neonatal Cephalic	TIS, TIB
Any mode, other than 2D-only	Include <i>either</i> Adult Cephalic <i>or</i> Neonatal Cephalic	TIS, TIB, TIC

## Display Formats of Acoustic Output Index

This section describes the display of the acoustic output in various modes.

### Display Format in 2D

In 2D only, with the Freeze control off, a label for MI (the Mechanical Index) displays. For all transducers provided with the Terason Ultrasound System, the maximum MI value is less than 1.0. When the maximum value of a relevant acoustic for a particular transducer is less than 1.0, the 2D image display always shows the label for the Mechanical Index in standard video, with no current MI value displayed.

MI:

Since 2D operation under such conditions is considered without significant risk from non-linear acoustic effects, the Terason Ultrasound System can be used in 2D with all available transducers, for all intended applications, without concern for monitoring and minimizing a displayed MI value. However, in keeping with ALARA, the depth control should generally be operated in the deepest setting that yields the desired image quality (to minimize the time-average ultrasound energy).

### Display Format for Modes Other Than 2D

When any mode other than 2D is active, the display of MI is replaced by a format showing the thermal indices relevant to the transducer in use. For transducers not intended for transcranial use, the relevant indices are TIS (soft tissue) and TIB (bone). When no value is to be displayed, TIS and TIB are shown without any value. In those cases, the most common Thermal Index display is as follows:

TIB:

TIS:

When this format displays, control settings for the active transducer do not allow either TIS or TIB to exceed 1.0. For these transducers, operation in the intended clinical applications is considered without significant tissue-heating risk from ultrasound energy. No real-time TI values need be monitored, and the transducer may be used without concern for minimizing any displayed TI value.

Some other transducers with the Terason Ultrasound System display the following thermal index format:

TIB: 0.8

TIS:

Since the label for TIS is still shown in standard video format and no value is displayed, no real-time TIS values need be monitored. The display of the TIB label, however, indicates that the controls for the transducer in use may sometimes be set so that the Bone Thermal Index exceeds 1.0. (In the example shown, the current real-time TIB value is approximately 0.8).

For another group of transducers in the Terason Ultrasound System, the Thermal Index display shows a format of the following type:

TIB: 0.8

TIS: 0.6

The display of both Thermal Index labels indicates that the controls for the transducer in use may sometimes be set so that either the TIS, or the TIB, or both may exceed 1.0.

### Display Format of Acoustic Output Index

Of the transducers used with the Terason Ultrasound System, only certain transducers are intended for clinical applications that may include transcranial examinations (Neo-natal Cephalic uses). For these transducers, the maximum TIC value is less than 1.0. If the maximum values of TIS and TIB for a given transducer/mode combination exceed 1.0, the Thermal Index display shows a format of the following type:

TIS: 0.6

TIB: 0.8

TIC:

### Control of Acoustic Index Parameters

For any transducer used with the Terason Ultrasound System in which all relevant acoustic indices are displayed in standard video (without an associated real-time value), operation in the intended clinical applications of the active transducer is considered normally without significant risk due to mechanical effects or heating of tissues by ultrasound energy. No real-time MI or TI values need be monitored, and the transducer may be used without concern for minimizing the displayed value of any index.

For any transducer in which one or more relevant indices are displayed, some control settings may produce an index value greater than 1.0. For those indices, real-time values are displayed, to allow monitoring and control. The displayed indexes may take on the following values (shown along with the corresponding labels, where  $x$  indicates the actual calculated index value):

#### Acoustic Index Parameters

Display of TI Values		Display of MI Values	
Range of calculated value $x_{\text{Calc.}}$	Displayed value $x_{\text{Display}}$	Range of calculated value $x_{\text{Calc.}}$	Displayed value $x_{\text{Display}}$
$x < 0.4$	$< 0.4$	$x < 0.4$	$< 0.4$
$0.4 \leq x < 0.5$	0.4	$0.4 \leq x < 0.5$	0.4
$0.5 \leq x < 0.7$	0.6	$0.5 \leq x < 0.7$	0.6
$0.7 \leq x < 0.9$	0.8	$0.7 \leq x < 0.9$	0.8
$0.9 \leq x < 1.1$	1.0	$0.9 \leq x < 1.1$	1.0
$1.1 \leq x < 1.3$	1.2	$1.1 \leq x < 1.3$	1.2
$1.3 \leq x < 1.5$	1.4	$1.3 \leq x < 1.5$	1.4
$1.5 \leq x < 1.7$	1.6	$1.5 \leq x < 1.7$	1.6
$1.7 \leq x < 1.9$	1.8	$1.7 \leq x < 1.9$	1.8
$1.9 \leq x < 2.25$	2.0	$x = 1.9$	1.9
$2.25 \leq x < 2.75$	2.5		
$2.75 \leq x < 3.25$	3.0		
Etc.	Etc.		

In all operating modes with the Terason Ultrasound System, control of acoustic exposure is available indirectly. For a description of the indirect effects that certain control adjustments may have on displayed index values, consult Chapter 5 - [Working with Scan Modes](#) for information on the particular operating modes.

## Accuracy of Acoustic Output Display

The acoustic output display indices are calculated on the basis of measured values of acoustic parameters (acoustic power, intensity, pressure, etc.). The accuracy of the indices (discussed in the *Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment*) described below refers to accuracy of the measurement of the acoustic parameters and the effect of these errors on the estimated index values. (For a discussion of statistical considerations in acoustic measurement, refer to “Measurement Uncertainty in Ultrasonic Exposimetry”, in *Ultrasonic Exposimetry*, M. C. Ziskin and P. A. Lewin, eds., CRC Press).

The remainder of this section lists the relative errors for the following items:

- Intensity measurements
- Spatial-peak derated pulse-intensity integral, defined as  $e_{\text{SPPA.3}}$
- Spatial-peak derated temporal average intensity for unscanned modes
- Spatial-peak derated temporal average intensity for scanned modes
- Peak derated rarefactional pressure
- Mechanical Index
- Soft-Tissue Thermal Index for scanned modes, total acoustic power at the scan/beam entrance to the body
- Soft-Tissue Thermal Index for unscanned modes, when the beam-entrance dimension is less than 1 cm<sup>2</sup> in area
- Soft-Tissue Thermal Index for unscanned modes, when the beam-entrance dimension is greater than 1 cm<sup>2</sup> in area
- Bone Thermal Index for unscanned modes
- Cranial Thermal Index

The **relative error in intensity measurements due to uncertainty in the hydrophone calibration**, defined as  $e_k$ , is approximately:

$$\varepsilon_k = (\varepsilon_{\text{Cal}}^2 + \varepsilon_A^2 + \varepsilon_{V^2}^2)^{\frac{1}{2}} = 10.2\%$$

where the following are defined:

- $e_{\text{Cal}}$  Calibration error, as supplied by the National Physical Laboratory; 8% at the frequency range of the transducers tested.
- $e_A$  Relative error in the reproducibility of positioning the hydrophone at the point of the spatial peak of the pulse intensity integral, estimated as 5%
- $e_{V^2}$  Relative error resulting from errors in reading peak squared voltage in the recorded waveform, estimated as 4%

The **relative error in the spatial-peak derated pulse-intensity integral, defined as  $e_{\text{SPPA.3}}$** , is approximately:

$$\varepsilon_{\text{SPPA.3}} = (\varepsilon_k^2 + \varepsilon_{\text{TI}}^2 + \varepsilon_{\text{stab}}^2 + \varepsilon_{.3}^2 + \varepsilon_{\text{lin}}^2 + \varepsilon_v^2 + \varepsilon_{\text{PD}}^2)^{1/2} = 12$$

where the following is defined:



$\epsilon_{TI}$	Relative error due to hydrophone positioning and temporal integration of the waveform, estimated as 4%
$\epsilon_{stab}$	Relative error due to temporal instability of the hydrophone, estimated as 1%
$\epsilon_{.3}$	Relative error in estimating derating factor, due to uncertainties in estimating frequency and reproducibility in determining derating location, estimated as 4%
$\epsilon_{lin}$	Relative error due to the effects of non-linearities in the pressure waveform upon the hydrophone and integral amplifier, estimated as 0% for this transducer set
$\epsilon_{PD}$	Relative error in estimate of pulse duration, estimated as 5%

The **relative error in the spatial-peak derated temporal average intensity for unscanned modes**, defined as  $\epsilon_{SPTA.3-unsc.}$ , is approximately:

$$\epsilon_{SPTA.3-unsc.} = (\epsilon_{SPPII.3}^2 + \epsilon_{prf}^2)^{1/2} = 11.3\%$$

where the following is defined:

$\epsilon_{prf}$	Relative error in prf estimation for operating condition giving actual peak $I_{SPTA.3-unsc.}$ , estimated as 1%
------------------	--

The **relative error in estimating spatial-peak derated temporal average intensity for scanned modes**, defined as  $\epsilon_{SPTA.3-scan.}$ , is approximately:

$$\epsilon_{SPTA.3-scan.} = (\epsilon_{SPII.3}^2 + \epsilon_{srf}^2 + \epsilon_{BOF}^2)^{1/2} = 12.8\%$$

where the following are defined:

$\epsilon_{srf}$	Relative error in estimating srf (scan repetition frequency) for operating condition giving actual peak $I_{SPTA.3-scan.}$ , estimated as 1%
$\epsilon_{BOF}$	Relative error in estimating BOF (beam-overlap factor) for operating conditions giving actual peak $I_{SPTA.3-scan.}$ , estimated as 5%

The **relative error in the peak derated rarefactional pressure**, defined as  $\epsilon_{pr.3}$ , is approximately:

$$\epsilon_{pr.3} = \left(\frac{1}{2}\right) \epsilon_{SPPII.3} = 5.9\%$$



**Note:** In accordance with Subsection 6.4.3 (Measurement of Precision of Peak Rarefactional Pressure,  $p_r$ ) of the *Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment*, a series of ten independent measurements on the specified standard test transducer/driver combination yielded a relative standard deviation of  $W$  of less than 1% for the sample measurements.

The **relative error in the Mechanical Index**, defined as  $\epsilon_{MI}$ , is approximately:

$$\epsilon_{MI} = \left( \epsilon_{pr.3}^2 + \left( \frac{\epsilon_{fc}}{2} \right)^2 \right)^{1/2} = 6.4\%$$

where the following is defined:

$\epsilon_{fc}$       Relative error in estimating center frequency, estimated as 5%.



**Note:** In accordance with Subsection 6.4.1 (Measurement of Precision of Center Frequency  $f_c$ ) of the *Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment*, a series of ten independent measurements on the specified standard test transducer/driver combination yielded a relative standard deviation of  $f_c$  of less than 1% for the sample measurements.

The **relative error in the Soft-Tissue Thermal Index for scanned modes**, defined as  $\epsilon_{TISscan}$ , is approximately:

$$\epsilon_{TISscan} = (\epsilon_{W01}^2 + \epsilon_{fc}^2)^{1/2} = 11.2\%$$

where the following is defined:

$\epsilon_{W01}$       Relative error in estimating the peak acoustic power from a 1 cm width of the active scanned aperture, estimated as 10%



**Note:** In accordance with Subsection 6.4.2 (Measurement of Precision of Power,  $W$ ) of the *Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment*, a series of ten independent measurements on the specified standard test transducer/driver combination yielded a relative standard deviation of  $W$  of less than 1% for the sample measurements.

The **relative error in total acoustic power at the scan/beam entrance to the body**, defined as  $\epsilon_{W0}$ , is approximately:

$$\epsilon_{W0} = \epsilon_{FB} = 10\%$$



**Note:** In accordance with Subsection 6.4.2 (Measurement of Precision of Power, W) of the *Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment*, a series of ten independent measurements on the specified standard test transducer/driver combination yielded a relative standard deviation of W of less than 1% for the sample measurements.

The **relative error in the Soft-Tissue Thermal Index for unscanned modes, when the beam-entrance dimension is less than 1 cm<sup>2</sup> in area**, defined as  $\epsilon_{TISunc-A < 1}$ , is approximately:

$$\epsilon_{TISunc-A \leq 1} = (\epsilon_{W0}^2 + \epsilon_{fc}^2)^{1/2} = 11.2\%$$

The **relative error in the Soft-Tissue Thermal Index for unscanned modes, when the beam-entrance dimension is greater than 1 cm<sup>2</sup> in area**, defined as  $\epsilon_{TISunc-A > 1}$ , is approximately:

$$\epsilon_{TISunc-A > 1} = (\epsilon_{W0}^2 + \epsilon_{fc}^2 + \epsilon_{ITA.6}^2)^{1/2} = 16.2\%$$

where the following is defined:

$\epsilon_{ITA.6}$  Relative error in estimating the spatial peak intensity, when derated at 0.6 dB/cm/MHz, estimated to be:

$$\epsilon_{ITA.6} = \epsilon_{SPTA.3-unc.} = 11.8\%$$

The **relative error in the Bone Thermal Index for unscanned modes**, defined as  $\epsilon_{TIBunc.}$ , is approximately:

$$\epsilon_{TIBunc.} = (1/2)(\epsilon_{W0}^2 + \epsilon_{ITA.6}^2)^{1/2} = 7.7\%$$

The **relative error in estimating the Cranial Thermal Index**, defined as  $\epsilon_{TIC}$ , is approximately:

$$\epsilon_{TIC} = (\epsilon_{W0}^2 + \epsilon_{Deq}^2)^{1/2} = 10.2\%$$

where the following is defined:

$\epsilon_{Deq}$  Relative error in estimating the equivalent diameter of the active aperture, estimated as 2%

The **estimated relative errors of the calculated indices** are as follows.

$$e_{MI} = 6.4\%$$

$$e_{TISscan} = 11.2\%$$

$$e_{TISunsc-A<1} = 11.2\%$$

$$e_{TISunsc-A>1} = 16.2\%$$

$$e_{TIBunsc} = 7.7\%$$

$$e_{TIC} = 10.2\%$$

## Relationship of Index to Display Accuracy

The above discussion concerns the relationship between the calculated index value ( $x_{Calc.}$ ), and the “true” value ( $x_{Actual}$ ), which would be obtained under conditions without measurement uncertainty. The issue of display precision deals with the relationship between the displayed index value ( $x_{Display}$ ) and ( $x_{Calc.}$ ). The displayed values (shown in reverse video along with the corresponding labels) may take on the following values (where x indicates the actual calculated index value ( $x_{Calc.}$ ))

### Display Precision of TI Values

The following table indicates the precision of the display for TI values.

**TI Value Precision**

Range of calculated value $x_{Calc.}$	Displayed value $x_{Display}$
$x < 0.4$	<0.4
$0.4 \leq x < 0.5$	0.4
$0.5 \leq x < 0.7$	0.6
$0.7 \leq x < 0.9$	0.8
$0.9 \leq x < 1.1$	1.0
$1.1 \leq x < 1.3$	1.2
$1.3 \leq x < 1.5$	1.4
$1.5 \leq x < 1.7$	1.6
$1.7 \leq x < 1.9$	1.8
$1.9 \leq x < 2.25$	2.0
$2.25 \leq x < 2.75$	2.5
$2.75 \leq x < 3.25$	3.0
Etc.	Etc.

## Display Precision of MI Values

The following table indicates the precision of the display for MI values.

**MI Value Display Precision**

Range of calculated value $x_{Calc.}$	Displayed value $x_{Display}$
$x < 0.4$	$< 0.4$
$0.4 \leq x < 0.5$	0.4
$0.5 \leq x < 0.7$	0.6
$0.7 \leq x < 0.9$	0.8
$0.9 \leq x < 1.1$	1.0
$1.1 \leq x < 1.3$	1.2
$1.3 \leq x < 1.5$	1.4
$1.5 \leq x < 1.7$	1.6
$1.7 \leq x < 1.9$	1.8
$x = 1.9$	1.9

When the effects of calculation errors are combined with the effects of display precision, an overall Display Accuracy can be defined as follows:

$$\text{DisplayAccuracy} = \frac{x_{Display} \angle x_{Actual}}{x_{Actual}}$$

The following table lists the values of Display Accuracy that are estimated to occur with the Terason Ultrasound System. These values of Display Accuracy are given in conjunction with the values of relevant indices that may be displayed with transducers available with the system.

In the following table, only items in unshaded **boldface** type correspond to index values actually displayed with the Terason Ultrasound System. For those indices for which no values are displayed in unshaded boldface type, all calculated values of the index are less than 1.0 when the given index is considered relevant to the operating mode and possible intended use of the transducer.

**Estimated Display Accuracy Values**

Display Value	MI	TIS <sub>scan</sub>	TIS <sub>unsc-A&lt;1</sub>	TIS <sub>unscA&gt;1</sub>	TIB <sub>unsc</sub>	TIC
<0.4	(a) (b)	(a) (b)	(a) (b)	(a) (b)	(a) (b)	(a) (b)
0.4	0% -18%	0% -18%	0% -18%	0% -18%	0% -18%	0% -18%
0.6	20% -13%	20% -13%	20% -13%	20% -13%	20% -13%	20% -13%
0.8	14% -10%	14% -10%	14% -10%	14% -10%	14% -10%	14% -10%
1.0	11% -8%	11% -19%	11% -19%	11% -19%	11% -19%	11% -19%
1.2	9% -7%					
1.4	8% -6%					
1.5		20% -14%	20% -14%	20% -14%	20% -14%	20% -14%

Estimated Display Accuracy Values (Continued)

Display Value	MI	TIS <sub>scan</sub>	TIS <sub>unsc-A&lt;1</sub>	TIS <sub>unscA&gt;1</sub>	TIB <sub>unsc</sub>	TIC
1.6	7% -5%					
1.8	6% -10%					
2.0	(c)	14% -11%	14% -11%	14% -11%	14% -11%	14% -11%
2.5						
3.0		33% -14%	33% -14%	33% -14%	33% -14%	33% -14%
3.5						
4.0		14% -11%	14% -11%	14% -11%	14% -11%	14% -11%

- a. Display Accuracy is not defined for actual index values ( $x_{\text{Actual}}$ ) of zero.  
b.  $x_{\text{Display}} - x_{\text{Actual}}$  is always greater than zero.  
c. Mechanical Index (MI) values greater than 1.9 exceed FDA Guideline levels.

## Acoustic Output Tables

The table [Track 3 Transducer/Mode Combination Summary](#) on page 270 lists those Terason Ultrasound System transducer and mode combinations for which a relevant index parameter can exceed 1.0 (they are indicated by X in that table). For an accompanying acoustic-output page for each transducer, refer to Appendix F, [Acoustic Output Reporting for Track 3](#).

The default settings for the PWD (and B+PWD) mode using the 4V2 and 5C2A Transducers are set to limit the Bone Thermal Index (TIB) to 40% of the peak value (i.e., a global index value of 0.92). Any parameter (PRF or SV) which increases the TIB should be chosen consistent with ALARA exposure.

Track 3 Transducer/Mode Combination Summary

Transducer Model	Mode						
	2D	M	PWD	CWD	Color Doppler <sup>a</sup>	Combined <sup>b</sup>	Other
4V2	X	X	X	X	X	X	
5C2A			X		X	X	
7L3V			X		X	X	
8EC4 (t3000 only)			X		X	X	
12L5V	X (Echo only)		X		X	X	

- a. Includes Directional Power Doppler (DPD), Non-Directional Power Doppler (PD), and Color Doppler (CD).  
b. B+PWD: refer to acoustic output tables for PWD in Appendix F, [Acoustic Output Reporting for Track 3](#).

## Accuracy Measures

The following general assumptions can be made about the accuracy of any ultrasound system:

- Velocity of sound uncertainty = 5%
- Tissue shape is modeled as an ellipse or an ellipsoid
- Caliper placement accuracy is one pixel (operator dependent)
- Measurement accuracy is based on the root-mean-square combination of all independent sources of error
- RMS errors are due to velocity of sound uncertainty, pixel error, and typical transducer geometry

### Distance Accuracy

Distance accuracy measures are as follows:

**Formula:**

$$D = \sqrt{(x_1 + x_2)^2 + (y_1 + y_2)^2}$$

where (x<sub>1</sub>,y<sub>1</sub>) and (x<sub>2</sub>,y<sub>2</sub>) are the coordinates of the end points.

**Range:** 0-20 cm

**Accuracy:** For a 20 cm measurement, a 1 pixel error is 0.2 mm.

**RMS errors:**

- For D = 10mm, accuracy = 9%
- For D = 20mm, accuracy = 6%
- For D > 50mm, accuracy = 5%

### Area

Area accuracy measures are as follows:

**Assumptions:** Circular cross section, length of axes: 2a, 2b

**Formula:** K=πab

**Range:** 0-300 cm<sup>2</sup>

**Accuracy:** Determined by two independent distance measurements. The derivation of a particular tissue shape from the circular model cannot be quantified.

**RMS errors:** For A=3.1 cm<sup>2</sup>, accuracy=4%

### Circumference

Circumference accuracy measures are as follows:

**Assumptions:** Elliptical cross section, length of axes: 2a, 2b

**Formula:**  $C = 2\pi \sqrt{\frac{a^2 + b^2}{2}}$

**Range:** 0-60 cm

**Accuracy:** Determined by two independent distance measurements

**RMS errors:** For C=6.3 cm, accuracy=6%

## Volume

Volume accuracy measures are as follows:

**Assumptions:** Cylinder, length of axes: 2a, 2b, 2c (height)

**Formula:**  $V = 4/3(\pi abc)$

**Range:** 0-3000 ml

**Accuracy:** Determined by three independent distance measurements. The deviation of a particular shape from the ellipsoid cannot be quantified.

**RMS errors:** For V=16 ml, accuracy=8%

Reference information for the above accuracy measures was obtained from the following source:

*Standard Mathematical Tables*, 24th Edition, (Cleveland: CRC Press, 1976), 12, 17.

## Between-Use Processing of Terason Transducers

Each transducer must be processed between uses according to the type of tissue it will contact during use:

- Non-critical applications in which the device contacts only intact skin –clean and low-level disinfect the transducer.
- Semi-critical use, such as endocavity applications (where the device may contact mucous membranes) – clean and high-level disinfect the transducer. Use of a sheath is recommended. The sheath can be surgically clean for transvaginal or transrectal uses, but must be sterile for endoscopic use.
- Critical use, in which the device contacts blood, compromised tissue, or is used in a sterile field – clean and at least high-level disinfect the transducer. Use of a sheath is required.



**Warning:** In addition to the instructions in this guide, follow the instructions provided by the manufacturer of cleaners and disinfectants.

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**Warning:** Never place the electronics casing on the floor when cleaning the transducer. The cable connection to the electronics must always be higher than the lowest point of the cable, to prevent fluid from flowing down the cable to the electronics.

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For information on cleaning the laptop computer, refer to the laptop's user guide.

## General Cleaning

After use that involves only contact with intact skin, cleaning and low-level disinfection are generally sufficient. If high-level disinfection is required (as in semi-critical or critical uses), the transducer must be first be cleaned and then processed using one of the high-level disinfectants listed in [High-Level Disinfectants](#) on page 274.

Between patient exams, perform the following steps to clean the transducer:

1. Wipe all ultrasound transmission **gel** off the transducer.
2. Wipe the **transducers and cable** with a dry, water-moistened or precleaner-moistened soft cloth.
3. To clean the transducer, wipe it with a cloth moistened with a (typically) **low-level disinfectant** from the list on page 274.
4. To prevent the solution from air-drying on the transducer and cable, immediately wipe them with a soft cloth moistened with **sterile water**.



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**Warning:** The following cleaning techniques, may damage the transducers: Do not sterilize a transducer with autoclave, ultraviolet, gamma radiation, gas, or dry-heat sterilization techniques. Transducers can be submerged up to, but not including, the strain relief of the transducer array. Do not immerse or soak any other part of a transducer in any cleaning material.

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**Warning:** The cable and connector are not waterproof. Do not immerse the cable or allow liquid to contact the connector.

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**Warning:** The Terason Ultrasound System (electronics), the laptop, AC/DC adapter, and the isolation transformer are not protected from spills or splashes. Protect them with a drape as needed when cleaning the transducers.

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## Precleaners and Low-Level Disinfectants

The following precleaners and disinfectants have been tested and found compatible with transducers used with the Terason Ultrasound System:

- Enzol
- Klenzyme
- Alkazyme

## High-Level Disinfectants

The following high-level disinfectants have been tested, found compatible with transducers used with the Terason Ultrasound System, and are cleared for use by the United States Food and Drug Administration (FDA):

- Cidex 2%
- Cidex OPA
- Cidex Plus

For more information on infection control, refer to the following articles:

- *Design Testing and Labeling of Reusable Medical Devices for Reprocessing in Healthcare Facilities: A Guide for Manufacturers*, AAMI Publishing Company, 1995
- *Disinfections and Preservation*, Block, Seymour S., Lea and Febiger, 1991
- *Sterilants and High Level Disinfectants Cleared by FDA in a 510(k)*, <http://www.fda.gov/cdrh/ode/germlab.html>

## Pre-Cleaning

Immerse the transducer in an enzymatic antiseptic detergent solution, using one of the precleaners previously listed.

Soak the transducer in the enzymatic detergent for at least 30 minutes to remove all visible soil and dried protein.



**Warning:** Transducers can be submerged to, but not including, the strain relief of the transducer array. Do not immerse or soak any part of a transducer in any cleaning material not listed in the recommended list of disinfectants. The following figure defines how much of the transducer can be submerged.



**Do Not Submerge Transducers Above Line**

## Compliance and Approvals

The Terason Ultrasound System is in compliance with the following:

- CE Marking: Medical Device Directive, 93/42/EEC (Annex II)
- EN 60601-1 Medical Electrical Equipment – General Requirements for Safety
- IEC 60601-1 Medical Electrical Equipment – General Requirements for Safety
- IEC 60601-1-1 Collateral Standard: Safety Requirements for Medical Electrical Systems
- UL Std. 60601-1, “Medical Electrical Equipment General Requirements for Safety”; CAN/CSA C22.2 No. 601.1-M90 “Medical Electrical Equipment, General Requirements for Safety.”
- Electromagnetic Compatibility: EN60601-1-2, (CISPR11) Group 1, Class B
- Electric Shock: IEC 60601-1, Class I, Type BF

## 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.

## Recommended Maintenance

Terason transducers require very little maintenance. Transducers should be inspected monthly. If the transducer is dropped, immediately examine it for signs of damage. Check for these potential problems:

- Cracks or damage to the handle, nose piece, or connector
- Cuts or gouges on lens material
- Swelling of lens material
- Cuts or cracks in the cable

Do not expose transducers to direct heat such as strong sunlight or a local heat source, as heat can cause crystal aging and loss of sensitivity.

When storing the Terason Ultrasound System in environments between 0° and 50°C, the original shipping container must be used.

All components of the Terason Ultrasound System should be checked monthly for these potential problems:

- Cuts, cracks or damage to the power cables
- Dents or cracks in the electronics housing

Refer to the laptop manual for information on laptop maintenance. Refer to the isolation transformer manual for information on transformer maintenance.



**Caution:** Do not use any equipment that is cut, cracked, dented, or displays any other damage. Use of damaged equipment can create shock hazards for the operator and patient. Contact Terason Customer Support for help.

## Equipment List

The Terason Ultrasound System may be shipped with the following hardware:

- Laptop computer with operating system and ultrasound imaging software. Refer to the user guide that came with your computer for details about your particular computer system.
- Computer user guide
- Online *Terason Ultrasound System User Guide* (this document)
- CD-ROMs containing the operating system and Terason ultrasound imaging software
- Terason Ultrasound System engine that connects the transducer to the computer
- Medical grade isolation transformer or Medical grade AC/DC power adapter
- Two (2) power cords (wall-to-transformer and transformer-to-adapter)
- Computer AC/DC adapter
- 6-pin to 6-pin FireWire Adapter
- ECG
- ECG lead set - 10 sets of electrodes
- Docking Base
- Cart
- Monitor
- Printer
- DVD recorder
- One or more Transducers:
  - 5C2A Convex-Linear Transducer
  - 7L3 Linear Array Transducer
  - 12L5 Linear Array Transducer



**Warning:** Using accessories, transducers, 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 Specifications

The following table lists the system specifications for the Terason Ultrasound System. Gray blocks signify that the category does not apply to that component.

**Terason System Specifications**

Category	Specification	Ultrasound Engine	Samsung X25	Isolation Transformer	Jerome Power Supply
Frequency	5C2A, 4V2	2-4 Mhz			
	8B4S, 8EC4, 8MC4	4-8 Mhz			
	12L5, 10V5	5-10 Mhz			
Frame Rate	2D Imaging (based on input data rate)	124 Hz Maximum			
Ultrasound Lines/Frame		256			
External Video Output			NTSC/PAL VGA Monitor		
Liquid-Crystal Display			15.0 XGA		
Size	Width	5.7' (14.5 cm)	13" (33 cm)	5.85" (14.9 cm)	3.75" (9.5 cm)
	Height	1.1" (2.8 cm)	1.23" (3.1 cm)	3.67" (9.3 cm)	2.17" (5.5 cm)
	Depth	7.0" (17.8 cm)	10.8" (27.4 cm)	7.65" (19.4)	6.5" (16.5 cm)
Weight	Weight	2 lbs. (0.9 kg)	5.3 lbs. (2.4 kg)	9 lbs. (4.1 kg)	1 lbs. (.45 kg)
Power Adapter	Input			115V~/230V~	100V~/250V~
	Output			115V~ @ 2.5A 230V~ @ 1.25A	115V~ @ 2.5A 230V~ @ 1.25A
Laptop Battery	Input		Lithium-Ion Battery Pack (53.28Whr)		
	Leakage Current			Less than 100mA See Product Specification	
	Primary Breakdown Voltage				
Safety Standards			IEC 60601-1 IEC 60601-1-1 IEC 60601-1-2 IEC 60601-2-37 CAN/CSA C22.2 No. 601.1-M90, EN 60601-1-2 EN 60601-1	UL 2601, CSA C22.2 No. 601.1, EN 60601-1, EN 60742, EN 60601-1, IEC 601-1	UL60601-1 UL60950-1, C22.2 No. 601-1, C22.2 No. 60950.1 EN 60601-1 EN 60950-1

## Terason System Specifications (Continued)

Category	Specification	Ultrasound Engine	Samsung X25	Isolation Transformer	Jerome Power Supply
Mechanical Shock			IEC 68-2-27 Compliant		
Mechanical Vibration			Sinusoidal: IEC 68-2-6		
Drop Test	(to concrete)	3 Feet	3 Feet		
Operating Temperature		5-35°C (41-95°F)	10-32°C (50-90°F)		0-40°C (32-104°F)
Humidity		20-80% RH, non-condensing	20-80% RH, non-condensing	20-80% RH, on-condensing	10-95% RH, on-condensing
Water Resistance		Transducer array watertight to the strain relief			
Operating Altitude	Pressure	63 kPa to 101.3 kPa (472.5 to 759.8 mmHg)			
Storage	Temperature	-25 to 60°C (-13 to 140°F)	-5 to 40°C (23 to 104°F)	-10 to 65°C (14 to 149°F)	-40 to 75°C (-40 to 167°F)
	Humidity	15-98% RH, non-condensing	5-90% RH, non-condensing	20-80% RH, non-condensing	< 95% RH, non-condensing

## Optional

The following table lists the system specifications for optional equipment that may be shipped with the Terason Ultrasound System:

## Optional Equipment Specifications

Category	Specification	Samsung X25 Docking Base	ECG	ECG Lead Set
Size	Width	13.75' (33.9 cm)	1.5 (3.8 cm)	
	Height	2.5" (3.6 cm)	1' (2.6 cm)	
	Depth	11.0" (27.9 cm)	6' (15 cm)	
	Cable Length		10' (3 Meters)	29' (74 cm)
Weight	Weight	8 lbs. (3.63 kg)	8 oz	
Power	Input	19V	650 mW	

## **Appendix A Working with Microsoft Windows**

If you are new to the Windows 2000 or Windows XP operating systems, here is a brief introduction to the operating system and how to use its features.

To use the Windows operating systems, you must be familiar with:

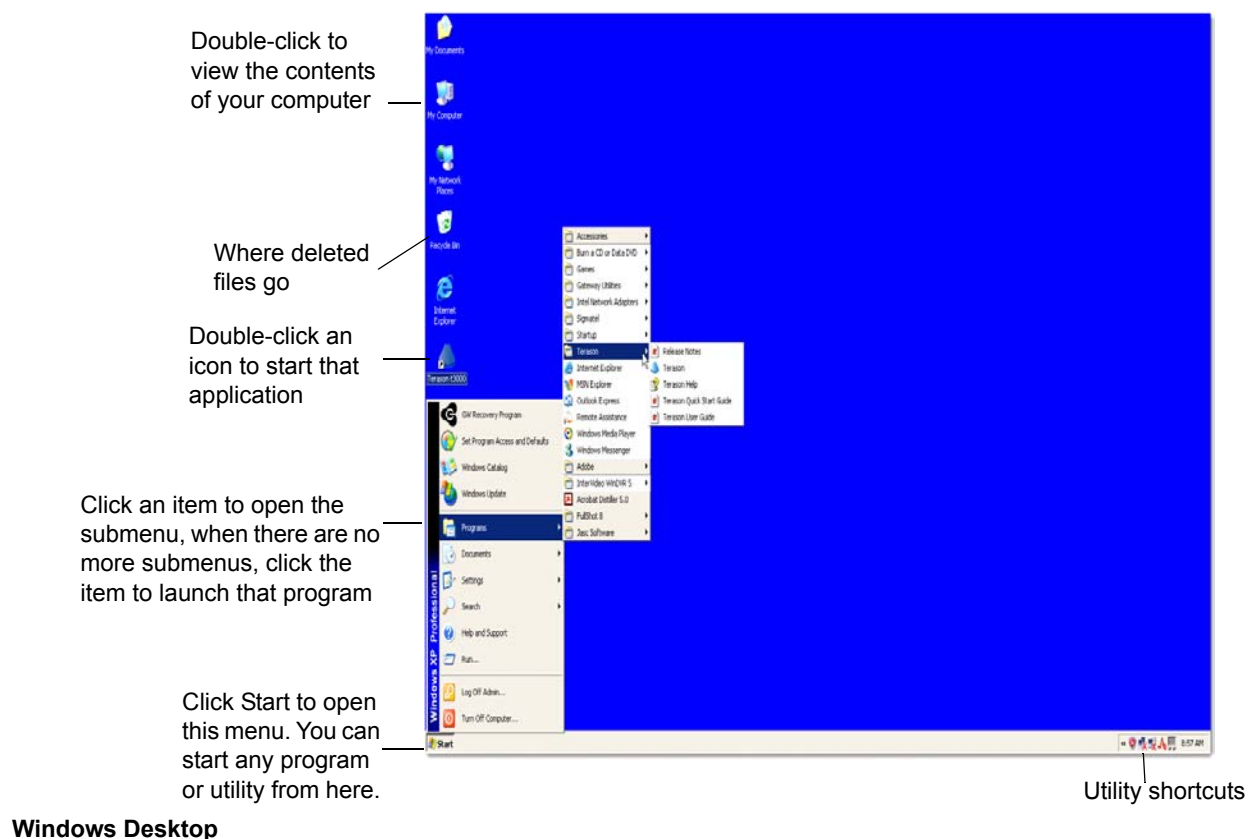
- [The Windows Desktop](#), see page 279
- [Application Windows](#), see page 281
- [Windows Terms](#), see page 282
- [Using the Touchpad or a 2-Button Mouse](#), see page 283
- [Starting/Exiting Programs](#), see page 284
- [Resizing Windows](#), see page 285
- [Moving Windows and Toolbars](#), see page 285

The examples use the Terason software, but the concepts apply to all programs that run on Windows.

If you want more help in using Windows, you can use the Windows online help, or you can purchase a third-party book available at most bookstores.

### **The Windows Desktop**

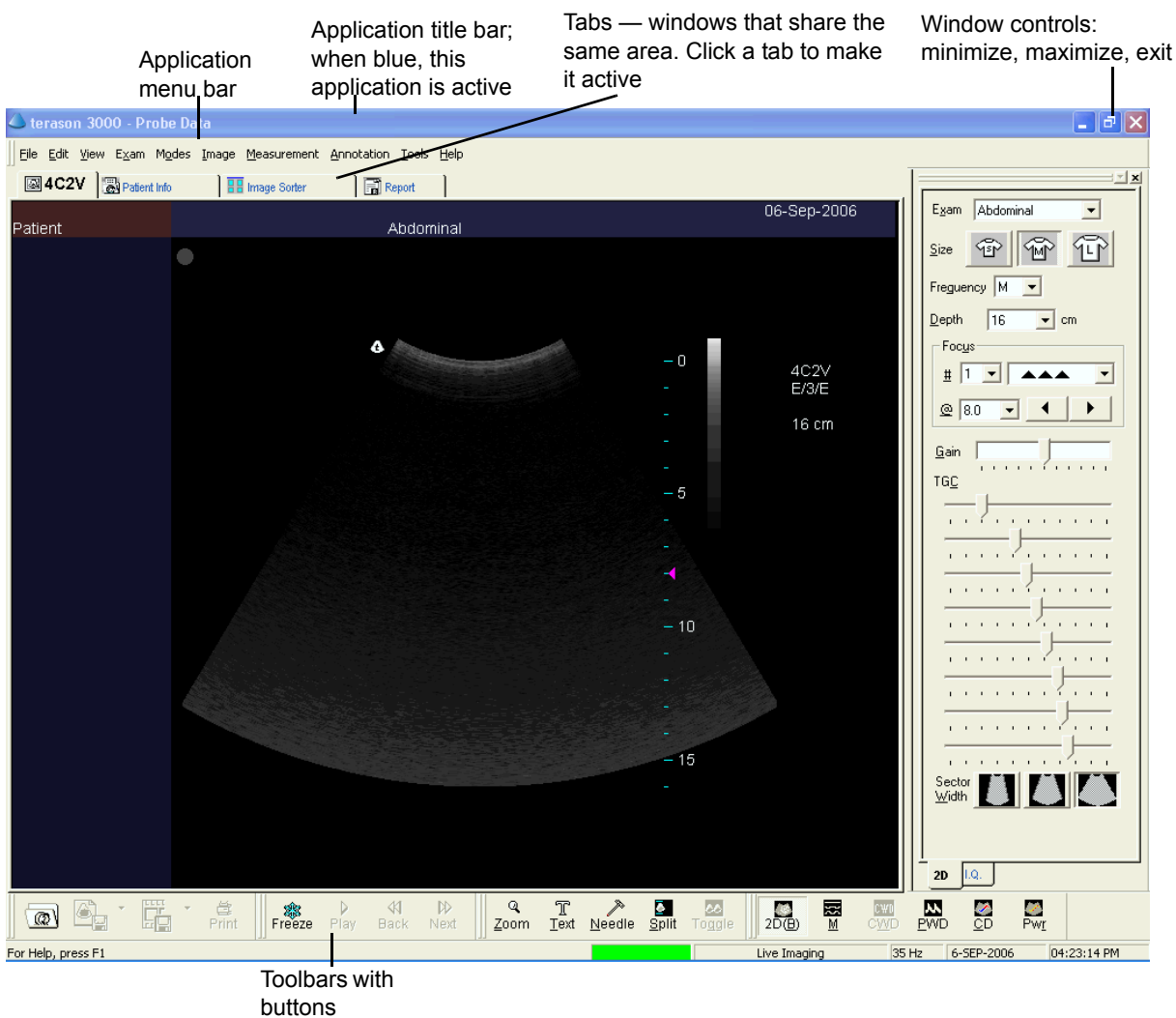
The figure below shows the Windows desktop and defines several key elements:





## Application Windows

Most applications have a similar user interface. When you learn a technique for one application, you can use it with other applications. The following figure shows the Terason application window:



Application Window - Terason Ultrasound System

## Windows Terms

The following table provides the definitions of several terms used to describe objects within Windows:

### Windows Terminology

Term	Definition
Button	A graphic that you can click to execute a function. For example, the Print button prints a file; the PWD button starts Pulsed-Wave Doppler scan mode. ( <i>Exception:</i> mouse buttons are physical buttons on a mouse.)
Check box	A check box can be checked or cleared. Each time you click in the box, it toggles to the other setting. When a box is checked, that item is selected or enabled. When a box is clear, that item is not used or disabled. For example, when the Invert check box is checked, the image is shown inverted; when the check box is clear, the image shows normally (not inverted).
Desktop	The entire Windows screen where you put things you want to use. The desktop can hold files, shortcuts to programs, and links to objects, and provides access to all of the programs and data on the computer.
Directory	The icon for a directory is a folder. A folder contains any number of files. Files can be data documents or applications.
Drop-down Menu	Looks like a field followed by a down arrow. When you click the down arrow, a menu opens. Click any of the items, and the software puts your choice in the field. Drop-down menus provide a quick method for selecting options.
Field	An area of a window where you can type characters for input to the software.
Hot Key	A keyboard shortcut that lets you press keys instead of clicking with the mouse to perform an operation. For example, if you press Alt-F, Windows opens the File menu. In a menu or button name, the hot key is underlined (unless the option to view hot keys is turned off).
Icon	A graphic that represents a file, program, network connection, or other item. Icons can show you what type of format a file has, or they can be buttons to open a file or program.
Maximize	Enlarge the window to fill the desktop.
Menu	A list of functions from which you select what you want to do or use. For example, you can select Print from the File menu, or you can open the online help from the Help menu.
Menu bar	The menu bar displays along the top of the application window. It carries the individual menus. Most applications have a File menu (to open, save, print files), Edit menu, and other menus specific to that application's function.
Minimize	Condense the window to the size of a button, and show that button on the task bar at the bottom of the desktop. You can later click that button to return the window to its original size.
Program	Also known as a software application. A program does something using the computer components. It could be a game, a word processor, or an ultrasound scanning system.
Restore	If you minimized a window, you use the Restore function to return it to its original size. You can restore a program by clicking its button on the Task bar, or by selecting Restore from the right-click menu if you click the button.

**Windows Terminology (Continued)**

Term	Definition
Shortcut	A shortcut lets you quickly access something that could be stored in a different location. For example, the Terason software is stored several directory levels deep on your computer, but the desktop shortcut lets you access it without having to find its specific location. A shortcut icon usually includes a small boxed arrow to indicate it is a shortcut and not the actual object.
Slider	Lets you adjust a setting over a range of possible values, from Low to High. The slider points to the current value, and you can move it up-or-down or left-or-right as needed.
Start button (Start menu)	Button at the bottom left of the desktop; used to find files, open programs, and start any task. Also used to shut down the computer.
Status bar	Message area at the bottom of a window where the program can display application messages or help.
Submenu	Menus can have several levels. If you highlight a menu item and another menu pops out beside it, that is a submenu. Also called a pop-out menu.
Tab	Tabs let multiple items share the same space. When you click a tab, Windows brings a window associated with that tab to the front, and puts all other tabs behind it. The Image Display, Image Sorter, and Patient Info tabs share the same space in the Terason window, but you can only see one of them at a time.
Task bar	The bottom of the desktop, where you can access utilities, the Start menu, and minimized programs.
Text box	<i>See Field</i>
Thumbnail	A small picture that represents a larger image. Because thumbnails are small, you can fit more of them on a page. Typically, thumbnails also act as links to the full-sized image.
Toolbar	A collection of buttons.
Tree	A tree is a hierarchical representation of a file system.
Window	A defined area on the screen that contains other items, and can be moved to other locations on the screen independently of other windows.

## Using the Touchpad or a 2-Button Mouse

The laptop includes a touchpad that you use to control the movement of the cursor on the screen. The touchpad also has two buttons below it. The laptop or desktop computer can also be connected to a 2-button mouse to control the cursor.

In general, you gently drag your finger across the touchpad or roll the mouse around to move the cursor. To select something on the screen, such as a menu or a button, you move the cursor on top of the item and tap the touchpad lightly or click the left button.

The word “click” means that you either tap the touchpad lightly, press and release the left button beneath the touchpad, or press and release the left button on the mouse.

### To select a menu item:

1. Move the cursor to the menu name and tap the touchpad or click the left button. The menu pops up.

2. Slide the cursor down the menu to the item you want.
3. Click the left button to select that menu item.

This guides uses this format when instructing you to choose a menu item: select View > Image Display Properties > Frame Rate. This instruction means that you click the **View** menu in the menu bar, slide down the menu to Image Display Properties, then slide to the right and click Frame Rate.

You can also access any menu by using its shortcut key combination. To see a menu using a shortcut, press the Alt key and the underlined letter in the menu name. For example, to see the **View** menu, hold down the Alt key and press the V key.

This user guide uses the following terms in procedures:

<b>Click</b>	Gently tap the touchpad or press and release the left button on the mouse or touchpad
<b>Double-click</b>	Gently tap the touchpad twice or press the left button twice in quick succession
<b>Right-click</b>	Press and release the right button on the mouse or touchpad
<b>Drag</b>	Press the left button on the touchpad or mouse, hold it down, and move the cursor

## Starting/Exiting Programs

Windows provides several methods to start and exit programs. You can use either of these methods to start an application:

- Start button
- Desktop shortcut

You can use either of these methods to exit an application:

- File menu
- Close button

Typically, if you have not saved what you were working on, the application prompts you to save your work when you try to exit.

### Starting Using the Start button:

1. Click the Start button at the bottom left corner of the screen. The Start menu opens.
2. Move the cursor onto **All Programs**. A list of software programs installed on the computer pops out to the right.
3. Move the cursor onto the list and onto the one you need. Windows highlights that item, and if it has more choices for that application, displays another list of items.
4. Click the application. Windows starts that application.

### Starting From the Desktop:

Most applications place a shortcut on the computer desktop when they are installed. To start the application, double-click its icon on the desktop.


### Closing Using the File menu:

When finished using an application, you should close it. To close an application, complete these steps:

1. Click **File** on the menu bar.
2. Click **Exit** on the File menu.





The application closes, or, if you have not saved what you were working on, the application displays a dialog box asking if you want to save your work.

### Closing Using the Close Button

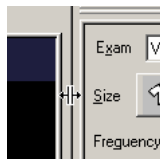
Every application window in Windows has  in the upper right corner. Clicking this button is the same as clicking Exit on the File menu. If you have not saved your work, the application prompts you to do so before it closes.

## Resizing Windows

The small buttons in the upper right of an application let you minimize, maximize, and exit the program.

-  Closes the window but leaves the program running (called minimizing the window). A button appears at the bottom of the screen in the taskbar. Click the button in the taskbar to re-open the window.
-  Enlarges the window to fill the entire screen (also called maximizing).
-  Returns the window to the size that it was before you maximized it.
-  Exits the application. Be sure to save any images that you want to keep before you click this button.

When an application displays more than one pane in a window, you can usually resize the panes to enlarge or reduce the area used for adjacent panes. Enlarging the size of one pane usually reduces the size of another pane. To make a pane narrower, place your cursor between the two panes and watch for the cursor to change shape as shown in the figure below, then click and drag the pane border to a new position.



Resizing Parts of the Window

## Moving Windows and Toolbars

You can change where panes and toolbars appear within the Terason window. For example, you can move the Terason Explorer pane to the far right, and you can move the Tools toolbar to below the Playback toolbar.

Notice that each window and toolbar has a set of double lines along one edge. If you click these lines, you can drag the window or toolbar to any other location. A gray rectangle shows as you move the toolbar.

**Moving a Toolbar**

Hold the mouse button down and move the cursor to where you want to put the toolbar, and release the mouse button. The software adjusts the spacing in the window to insert the toolbar.

**Moved Toolbar**

## Appendix B Menu and Toolbar Reference

This Appendix briefly describes these parts of the Terason software:

- [Shortcut Keys](#), see page 287
- [Menu Reference](#), see page 288
- [Shortcut Menu Reference](#), see page 295
- [Toolbar Reference](#), see page 299

### Shortcut Keys

The Terason software has mapped the keyboard function keys (F1 to F12) and several other keys to specific functions, as listed in the following table.

#### Shortcut Keys

Key	Description	Key	Description
Space	Freeze/Live image (toggles)	Esc	Exit Full Screen Mode; Delete unfinished measurement
Shift	In Duplex and Triplex modes, toggles Update on & off	B	Start scanning in 2D
Ctrl-arrow (L & R)	Select a different Image Control tab	M	Start scanning in M-Mode
F1	Open Terason online help	P	Start scanning in PWD mode
F2	Freeze imaging	C	Start scanning in Color Doppler mode
F3	Live imaging	D	Start scanning in DPD mode
F4	Copy Image	R	Start scanning in Power Doppler mode
F5	Refresh	W	Start scanning in CWD mode
F8	Save Image	H	Start scanning in THI mode
F9	Save Loop	G	Toggle split screen
F11	Full Screen/Exit Full Screen	S	Enter Split screen mode
F12	Print	T	Text
Alt + F4	Exit	Z	Enter or exit Zoom mode
PrtSc	Print Screen	N	Show Needle Guides
.	(Period) Select region of interest to move; select scan line in M-Mode	/	(Slash) Select steering angle

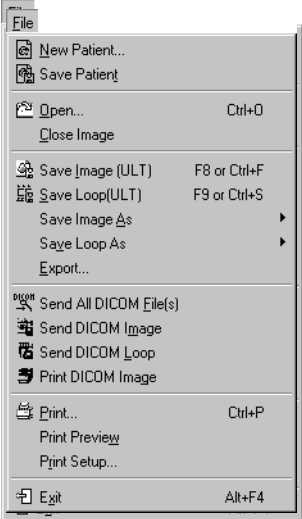
## Shortcut Keys (Continued)

Key	Description	Key	Description
. .	(Two periods) Select region of interest to resize	//	(Two slashes) Select PWD correction angle
Shift	Toggle Update On or Off in	Ctrl-Tab	Cycle through Imaging, Patient Info, Image Sorter tabs

## Menu Reference

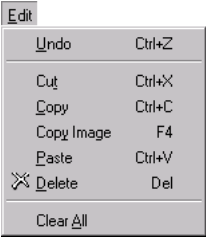
For each menu item, the table provides a brief description, and the location where more information about that menu item can be found.

## Menu Reference

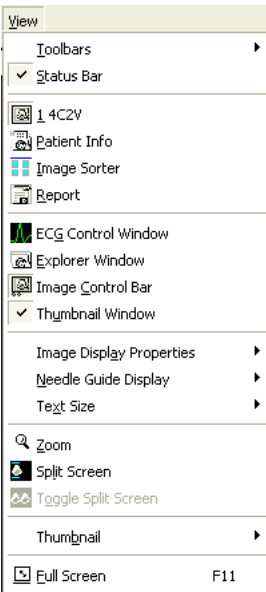
Menu	Menu Item	Description	Where Described in Guide
	New Patient	Clears the current patient info in the Patient Info tab	<a href="#">Adding a New Patient</a> on page 61
	Save Patient	Saves any changes made to the patient info in the Patient Info tab	<a href="#">Adding a New Patient</a> on page 61
	Open	Opens the Windows File Browser window and you can locate a needed saved image or loop	<a href="#">Finding Stored Images and Loops</a> on page 151
	Close Image	Closes the tab showing a saved image file	<a href="#">Finding Files in the Terason Explorer</a> on page 151
	Save Image (ULT)	Saves the displayed frame as a Terason format (ULT) image file	<a href="#">Saving Images and Loops</a> on page 148
	Save Loop (ULT)	Saves an image loop as a Terason format loop file	<a href="#">Saving Images and Loops</a> on page 148
	Save Image As	Saves an image in a specific file format (select from pop-out menu)	<a href="#">Saving Images and Loops</a> on page 148
	Save Loop As	Saves an image loop in a specific file format (select from pop-out menu)	<a href="#">Saving Images and Loops</a> on page 148
	Export	Specify a filename, location, and image format when saving an image or loop	<a href="#">Exporting a File</a> on page 150
	Send All DICOM File(s)	Sends saved DICOM files to the server	<a href="#">Sending Files to a DICOM Server</a> on page 225
	Send DICOM Image	Exports an image to a DICOM server	<a href="#">Sending Files to a DICOM Server</a> on page 225
	Send DICOM Loop	Exports an image loop to a DICOM server	<a href="#">Sending Files to a DICOM Server</a> on page 225
	Print DICOM Image	Prints to a DICOM printer	<a href="#">Printing Files to a DICOM Printer</a> on page 225



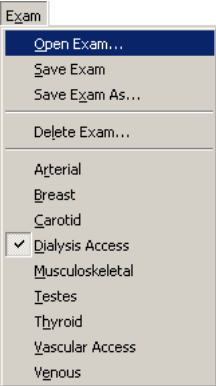
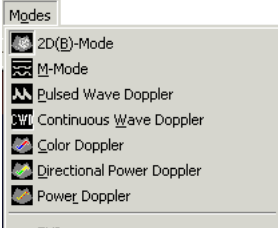
## Menu Reference (Continued)

Menu	Menu Item	Description	Where Described in Guide
	Print	Prints the image(s) in the Image Display window, Image Preview window, or the Image Sorter window	<a href="#">Printing Images</a> on page 165
	Print Preview	Views a picture of what the print out will look like when it is printed	<a href="#">Printing from the Print Preview Window</a> on page 167
	Print Setup	Configures the default printer options	<a href="#">Printing Images</a> on page 165
	Exit	Closes the Terason Ultrasound System application	<a href="#">Starting and Exiting the Software</a> on page 67
	Undo	Undoes the most recent text edit (cut, paste, or delete) or entry in the Patient Info window	<a href="#">Using the Patient Info Window</a> on page 61
	Cut	Removes the selected text from its current location and puts it in the clipboard	<a href="#">Using the Patient Info Window</a> on page 61
	Copy	Copies the selected text to a clipboard	<a href="#">Using the Patient Info Window</a> on page 61
	Copy Image	Copies the image in the Image Display window to the computer's clipboard for pasting it into a different application	<a href="#">Storing Images and Loops</a> on page 146
	Paste	At the location of the cursor, inserts the last text cut or copied	<a href="#">Using the Patient Info Window</a> on page 61
	Delete	Deletes the selected text in a text box or text on the Image Display window,	<a href="#">Deleting Text from an Image</a> on page 86
	Clear All	Deletes text entries and measurements on the Image Display window	<a href="#">Deleting Text from an Image</a> on page 86

## Menu Reference (Continued)

Menu	Menu Item	Description	Where Described in Guide
	Toolbars	Shows or hides any of the Terason toolbars (see <a href="#">Toolbar Reference</a> on page 299)	<a href="#">Hiding Windows and Toolbars</a> on page 76
	Status Bar	Shows or hides the Status bar	
	Active Probe	Shows the current probe that is attached	
	Patient Info	Shows the Patient Info window	<a href="#">Hiding Windows and Toolbars</a> on page 76
	Image Sorter	Shows the Image Sorter window	
	Report	Shows the Report window	<a href="#">Working with Reports</a> on page 214
	ECG Control	Opens a control panel for ECG exams	
	Explorer Window	Shows or hides the Terason Explorer window	<a href="#">Terason Explorer Window</a> on page 37 <a href="#">Terason Explorer Window</a>
	Image Control Bar	Shows or hides the Image Control Bar	<a href="#">Image Control Bar/Measure Tabs</a> on page 38
	Thumbnail Window	Shows or hides the Thumbnail Window	
	Image Display Properties	Shows or hides guides on the Image Display window	<a href="#">Adding Guides to the Image Display</a> on page 78
	Needle Guide Display	Shows or hides needle guide lines (used for biopsies only)	<a href="#">Selecting a Needle Guide</a> on page 103
	Text Size	Sets the size of text in the Image Display window	<a href="#">Changing the Text Size</a> on page 79
	Zoom	Enlarges a selected area of the image in the Image Display window	<a href="#">Enlarging an Area of the Image</a> on page 74
	Split Screen	Splits the Image Display window into two screens	<a href="#">Using Split Screen Mode</a> on page 80
	Toggle Split Screens	Makes the opposite screen the active screen	<a href="#">Using Split Screen Mode</a> on page 80
	Thumbnail	When checked, specifies large thumbnails in the Image Sorter window, otherwise small thumbnails are used	<a href="#">Finding Files in the Image Sorter Window</a> on page 154
	Full Screen	Enlarges the Image Display window to cover the entire computer's screen, hiding all other windows and toolbars	<a href="#">Displaying the Image in Full Screen</a> on page 76
	Refresh	Updates the thumbnail list	

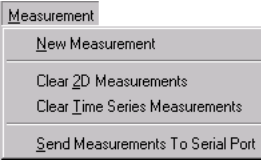

## Menu Reference (Continued)

Menu	Menu Item	Description	Where Described in Guide
	Open Exam	Opens a dialog box where you can select an exam type for the current exam	<a href="#">Opening an Exam</a> on page 220
	Save Exam	Saves any edited settings (changes made to preset values in the Image Control window) to the exam; you cannot save changes to any of the Terason-provided exams	<a href="#">Creating Custom Exams</a> on page 221
	Save Exam As	Saves the current set of Image Control settings to a new Exam type	<a href="#">Creating Custom Exams</a> on page 221
	Delete Exam	Deletes a custom exam type. You can only delete exam types you created; you cannot delete any of the Terason-provided exam types	<a href="#">Deleting Custom Exams</a> on page 222
	[Exam Type]	Opens the selected exam; lists the Terason-provided exams	<a href="#">Opening an Exam</a> on page 220
	# [Exam Name]	Opens the selected custom exam; lists the custom exams for the connected transducer	
	2D	Activates 2D scanning and starts a live image	<a href="#">2D Mode</a> on page 28
	M-Mode	Activates M-Mode scanning and starts a live image	<a href="#">M-Mode (Motion Mode)</a> on page 28
	Pulsed-Wave Doppler	Activates Pulsed-Wave Doppler scanning and starts a live image	<a href="#">Pulsed-Wave Doppler</a> on page 32
	Color Doppler	Activates Color Doppler scanning and starts a live image	<a href="#">Color Doppler</a> on page 30
	Directional Power Doppler	Activates Directional Power Doppler scanning and starts a live image	<a href="#">Directional Power Doppler</a> on page 31

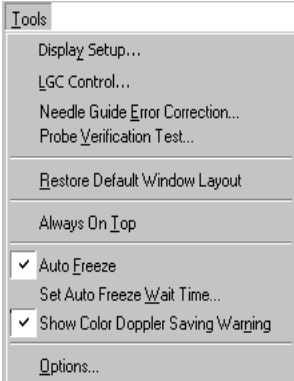
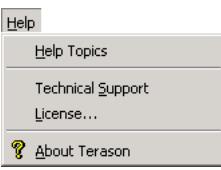
## Menu Reference (Continued)

Menu	Menu Item	Description	Where Described in Guide
	Power Doppler	Activates Power Doppler scanning and starts a live image	<a href="#">Power Doppler</a> on page 29
	Freeze/Live	Live if the Image Display window is frozen; Freeze if the Image Display window is live: menu chooses the opposite imaging state	<a href="#">Freezing Images</a> on page 72
	Play	Play runs through the frames in a loop	<a href="#">Working with Image Loops</a> on page 72
	Pause	Halts a playing loop at the current frame	<a href="#">Working with Image Loops</a> on page 72
	Back	Moves to the previous frame in a loop	<a href="#">Working with Image Loops</a> on page 72
	Next	Moves to the next frame in a loop	<a href="#">Working with Image Loops</a> on page 72
	Size	Opens a submenu used for 2D, to select Small, Medium, or Large	<a href="#">Adjusting the Size</a> on page 92
	Depth	Opens a submenu used for 2D, to set the depth for the scan	<a href="#">Adjusting the Depth</a> on page 93
	Gain	Opens a submenu used to increase (Up) or decrease (Down) the gain setting by one unit	<a href="#">Adjusting the Gain</a> on page 114
	Invert	Opens a submenu used for 2D, to choose Left/Right or Up/Down inverts	<a href="#">Inverting Images</a> on page 100
	Colorization	Opens a submenu used for 2D to choose a color palette	<a href="#">Adjusting Colorization</a> on page 101
	Smoothing	Opens a submenu used for 2D to choose a Smoothing algorithm	<a href="#">Adjusting Smoothing</a> on page 101
	Persistence	Opens a submenu used for 2D to choose a Persistence level	<a href="#">Adjusting Persistence</a> on page 102
	Map	Opens a submenu used for 2D to choose an image map	<a href="#">Adjusting the Image Map</a> on page 102
	Sweep Speed	Opens a submenu used to set the speed for the Time Series scan	<a href="#">Adjusting the Sweep Speed</a> on page 105
	Time Series Image Height	Opens a submenu used to set the Time Series Image Height.	

## Menu Reference (Continued)

Menu	Menu Item	Description	Where Described in Guide
	New Measurement	Initiates a measurement of the type selected in the Measure tab	<a href="#">Working with Measurements</a> on page 169
	Clear 2D Measurements	Deletes all measurements in the 2D image display window	<a href="#">Deleting Measurements</a> on page 214
	Clear Time Series Measurements	Deletes all measurements in the Time Series window	<a href="#">Deleting Measurements</a> on page 214
	Send Measurements to Serial Port	Transmits OB and GYN measurements to another computer	
	Body Marker	Opens Annotation window showing the Body Marker tab where you can select a body marker icon	<a href="#">Adding a Body Marker</a> on page 87
	Body Marker Indicator	Opens a submenu that lets you choose to display the body marker indicator horizontally or vertically	<a href="#">Changing the Indicator's Direction</a> on page 89
	Text	Activates the Text tool and opens the Annotation window showing the Text tab	<a href="#">Adding Text to an Image</a> on page 82
	Set Text Home Position	Sets the home position for text at the location where you click after selecting this menu item	<a href="#">Setting the Text Home Position</a> on page 84
	Clear Text Annotation	Deletes all text on the Image Display window	<a href="#">Deleting Text from an Image</a> on page 86

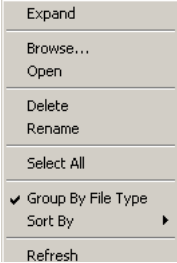
## Menu Reference (Continued)

Menu	Menu Item	Description	Where Described in Guide
 <p>Tools</p> <ul style="list-style-type: none"> <li>Display Setup...</li> <li>LGC Control...</li> <li>Needle Guide Error Correction...</li> <li>Probe Verification Test...</li> <li>Restore Default Window Layout</li> <li>Always On Top</li> <li><input checked="" type="checkbox"/> Auto Freeze</li> <li>Set Auto Freeze Wait Time...</li> <li><input checked="" type="checkbox"/> Show Color Doppler Saving Warning</li> <li>Options...</li> </ul>	Display Setup	Provides tools to adjust the display characteristics of the monitor	
	LGC Control	Displays a set of sliders that control gain on lateral segments of the scan display	<a href="#">Adjusting Lateral Gain Compensation (LGC)</a> on page 97
	Needle Gauge Error Correction	Adjusts the guides for biopsy applications	<a href="#">Setting the Error Correction</a> on page 144
	Probe Verification Test	Runs several tests on the transducer; use only if instructed to do so by a Terason Technical Service Representative	<a href="#">Running a Probe Verification Test</a> on page 238
	Restore Default Window Layout	Changes the location and visibility (hidden or shown) for all windows and toolbars to the default	<a href="#">Restoring the Default Layout</a> on page 240
	Always on Top	Prohibits other Windows applications from obscuring the Terason window	<a href="#">Keeping the Terason Software on Top</a> on page 240
	Auto Freeze	Stops sending power to the transducer after the transducer is not in use and the wait time expires	<a href="#">Setting a Time-Out Value</a> on page 241
	Set Auto Freeze Wait Time	Sets the wait time for auto freeze	<a href="#">Setting a Time-Out Value</a> on page 241
	Show Color Doppler Saving Warning	Hides or shows the warning if you try to save a color Doppler scan with a high level of color persistence	<a href="#">Adjusting the Color Persistence</a> on page 122
	Options	Sets options for Save functions, Display Modes, Measurements, and Annotations	<a href="#">Specifying Optional Settings</a> on page 242
 <p>Help</p> <ul style="list-style-type: none"> <li>Help Topics</li> <li>Technical Support</li> <li>License...</li> <li> About Terason</li> </ul>	Help Topics	Opens the Terason Online Help window	<a href="#">Terason Online Help</a> on page 25
	Terason Support	Opens a message box with contact information	<a href="#">Contacting Terason</a> on page 26
	License	Opens a dialog box where you can read your licensing information or register (if you have not yet registered an evaluation copy of the software)	<a href="#">Contacting Terason Technical Support</a> on page 307
	About Terason	Opens a message box that displays the Terason copyright information, and the current version of the software	<a href="#">Contacting Terason Technical Support</a> on page 307

## Shortcut Menu Reference

When you right-click on an area in the Terason window, a shortcut menu pops up with items specific to the location or item where you clicked. The following table lists the shortcut menus you might see, with a brief description of the available menu items.

### Shortcut Menus

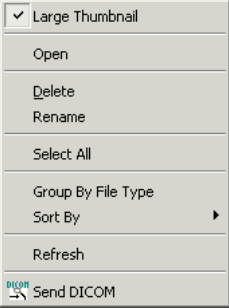
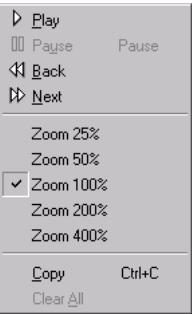
Where Active/Menu	Menu Item	Description	Where Described
Any item in the Terason Explorer Window:  	Expand/ Collapse	Shows as Expand if the folder is closed and shows as Collapse if the folder is open. Shows (Expand) or hides (Collapse) the contents of the folder	<a href="#">About the Terason Main Screen</a> on page 36
	Browse	Opens the Windows File dialog box. You can use that dialog box to locate a Patient info file or an image file	<a href="#">Browsing to Find Files</a> on page 155
	Open	Opens the selected item, either a Patient info file or an image file	<a href="#">Preparing Patient Info for an Exam</a> on page 64 <a href="#">Finding Stored Images and Loops</a> on page 151
	Select All	Selects all images in a folder	
	Rename	Changes the file name to an edit box where you can type or edit the file name	<a href="#">Renaming Files</a> on page 161
	Delete	Permanently deletes the selected image file (does not work with Patient Info files)	<a href="#">Deleting Files Using the Terason Explorer, Image Sorter, and Thumbnail window</a> on page 162
	Group By File Type	Sort images in folders based on file type	<a href="#">Finding Files in the Image Sorter Window</a> on page 154 <a href="#">Finding Files in the Image Sorter Window</a>
	Sort by	Sort images in folder based on file name or creation date	<a href="#">Finding Files in the Image Sorter Window</a> on page 154 <a href="#">Finding Files in the Image Sorter Window</a>
	Refresh	Updates the file listing	<a href="#">Finding Files in the Terason Explorer</a> on page 151
	Send DICOM	Available if DICOM is installed. Sends the selected DICOM file to the DICOM server	<a href="#">Sending Files to a DICOM Server</a> on page 225

## Shortcut Menus (Continued)

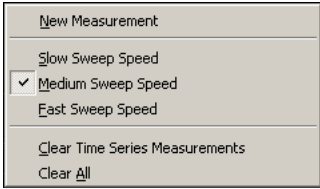
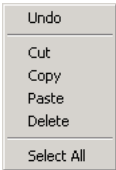

Where Active/Menus	Menu Item	Description	Where Described
2D Image Display Window: 	New Measurement	Start a measurement of the type currently selected in the 2D Measure tab	<a href="#">Measuring in the 2D Window</a> on page 170
	Clear All	Deletes measurement and text entries on the Image Display window	<a href="#">Deleting Text from an Image</a> on page 86
	Clear 2D Measurements	Deletes all measurements in the 2D Image Display window	<a href="#">Deleting Measurements</a> on page 214
	Clear All Text Annotations	Deletes all text added to the Image Display window	<a href="#">Deleting Text from an Image</a> on page 86
	Live/Freeze	Item shows as Live if the Image Display window is frozen; shows as Freeze if the Image Display window is live: menu chooses the opposite imaging state	<a href="#">Freezing Images</a> on page 72
	Play	If the Image Display window contains a frozen loop or a saved loop, runs through the frames in the loop	<a href="#">Working with Image Loops</a> on page 72
	Set PWD Gate	Locks the cursor position and switches to the PWD scan mode	<a href="#">Adjusting the Sample Volume (SV) Size and Depth</a> on page 112
	Text	Activates the Text tool; you can click in the Image Display window and type any needed text	<a href="#">Typing Text on an Image</a> on page 85
	Save Image (ULT)	Saves the displayed frame as an image file in the Terason file format	<a href="#">Saving Images and Loops</a> on page 148
	Save Loop (ULT)	Saves an image loop in the Terason file format	<a href="#">Saving Images and Loops</a> on page 148
	Export	Specifies a filename, location, and image format when saving an image or loop	<a href="#">Exporting a File</a> on page 150
Image Control window, toolbars, or menu bar: 	Image Control Bar	Shows or hides the Image Control window	<a href="#">Hiding Windows and Toolbars</a> on page 76
	Exit	Shows or hides the Exit button	
	File	Shows or hides the File toolbar	
	Full	Shows or hides the Full button	
	Playback	Shows or hides the Playback toolbar	
	Tools	Shows or hides the Tools toolbar	
	Transducer	Shows or hides the Switch transducer button	
	Scan Mode	Shows or hides the Image Mode toolbar	




## Shortcut Menus (Continued)

Where Active/Menus	Menu Item	Description	Where Described
Image Sorter and Thumbnail window: 	Large Thumbnail	Specifies large thumbnails in the Image Sorter window	<a href="#">Finding Files in the Image Sorter Window</a> on page 154
	Open	Opens the selected image	
	Delete	Deletes the selected thumbnail from the Image Sorter window; does not delete the actual file	
	Rename	Allows you rename the selected image	
	Select All	Selects all images shown in the Image Sorter window	
	Group By File Type	Arranges the images based on file type	
	Sort By	Sorts the images by file name or creation type (pop-up menu)	
	Refresh	Updates the Image Sorter window to show thumbnails for all images in the selected folder	
	Send DICOM	Available if DICOM is installed. Sends the selected DICOM file to the DICOM server	<a href="#">Sending Files to a DICOM Server</a> on page 225
Image Display window when viewing a saved non-ULT file: 	Play	Plays the AVI or DICOM loop	<a href="#">Working with Image Loops</a> on page 72
	Pause	Halts the AVI or DICOM loop	
	Previous	Moves to the previous frame in the AVI or DICOM loop	
	Next	Moves to the next frame in the AVI or DICOM loop	
	Zoom values	Enlarges or reduces the image based on the selected zoom percentage value	<a href="#">Finding Files in the Terason Explorer</a> on page 151
	Copy	Copies the image to the system clipboard (makes it available to paste into another application file)	
	Clear All	Not Implemented for this release	

## Shortcut Menus (Continued)

Where Active/Menus	Menu Item	Description	Where Described
Time Series window 	New Measurement	Initiates a measurement of the type selected in the M Measure or PWD Measure tab	<a href="#">Measuring in the M-Mode Window</a> on page 184 and <a href="#">Measuring in the PWD Window</a> on page 185
	Slow Sweep Speed	Select the Slow sweep speed for an M-Mode or PWD scan	<a href="#">Adjusting the Sweep Speed</a> on page 105
	Medium Sweep Speed	Select the Medium sweep speed for an M-Mode or PWD scan	<a href="#">Adjusting the Sweep Speed</a> on page 105
	Fast Sweep Speed	Select the Fast sweep speed for an M-Mode or PWD scan	<a href="#">Adjusting the Sweep Speed</a> on page 105
	Clear Time Series Measurements	Deletes all measurements in the 2D and Time Series windows	<a href="#">Deleting Measurements</a> on page 214
	Clear All	Deletes all text and measurements from the 2D and Time Series windows	<a href="#">Deleting Measurements</a> on page 214
Patient Info fields: 	Undo	Undoes the most recent text edit (cut, paste, or delete) or entry in the Patient Info window	<a href="#">Using the Patient Info Window</a> on page 61
	Cut	Removes the selected text from its current location and puts it in the clipboard	
	Copy	Copies the selected text to a clipboard	
	Paste	At the location of the cursor, inserts the last text cut or copied	
	Delete	Deletes the selected text in a text box or text on the Image Display window	<a href="#">Deleting Text from an Image</a> on page 86
	Select All	Highlights all text in the field where you placed the cursor	N/A
Body Marker: 	Body Marker	Show Annotation window with Body Marker tab visible	<a href="#">Adding a Body Marker</a> on page 87
	Display Indicator Horizontally	Show the pink indicator horizontally	<a href="#">Changing the Indicator's Direction</a> on page 89
	Display Indicator Vertically	Show the pink indicator vertically	
	Remove Body Marker	Removes the body marker icon	<a href="#">Removing the Body Marker</a> on page 89

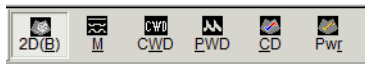








## Shortcut Menus (Continued)

Where Active/Menus	Menu Item	Description	Where Described
Text in 2D window: 	New Text	Add a new line for typing text beneath the current line	<a href="#">Editing Text</a> on page 86
	Delete Text	Delete the highlighted text	<a href="#">Deleting Text from an Image</a> on page 86
	Show Arrow	Add an arrow from the text toward the center of the 2D scan (you can then move the arrow head to any location)	<a href="#">Placing Arrows on the Image</a> on page 84




















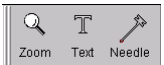



## Toolbar Reference

The Terason software provides several toolbars that you can hide or display, or move into individual windows.


### Descriptions of Buttons on the Image Mode Toolbar

Toolbar	Button	Mode Description
		Opens and closes the Terason Explorer Bar
		2D: provides a standard two-dimensional display in real time.
		Motion: displays motion along a line depicted in the 2D image as a function of time.
		Pulsed-Wave Doppler: displays a line in the 2D image that contains the sample size and location of interest. The pulsed Doppler waveform depicts the instantaneous velocity of flow within that sample, as a function of time.
		Continuous Wave Doppler:
		Color Doppler: displays, in real time, a two-dimensional image of blood flow overlaid on the B-Mode image. The hues in the color palette indicate mean flow velocity, and the different colors indicate the direction of blood flow.
		Power Doppler: displays, in real time, a two-dimensional image of blood flow overlaid on the B-Mode image. The hues in the color palette indicate the density of red blood cells. Brighter hues indicate greater density. Directional information is not provided. Power Doppler is not subject to aliasing and is generally more sensitive to low flow than Color Doppler or Directional Power Doppler.
		Launch Sonocubic 3-D imaging software (only displays if Sonocubic software is installed on the computer)

## Descriptions of Buttons on the Image Mode Toolbar (Continued)

Toolbar	Button	Mode Description
		Play button (visible when viewing a frozen image) lets you play loops of data. You can play up to sixty frames of loop information
		Pause button (visible when a playing an image) lets you pause the loops of data in Play mode
		Back button lets you return to the previous frame during Playback Mode
		Next Image button allows you to advance to the next frame during Playback Mode
 or 		Save button saves the current image to a file; icon may be different if you selected a default format other than Terason ULT; click arrow to select different file format
		Save Loop button saves the maximum allowed number of previous frames as a Cine loop; icon may be different if you selected a default format other than Terason ULT; click arrow to select different file format
		Print button lets you print the current image to a printer
		Options set to use DICOM send as default; sends the current image to the DICOM server
		Options set to use DICOM send as default; sends the current image loop to the DICOM server
		Options set to use DICOM print as default; prints the current image on the configured DICOM printer
 (toggles between Live and Freeze)		Live button provides a real-time image display
		Freeze button freezes the image during the scan to allow you to print or save to a file
		Split screen toggles split screen (two current scans displayed in the 2D window) on and off
		Toggle button makes the other screen active in split screen mode
		Zoom: magnifies the selected region of your image
		Text: lets you enter text on live or frozen images
		Needle: Show or hide the needle guides for medical procedures; also shows target indicator if that option is selected and the image is Live

## Descriptions of Buttons on the Image Mode Toolbar (Continued)

Toolbar	Button	Mode Description
		Exit button: shut down the Terason ultrasound program. This button is normally hidden; it turns on from the Image Control shortcut menu.

## Appendix C 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:

- [Installation Problems](#) on page 302
- [Problems with Scanning](#) on page 302
- [Interference on the Scan](#) on page 305
- [Printing Problems](#) on page 305
- [Display Problems](#) on page 306
- [VCR/TV Problems](#) on page 306
- [CD Writing or Reading Problems](#) on page 306
- [Network Problems](#) on page 307

If you complete the procedures and the problem persists, contact Terason as described in [Contacting Terason Technical Support](#) on page 307.

### Installation Problems

When installing the Terason software, you cannot have any other applications open on the laptop, especially Microsoft Outlook. A known 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.

There is a known bug in Windows XP Service Pack 2 that prevents proper installation of the Terason software. For a solution, see *Terason 3000 Software Install/Uninstall Instructions on Windows XP Service Pack 2*, Terason document number 16-2055-0.

### Problems with Scanning

If the software does not show a scan image, the problem could be:

- The transducer is not plugged in
- The connector for the FireWire or transducer is loose
- The device driver is not installed

To determine how to proceed, look at the Image Status Message at the bottom of the Terason window. This message describes the current status of scanning as defined in [Determining Image Status](#) on page 73. Use the following table to determine how to resolve the problem:

**Terason Transducer States**

If the Image Status is...	Then...
Frozen Image	Either you have frozen an image, or the transducer has not been used in several minutes and has shut down to conserve power. Press any key on the keyboard or move the mouse, and the laptop sends power to the transducer
Live Imaging	The transducer is functioning. Try adjusting the brightness and contrast controls on the 2D tab of the Image Control window

## Plugging in the Transducer

If you have used the transducer before, the driver is already installed, so it is probably a connection problem. Make sure all connections between the transducer and computer are secure.

## Reconnecting the Components


If the problem still exists, usually the cause is that one of the component connections has become loose. You must unplug all of the components and plug them in again, following these steps:

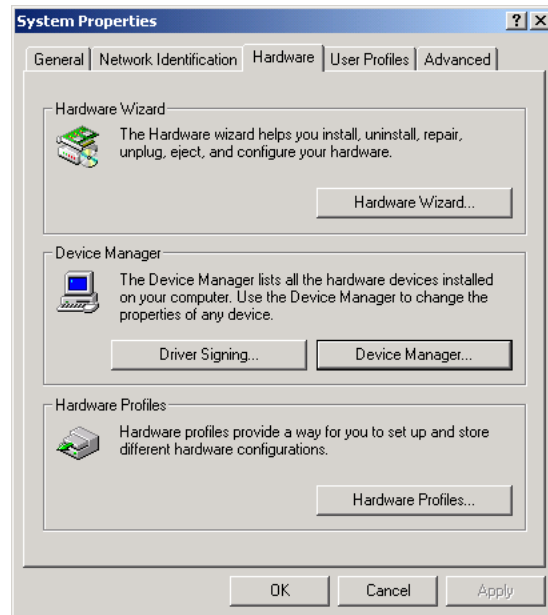
1. **Quit** the Terason software.
2. Shut down the **computer**.
3. Unplug the **transducer**.
4. Unplug the **FireWire cable**.
5. Plug in the **FireWire cable**.
6. Start the **computer**.
7. When the hourglass icon is gone, plug in the **transducer**.
8. Wait **15 seconds**.
9. If you see a “Digital Signature not Found” or a “Found New Hardware” message, follow the instructions in [Installing the FireWire Terason Transducer Driver](#) on page 45.
10. If no digital signature message displays, start the **Terason software**.

## Determining if the Driver Is Installed

If you still cannot see an image, complete these steps:

1. Quit the Terason software.

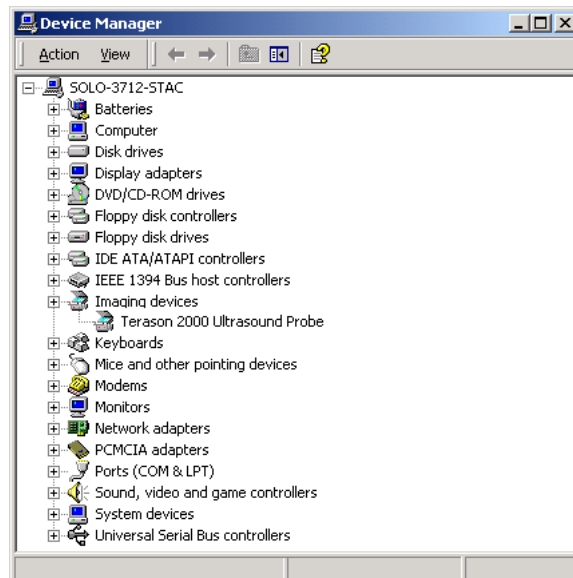
2. Select **Start > Settings > Control Panel**. The Control Panel window opens on the desktop.
3. Double-click the  icon. The System Properties window opens.
4. Click the Hardware tab.



#### System Properties: Hardware Tab

5. Click the **Device Manager** button.

A window listing all hardware devices connected to the computer opens.



#### Device Manager Window

6. Look for an entry named **Imaging devices**, and click the .



7. If you do not see **Terason 3000 Ultrasound Probe**, follow the instructions in [Installing the FireWire Terason Transducer Driver](#) on page 45.
8. If you see the Terason entry, close all windows and start the Terason software. If you still cannot see an image, contact Terason Technical Support.

## Interference on the Scan

If the transducer or the Terason electronics envelope is too close to an electronic device, such as your computer, you may see interference patterns in the scan image.

To resolve this problem, move the transducer and electronics away from all power sources, including the laptop. If the cable from the laptop to the electronics is coiled or looped, the laptop can interfere with the scan. Make sure the electronics is as far from the laptop as the cable permits.

## Printing Problems

The most common printing problems are:

- The printout is too light or too dark
- The printout is too small



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**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.

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## 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.

## The Print Output is Too Small

You can enlarge the image display by pressing F11 (see [Displaying the Image in Full Screen](#) on page 76 for more information). This function key hides all other elements on your desktop and uses the entire area for the image display. Print the image (press the PrtScrn key), then press F11 again to restore the other elements.

## Display Problems

If you install a printer using the Video port on the computer, the Windows operating system changes the screen size to 1024 x 768 pixels. The normal resolution is 1280 x 1024 pixels. This is a limitation of the Windows operating system and cannot be changed. If you need greater resolution on the screen, you must connect to the printer using the USB or parallel port on your computer.

If you must connect a separate monitor to the laptop, you can purchase third party cables. You will need a VGA cable. Please note that the ultrasound images can only be optimized for display on a single monitor.

## VCR/TV Problems

If you connected a VCR or TV to the computer but the VCR or TV is not working, refer to the owner's manual for the specific VCR or TV. Some VCRs require you to select Line 1, others Line 2, others Composite Video. The type of connection required is determined by the VCR, not by the laptop or the Terason software.



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**Caution:** A VCR or TV 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.

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The owner's manual for the VCR should contain instructions for connecting it to various devices, including computers and the TV.

Please note that only video output is sent to the VCR; you cannot record the audio output of Pulsed-Wave Doppler scans.

## 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 [Backing Up Files on a CD](#) on page 157 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 laptop 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 International locations: 781-270-4143 X 1048

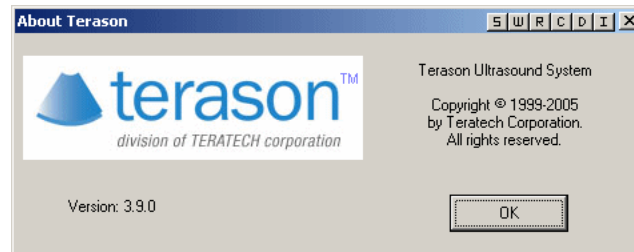
FAX: 1-781-270-4145

Email: [techsupport@terason.com](mailto:techsupport@terason.com)

Before you call, make sure you have the following information on hand:

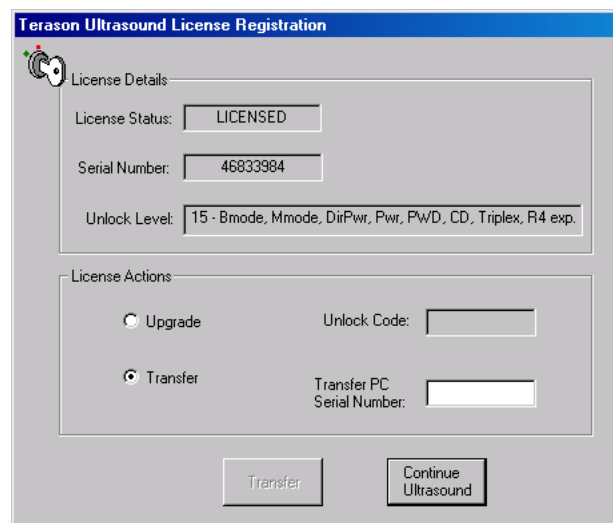
- Serial number on the transducer/electronics envelope
- Operating system (Windows 2000 or Windows XP) and service pack number
- Terason software version number
- If available, sales order number
- Name of the organization that purchased the Terason Ultrasound System

You can find the Terason software version by selecting Help > About Terason to open the About Ultrasound message box.

**About Terason Message Box**

Click **OK** to close the box.

You can find your serial number by selecting Help > License to open the License Registration box.

**License Registration Message Box**

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
- Transducer serial number
- Terason software version number
- Operating system (Windows 2000 or Windows XP) and service pack #
- Make of laptop or desktop computer

## Appendix D Gestational Tables

This appendix contains gestational tables for the measurements included with the Obstetrical exam type:

- AC Chart, Hadlock, 12-42 weeks
- BPD Chart, Hadlock, 12.1 - 41.6 weeks
- CRL Chart, Hadlock, 5.7 - 18 weeks
- FL Chart, Hadlock, 12.2 - 42 weeks
- GSD, Hansmann - 6.0 - 14.0 weeks
- HC Chart, Hadlock, 12.2-41.9 weeks
- HL Chart, Jeanty, 12.6 - 40.1 weeks

[Calculating Estimated Fetal Weight](#) on page 181 describes the procedure for measuring an obstetrical scan to estimate the fetal weight. This calculation is based on the Hadlock tables in this Appendix, and uses this formula:

$$EFW[g] = 10^{\left(1.326 - (0.00326 * AC[cm] * FL[cm]) + (0.0107 * HC[cm]) + (0.0438 * AC[cm]) + (0.158 * FL[cm])\right)}$$

where:

**EFW** Estimated Fetal Weight  
**AC** Abdominal Circumference  
**HC** Head Circumference  
**FL** Femur Length

**AC Chart, Hadlock, 12-42 weeks**

AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)
51	12.1	93	15.5	135	19.0	177	22.6	219	26.4	261	30.2	304	34.4	346	38.5
52	12.2	94	15.5	136	19.0	178	22.7	220	26.4	262	30.3	305	34.5	347	38.6
53	12.2	95	15.6	137	19.1	179	22.8	221	26.5	263	30.4	306	34.6	348	38.7
54	12.3	96	15.7	138	19.2	180	22.9	222	26.6	264	30.5	307	34.7	349	38.8
55	12.4	97	15.8	139	19.3	181	22.9	223	26.7	265	30.6	308	34.7	350	38.9
56	12.5	98	15.9	140	19.4	182	23.0	224	26.8	266	30.7	309	34.8	351	39.0
57	12.5	99	15.9	141	19.5	183	23.1	225	26.9	267	30.8	310	34.9	352	39.1
58	12.6	100	16.0	142	19.6	184	23.2	226	27.0	268	30.9	311	35.0	353	39.2
59	12.7	101	16.1	143	19.6	185	23.3	227	27.1	269	31.0	312	35.1	354	39.3
60	12.8	102	16.2	144	19.7	186	23.4	228	27.2	270	31.1	313	35.2	355	39.4
61	12.9	103	16.3	145	19.8	187	23.5	229	27.3	271	31.2	314	35.3	356	39.5

AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)	AC (mm)	MA (wks)
62	12.9	104	16.4	146	19.9	188	23.6	230	27.4	272	31.3	315	35.4	357	39.6
63	13.0	105	16.4	147	20.0	189	23.7	231	27.5	273	31.4	316	35.5	358	39.7
64	13.1	106	16.5	148	20.1	190	23.7	232	27.5	274	31.5	317	35.6	359	39.8
65	13.2	107	16.6	149	20.2	191	23.8	233	27.6	275	31.6	318	35.7	360	39.9
66	13.3	108	16.7	150	20.2	192	23.9	234	27.7	276	31.7	319	35.8	361	40.0
67	13.3	109	16.8	151	20.3	193	24.0	235	27.8	277	31.8	320	35.9	362	40.1
68	13.4	110	16.9	152	20.4	194	24.1	236	27.9	278	31.9	321	36.0	363	40.2
69	13.5	111	16.9	153	20.5	195	24.2	237	28.0	279	32.0	322	36.1	364	40.3
70	13.6	112	17.0	154	20.6	196	24.3	238	28.1	280	32.0	323	36.2	365	40.4
71	13.7	113	17.1	155	20.7	197	24.4	239	28.2	281	32.1	324	36.3	366	40.5
72	13.7	114	17.2	156	20.8	198	24.5	240	28.3	282	32.2	325	36.4	367	40.6
73	13.8	115	17.3	157	20.8	199	24.6	241	28.4	283	32.3	326	36.5	368	40.7
74	13.9	116	17.4	158	20.9	200	24.6	242	28.5	284	32.4	327	36.6	369	40.8
75	14.0	117	17.4	159	21.0	201	24.7	243	28.6	285	32.5	328	36.7	370	40.9
76	14.1	118	17.5	160	21.1	202	24.8	244	28.7	286	32.6	329	36.8	371	41.0
77	14.2	119	17.6	161	21.2	203	24.9	245	28.7	287	32.7	330	36.9	372	41.1
78	14.2	120	17.7	162	21.3	204	25.0	246	28.8	288	32.8	331	37.0	373	41.2
79	14.3	121	17.8	163	21.4	205	25.1	247	28.9	289	32.9	332	37.1	374	41.3
80	14.4	122	17.9	164	21.5	206	25.2	248	29.0	290	33.0	333	37.2	375	41.4
81	14.5	123	17.9	165	21.5	207	25.3	249	29.1	291	33.1	334	37.3	376	41.5
82	14.6	124	18.0	166	21.6	208	25.4	250	29.2	292	33.2	335	37.4	377	41.6
83	14.6	125	18.1	167	21.7	209	25.5	251	29.3	293	33.3	336	37.5	378	41.7
84	14.7	126	18.2	168	21.8	210	25.5	252	29.4	294	33.4	337	37.6	379	41.8
85	14.8	127	18.3	169	21.9	211	25.6	253	29.5	295	33.5	338	37.7	380	42.0
86	14.9	128	18.4	170	22.0	212	25.8	254	29.6	296	33.6	339	37.8		
87	15.0	129	18.5	171	22.1	213	25.8	255	29.7	297	33.7	340	37.9		
88	15.0	130	18.5	172	22.2	214	25.9	256	29.8	298	33.8	341	38		
89	15.1	131	18.6	173	22.2	215	26.0	257	29.9	300	34.0	342	38.1		
90	15.2	132	18.7	174	22.3	216	26.1	258	30.0	301	34.1	343	38.2		
91	15.3	133	18.8	175	22.4	217	26.2	259	30.1	302	34.2	344	38.3		
92	15.4	134	18.9	176	22.5	218	26.3	260	30.2	303	34.3	345	38.4		

**BPD Chart, Hadlock, 12.1 - 41.6 weeks**

BPD (mm)	MA (weeks)	BPD (mm)	MA (weeks)	BPD (mm)	MA (weeks)
15	12.1	44	19.3	73	29.3
16	12.3	45	19.6	74	29.7
17	12.5	46	19.9	75	30.1
18	12.8	47	20.2	76	30.5
19	13.0	48	20.5	77	30.9
20	13.2	49	20.8	78	31.3
21	13.4	50	21.1	79	31.7
22	13.6	51	21.5	80	32.1
23	13.8	52	21.8	81	32.5

BPD (mm)	MA (weeks)	BPD (mm)	MA (weeks)	BPD (mm)	MA (weeks)
24	14.1	53	22.1	82	33.0
25	14.3	54	22.4	83	33.4
26	14.5	55	22.8	84	33.8
27	14.8	56	23.1	85	34.2
28	15.0	57	23.4	86	34.7
29	15.2	58	23.8	87	35.1
30	15.5	59	24.1	88	35.6
31	15.7	60	24.5	89	36.0
32	16.0	61	24.8	90	36.5
33	16.3	62	25.2	91	36.9
34	16.5	63	25.5	92	37.4
35	16.8	64	25.9	93	37.8
36	17.0	65	26.3	94	38.3
37	17.3	66	26.6	95	38.7
38	17.6	67	27.0	96	39.2
39	17.9	68	27.4	97	39.7
40	18.1	69	27.7	98	40.2
41	18.4	70	28.1	99	40.6
42	18.7	71	28.5	100	41.1
43	19.0	72	28.9	101	41.6

**CRL Chart, Hadlock, 5.7 - 18 weeks**

CRL (mm)	Menstrual Age	CRL (mm)	Menstrual Age	CRL (mm)	Menstrual Age
2	5.7	42	11.1	82	14.2
3	5.9	43	11.2	83	14.2
4	6.1	44	11.2	84	14.3
5	6.2	45	11.3	85	14.4
6	6.4	46	11.4	86	14.5
7	6.6	47	11.5	87	14.6
8	6.7	48	11.6	88	14.7
9	6.9	49	11.7	89	14.8
10	7.1	50	11.7	90	14.9
11	7.2	51	11.8	91	15.0
12	7.4	52	11.9	92	15.1
13	7.5	53	12.0	93	15.2
14	7.7	54	12.0	94	15.3
15	7.9	55	12.1	95	15.3
16	8.0	56	12.2	96	15.4
17	8.1	57	12.3	97	15.5
18	8.3	58	12.3	98	15.6
19	8.4	59	12.4	99	15.7
20	8.6	60	12.5	100	15.9
21	8.7	61	12.6	101	16.0

CRL (mm)	Menstrual Age	CRL (mm)	Menstrual Age	CRL (mm)	Menstrual Age
22	8.9	62	12.6	102	16.1
23	9.9	63	12.7	103	16.2
24	9.1	64	12.8	104	16.3
25	9.2	65	12.8	105	16.4
26	9.4	66	12.9	106	16.5
27	9.5	67	13.0	107	16.6
28	9.6	68	13.1	108	16.7
29	9.7	69	13.1	109	16.8
30	9.9	70	13.2	110	16.9
31	10.0	71	13.3	111	17.0
32	10.1	72	13.4	112	17.1
33	10.2	73	13.4	113	17.2
34	10.3	74	13.5	114	17.3
35	10.4	75	13.6	115	17.4
36	10.5	76	13.7	116	17.5
37	10.6	77	13.8	117	17.6
38	10.7	78	13.8	118	17.7
39	10.8	79	13.9	119	17.8
40	10.9	80	14.0	120	17.9
41	11.0	81	14.1	121	18.0

FL Chart, Hadlock, 12.2 - 42 weeks

FL (mm)	MA (weeks)	FL (mm)	MA (weeks)	FL (mm)	MA (weeks)
7	12.2	33	20.3	58	30.3
8	12.4	34	20.7	59	30.8
9	12.7	35	21.0	60	31.2
10	13.0	36	21.4	61	31.7
11	13.3	37	21.8	62	32.1
12	13.5	38	22.2	63	32.6
13	13.8	39	22.5	64	33.1
14	14.1	40	22.9	65	33.5
16	14.4	41	23.3	66	34.0
17	14.7	42	23.7	67	34.5
18	15.3	43	24.1	68	34.9
19	15.6	44	24.5	69	35.4
20	16.0	45	24.9	70	35.9
21	16.3	46	25.3	71	36.4
22	16.6	47	25.7	72	36.9
23	16.9	48	26.1	73	37.4
24	17.2	49	26.5	74	37.9
25	17.6	50	26.9	75	38.4
26	17.9	51	27.3	76	38.9
27	18.2	52	27.7	77	39.4
28	18.6	53	28.2	78	39.9
29	18.9	54	28.6	79	40.4



FL (mm)	MA (weeks)	FL (mm)	MA (weeks)	FL (mm)	MA (weeks)
30	19.3	55	29.0	80	40.9
31	19.6	56	29.5	81	41.4
32	20.0	57	29.9	82	42.0

**GSD, Hansmann - 6.0 - 14.0 weeks**

Sac (mm)	Menstrual Age (weeks + days)	Sac (mm)	Menstrual Age (weeks + days)	Sac (mm)	Menstrual Age (weeks + days)
10	5 + 6	30	8 + 5	50	11 + 3
11	5 + 7	31	8 + 6	51	11 + 4
12	6 + 1	32	8 + 7	52	11 + 5
13	6 + 2	33	9 + 1	53	11 + 6
14	6 + 3	34	9 + 2	54	11 + 7
15	6 + 4	35	9 + 3	55	12 + 1
16	6 + 5	36	9 + 4	56	12 + 2
17	6 + 6	37	9 + 4	57	12 + 3
18	6 + 7	38	9 + 5	58	12 + 4
19	7 + 1	39	9 + 6	59	12 + 5
20	7 + 2	40	9 + 7	60	12 + 6
21	7 + 3	41	10 + 1	61	12 + 7
22	7 + 4	42	10 + 2	62	13 + 1
23	7 + 5	43	10 + 3	63	13 + 2
24	7 + 6	44	10 + 4	64	13 + 3
25	7 + 7	45	10 + 5	65	13 + 4
26	8 + 1	46	10 + 6	66	13 + 5
27	8 + 2	47	10 + 7	67	13 + 6
28	8 + 3	48	11 + 1	68	13 + 7
29	8 + 4	49	11 + 2		

**HC Chart, Hadlock, 12.2-41.9 weeks**

HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)
56	12.0	94	14.3	132	16.8	170	19.6	208	22.9	246	26.7	284	31.2	322	36.4
57	12.1	95	14.3	133	16.8	171	19.7	209	23.0	247	26.8	285	31.3	323	36.5
58	12.2	96	14.4	134	16.9	172	19.8	210	23.1	248	26.9	286	31.4	324	36.7
59	12.2	97	14.5	135	17.0	173	19.9	211	23.2	249	27.0	287	31.5	325	36.8
60	12.3	98	14.5	136	17.1	174	19.9	212	23.3	250	27.1	288	31.7	326	37.0
61	12.3	99	14.6	137	17.1	175	20.0	213	23.4	251	27.3	289	31.8	327	37.1
62	12.4	100	14.7	138	17.2	176	20.1	214	23.5	252	27.4	290	31.9	328	37.3
63	12.4	101	14.7	139	17.3	177	20.2	215	23.6	253	27.5	291	32.1	329	37.4
64	12.5	102	14.8	140	17.3	178	20.3	216	23.6	254	27.6	292	32.2	330	37.6
65	12.6	103	14.8	141	17.4	179	20.3	217	23.7	255	27.7	293	32.3	331	37.7
66	12.6	104	14.9	142	17.5	180	20.4	218	23.8	256	27.8	294	32.5	332	37.9
67	12.7	105	15.0	143	17.6	181	20.5	219	23.9	257	27.9	295	32.6	333	38.0

HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)	HC (mm)	MA (wks)
68	12.7	106	15.0	144	17.6	182	20.6	220	24.0	258	28.0	296	32.7	334	38.2
69	12.8	107	15.1	145	17.7	183	20.7	221	24.1	259	28.2	297	32.9	335	38.3
70	12.8	108	15.2	146	17.8	184	20.8	222	24.2	260	28.3	298	33.0	336	38.5
71	12.9	109	15.2	147	17.9	185	20.8	223	24.3	261	28.4	299	33.1	337	38.6
72	13.0	110	15.3	148	17.9	186	20.9	224	24.4	262	28.5	300	33.3	338	38.8
73	13.0	111	15.4	149	18.0	187	21.0	225	24.5	263	28.6	301	33.4	339	39.0
74	13.1	112	15.4	150	18.1	188	21.1	226	24.6	264	28.7	302	33.5	340	39.1
75	13.1	113	15.5	151	18.1	189	21.2	227	24.7	265	28.9	303	33.7	341	39.3
76	13.2	114	15.6	152	18.2	190	21.3	228	24.8	266	29.0	304	33.8	342	39.4
77	13.3	115	15.6	153	18.3	191	21.4	229	24.9	267	29.1	305	33.9	343	39.6
78	13.3	116	15.7	154	18.4	192	21.5	230	25.0	268	29.2	306	34.1	344	39.7
79	13.4	117	15.8	155	18.4	193	21.5	231	25.1	269	29.3	307	34.2	345	39.9
80	13.4	118	15.8	156	18.5	194	21.6	232	25.2	270	29.4	308	34.4	346	40.1
81	13.5	119	15.9	157	18.6	195	21.7	233	25.3	271	29.6	309	34.5	347	40.2
82	13.6	120	16.0	158	18.7	196	21.8	234	25.4	272	29.7	310	34.6	348	40.4
83	13.6	121	16.0	159	18.8	197	21.9	235	25.5	273	29.8	311	34.8	349	40.6
84	13.7	122	16.1	160	18.8	198	22.0	236	25.6	274	29.9	312	34.9	350	40.7
85	13.7	123	16.2	161	18.9	199	22.1	237	25.8	275	30.0	313	35.1	351	40.9
86	13.8	124	16.2	162	19.0	200	22.2	238	25.9	276	30.2	314	35.2	352	41.1
87	13.9	125	16.3	163	19.1	201	22.3	239	26.0	277	30.3	315	35.3	353	41.2
88	13.9	126	16.4	164	19.1	202	22.3	240	26.1	278	30.4	316	35.5	354	41.4
89	14.0	127	16.4	165	19.2	203	22.4	241	26.2	279	30.5	317	35.6	355	41.6
90	14.0	128	16.5	166	19.3	204	22.5	242	26.3	280	30.7	318	35.8	356	41.7
91	14.1	129	16.6	167	19.4	205	22.6	243	26.4	281	30.8	319	35.9	357	41.9
92	14.2	130	16.6	168	19.5	206	22.7	244	26.5	282	30.9	320	36.1		
93	14.2	131	16.7	169	19.5	207	22.8	245	26.6	283	31.0	321	36.2		

HL Chart, Jeanty, 12.6 - 40.1 weeks

HL (mm)	MA (weeks)	HL (mm)	MA (weeks)	HL (mm)	MA (weeks)
10	12.57	30	19.86	50	29.29
11	12.86	31	20.29	51	29.86
12	13.14	32	20.71	52	30.29
13	13.57	33	21.14	53	30.86
14	13.86	34	21.57	54	31.43
15	14.14	35	22.00	55	32.00
16	14.57	36	22.57	56	32.57
17	14.86	37	22.86	57	33.14
18	15.14	38	23.43	58	33.57
19	15.57	39	23.86	59	34.14
20	15.86	40	24.29	60	34.86
21	16.29	41	24.86	61	35.29
22	16.71	42	25.29	62	35.86
23	17.14	43	25.71	63	36.57

<b>HL (mm)</b>	<b>MA (weeks)</b>	<b>HL (mm)</b>	<b>MA (weeks)</b>	<b>HL (mm)</b>	<b>MA (weeks)</b>
24	17.43	44	26.14	64	37.14
25	17.86	45	26.71	65	37.71
26	18.14	46	27.14	66	38.29
27	18.57	47	27.71	67	38.86
28	19.00	48	28.14	68	39.57
29	19.43	49	28.86	69	40.14

## Appendix E Electromagnetic Compatibility Tables

This appendix provides reference tables for emissions and immunity requirements.

The Terason Ultrasound System is intended for use in the electromagnetic environment specified in the following tables. The customer or user of the Terason system should ensure that it is used in such an environment.

### Compatibility for All Equipment

**Guidance and Manufacturer's Declaration—Electromagnetic Emissions—For All Equipment and Systems (Table 201 from EN 60601-1-2:2001)**

Emissions Test	Compliance	Electromagnetic Environment - Guidance
RF Emissions CISPR 11	Group 1	The Terason Ultrasound System uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions CISPR 11	Class B	The Terason Ultrasound System is suitable for use in all establishments, including domestic, and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonics IEC 61000-3-2	Class A	
Flicker IEC 61000-3-3	Complies	

**Guidance and Manufacturer's Declaration—Electromagnetic Immunity—For All Equipment and Systems (Table 202 from EN 60601-1-2:2001)**

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment - Guidance
ESD IEC 61000-4-2	±6kV Contact ±8kV Air	±6kV Contact ±8kV Air	Floors should be wood, concrete or ceramic tile. If floors are synthetic, the relative humidity should be at least 30%

**Guidance and Manufacturer's Declaration—Electromagnetic Immunity—For All Equipment and Systems  
(Table 202 from EN 60601-1-2:2001) (Continued)**

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment - Guidance
EFT IEC 61000-4-4	$\pm 2$ kV Mains $\pm 1$ kV I/Os	$\pm 2$ kV Mains $\pm 1$ kV I/Os	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	$\pm 1$ kV Differential $\pm 2$ kV Common	$\pm 1$ kV Differential $\pm 2$ kV Common	
Voltage Dips/ Dropout IEC 61000-4-11	>95% Dip for 0.5 Cycle 60% Dip for 5 Cycles 30% Dip for 25 Cycles > 95% Dip for 5 Seconds	>95% Dip for 0.5 Cycle 60% Dip for 5 Cycles 30% Dip for 25 Cycles > 95% Dip for 5 Seconds	Mains power quality should be that of a typical commercial or hospital environment. The unit continues to operate during a 5-second loss of power. However, if the user of the Terason Ultrasound System requires continued operation during a longer power outage, Using an uninterruptible power supply to power the Terason system is recommended.
Power Frequency 50/60 Hz Magnetic Field IEC 61000-4-8	3A/m	3A/m	Power Frequency magnetic fields should be that of a typical commercial or hospital environment.

## Compatibility for Non-Life-Supporting Equipment

Guidance and Manufacturer's Declaration—Electromagnetic Immunity—For Equipment and Systems That Are Not Life Supporting (Table 204 from EN 60601-1-2:2001)

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment - Guidance
Conducted RF IEC 61000-4-6	3 Vrms	$[V_1] = 3 \text{ Vrms}$	Portable and mobile communications equipment should be separated from the Terason Ultrasound System by no less than the distances calculated/listed below $d = \left[ \frac{3.5}{V_1} \right] \sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	$[E_1] = 3 \text{ V/m}$	$d = \left[ \frac{3.5}{E_1} \right] \sqrt{P} \quad 80 \text{ to } 800 \text{ MHz}$ $d = \left[ \frac{7}{E_1} \right] \sqrt{P} \quad 800 \text{ MHz to } 2.5 \text{ GHz}$ where $P$ is the max power in watts and $d$ is the recommended separation distance in meters. Field strengths from fixed transmitters, as determined by an electromagnetic site survey, should be less than the compliance levels ( $V_1$ and $E_1$ ). Interference may occur in the vicinity of equipment containing a transmitter.

**Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Terason Ultrasound System and Systems that Are Not Life-Supporting**

Rated Maximum Output Power of Transmitter Watts (W)	Separation Distance According to Frequency of Transmitter Meters (m)		
	IEC 61000-4-6	IEC 61000-4-3	
	150 kHz to 80 MHz	80 MHz to 800 MHz	800 MHz to 2.5 GHz
	$1.1667 \sqrt{P}$	$1.1667 \sqrt{P}$	$2.3333 \sqrt{P}$
0.01	0.11667 m	0.11667 m	0.233 m
0.1	0.36894 m	0.36894 m	0.737 m
1	1.1667 m	1.1667 m	2.33 m
10	3.6894 m	3.6894 m	7.37 m
100	11.667 m	11.667 m	23.3 m

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



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**Note:** At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

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

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## **Appendix F    Acoustic Output Reporting for Track 3**

This appendix contains tables that display the Acoustic Output Reporting for Track 3. Tables are shown for the scanning modes for the following transducers:

- 4V2
- 5C2A
- 7L3V
- 8EC4 (t3000 only)
- 12HL7 (t3000 only)
- 12L5V

The tables are in two sections:

- [Acoustic Output Tables for t3000 Systems](#), see page 321
- [Acoustic Output Tables for Echo Systems](#), see page 335



## Acoustic Output Tables for t3000 Systems

Acoustic Output Reporting Table for Track 3 for the 4V2 Transducer  
(Terason t3000 Ultrasound System in 2D Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0)									
Transducer Model: 4V2 Operating Mode: 2D									
Index Label			M I	TIS		TIB	TIC		
				scan	non-scan			non-scan	
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1			
Global Maximum Index Value			1.10	1.04	–	–	–	2.17	
Associated Acoustic Parameter	Pr,3	(MPa)	1.56						
	W <sub>o</sub>	(mW)		109.81	–		–	109.81	
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA-3</sub> (Z <sub>1</sub> )]		(mW)				–		
	Z <sub>1</sub>		(cm)				–		
	Z <sub>bp</sub>		(cm)				–		
	Z <sub>sp</sub>		(cm)	4.90				–	
	d <sub>eq</sub> (Z <sub>sp</sub> )		(cm)					–	
	f <sub>c</sub>		(MHz)	2.00	–	–	–	–	2.00
	Dim of A <sub>aprt</sub>		X (cm)		–	–	–	–	0.90
	Y (cm)			–	–	–	–	1.40	
Other Information	PD	(μsec)	0.94						
	PRF	(Hz)	54						
	pr@PII <sub>max</sub>	(MPa)	2.13						
	deq@PII <sub>max</sub>	(cm)					–		
	Focal Length	(cm)		–	–	–		3.0	
	IP <sub>A,3</sub> @ MI <sub>max</sub>	(W/cm2)	112.28						
Operating Control Conditions	Control 1		X						
	Control 2			X				X	
	Control 3								
	Control n								

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 4V2 Transducer (Terason t3000 Ultrasound System in M-Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 4V2 Operating Mode: M-Mode								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			1.10	<1.0	–	(c)	<1.0	2.10
Associated Acoustic Parameter	Pr.3 (MPa)		1.56					
	W <sub>o</sub> (mW)			#	–		#	155.57
	min of [W.3(Z <sub>1</sub> ), I <sub>TA-3</sub> (Z <sub>1</sub> )] (mW)					#		
	Z <sub>1</sub> (cm)					#		
	Z <sub>bp</sub> (cm)					#		
	Z <sub>sp</sub> (cm)		4.90				#	
	d <sub>eq</sub> (Z <sub>sp</sub> ) (cm)						#	
	f <sub>c</sub> (MHz)		2.00	-	-	#	#	2.00
	Dim of A <sub>aprt</sub> X (cm)			-	-	#	#	1.92
	Y (cm)			-	-	#	#	1.40
Other Information	PD (μsec)		0.94					
	PRF (Hz)		240					
	pr@Pllmax (MPa)		2.13					
	deq@Pllmax (cm)						#	
	Focal Length (cm)			#	–	#		7.0
	IP <sub>A.3</sub> @ MI <sub>max</sub> (W/cm2)		112.28					
Operating Control Conditions	Control 1		X					
	Control 2							X
	Control 3							
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 4V2 Transducer (Terason t3000 Ultrasound System in Color Flow Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 4V2 Operating Mode: Color Flow									
Index Label			M I	TIS		TIB	TIC		
				scan	non-scan			non-scan	
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1			
Global Maximum Index Value			(a)	1.47	–	–	(a)	2.26	
Associated Acoustic Parameter	Pr.3	(MPa)	#						
	W <sub>o</sub>	(mW)		114.69	–		#	114.69	
	min of [W.3(Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]		(mW)				–		
	Z <sub>1</sub>		(cm)				–		
	Z <sub>bp</sub>		(cm)				–		
	Z <sub>sp</sub>		(cm)	#				#	
	d <sub>eq</sub> (Z <sub>sp</sub> )		(cm)					#	
	f <sub>c</sub>		(MHz)	#	2.64	–	–	#	2.64
	Dim of A <sub>aprt</sub>		X (cm)		0.90	–	–	#	0.90
			Y (cm)		1.40	–	–	#	1.40
Other Information	PD	(μsec)	#						
	PRF	(Hz)	#						
	pr@PII <sub>max</sub>	(MPa)	#						
	deq@PII <sub>max</sub>	(cm)					#		
	Focal Length	(cm)		3.0	–	–		3.0	
	IP <sub>A.3</sub> @ MI <sub>max</sub>	(W/cm2)	#						
Operating Control Conditions	Control 1			X				X	
	Control 2								
	Control 3								
	Control n								

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 4V2 Transducer (Terason t3000 Ultrasound System in PWD Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 4V2 Operating Mode: Pulsed-Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	—	—	1.06	4.02	2.26
Associated Acoustic Parameter	P <sub>r,3</sub>	(MPa)	#					
	W <sub>o</sub>	(mW)		—	—		135.51	108.20
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA-3</sub> (Z <sub>1</sub> )]		(mW)			84.25		
	Z <sub>1</sub>	(cm)				2.50		
	Z <sub>bp</sub>	(cm)				2.50		
	Z <sub>sp</sub>	(cm)	#				4.80	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					0.39	
	f <sub>c</sub>	(MHz)	#	-	-	2.65	2.00	2.64
	Dim of A <sub>aprt</sub>	X (cm)		-	-	1.56	1.56	0.90
	Y (cm)		—	—	1.40	1.40	1.40	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII <sub>max</sub>	(MPa)	#					
	deq@PII <sub>max</sub>	(cm)					0.37	
	Focal Length	(cm)		—	—	7.0		3.0
	IP <sub>A,3</sub> @ MI <sub>max</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1					X		
	Control 2						X	
	Control 3							X
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 4V2 Transducer (Terason t3000 Ultrasound System in Continuous-Wave Doppler Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 4V2 Operating Mode: Continuous-Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	–	–	<1.0	4.03	2.44
Associated Acoustic Parameter	Pr,3	(MPa)	#					
	W <sub>o</sub>	(mW)		–	–		117.33	117.33
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA-3</sub> (Z <sub>1</sub> )]		(mW)			#		
	Z <sub>1</sub>	(cm)				#		
	Z <sub>bp</sub>	(cm)				#		
	Z <sub>sp</sub>	(cm)	#				1.80	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					0.51	
	f <sub>c</sub>	(MHz)	#	–	–	#	2.00	2.00
	Dim of A <sub>aprt</sub>	X (cm)		–	–	#	0.81	0.81
		Y (cm)		–	–	#	1.40	1.40
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII <sub>max</sub>	(MPa)	#					
	deq@PII <sub>max</sub>	(cm)					0.50	
	Focal Length	(cm)		–	–	#		4.0
	IP <sub>A,3</sub> @ MI <sub>max</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1						X	X
	Control 2							
	Control 3							
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 5C2A Transducer (Terason t3000 Ultrasound System in Pulsed-Wave Doppler Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 5C2A Operating Mode: Pulsed-Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	-	1.32	(c)	3.51	(b)
Associated Acoustic Parameter	p <sub>r,3</sub>	(MPa)	#					
	W <sub>o</sub>	(mW)		-	86.96		99.47	#
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA-3</sub> (Z <sub>1</sub> )]	(mW)				#		
	Z <sub>1</sub>	(cm)				#		
	Z <sub>bp</sub>	(cm)				#		
	Z <sub>sp</sub>	(cm)	#				3.57	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					0.39	
	f <sub>c</sub>	(MHz)	#	-	3.17	#	2.00	#
	Dim of A <sub>aprt</sub>	X (cm)		-	0.80	#	1.20	#
	Y (cm)		-	1.20	#	1.20	#	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@P <sub>llmax</sub>	(MPa)	#					
	deq@P <sub>llmax</sub>	(cm)					0.37	
	Focal Length	(cm)		4.00	-	#		#
	IP <sub>A,3</sub> @ M <sub>lmax</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1			X				
	Control 2					X		
	Control 3							
	Control n							

**Note:** Maximum free air surface temperature of the lens is 44.5° C for this operating mode)

(a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 5C2A Transducer (Terason t3000 Ultrasound System in Color Flow Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 5C2A Operating Mode: Color Flow								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	2.17	–	(c)	(a)	(b)
Associated Acoustic Parameter	p <sub>r,3</sub>	(MPa)	#					
	W <sub>o</sub>	(mW)		141.92	–		#	#
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA-3</sub> (Z <sub>1</sub> )]	(mW)				#		
	Z <sub>1</sub>	(cm)				#		
	z <sub>bp</sub>	(cm)				#		
	z <sub>sp</sub>	(cm)	#				#	
	d <sub>eq</sub> (z <sub>sp</sub> )	(cm)					#	
	f <sub>c</sub>	(MHz)	#	3.17	–	#	#	#
	Dim of A <sub>aprt</sub>	X (cm)		1.00	–	#	#	#
	Y (cm)		1.20	–	#	#	#	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@P <sub>llmax</sub>	(MPa)	#					
	deq@P <sub>llmax</sub>	(cm)					#	
	Focal Length	(cm)		4.00	-	#		#
	IP <sub>A,3</sub> @ M <sub>lmax</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1			X				
	Control 2							
	Control 3							
	Control n							

**Note:** Maximum free air surface temperature of the lens is 42.3° C for this operating mode)

(a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 7L3V Transducer (Terason t3000 Ultrasound System in Pulsed-Wave Doppler Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 7L3V Operating Mode: Pulsed-Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	—	2.36	(c)	3.04	3.13
Associated Acoustic Parameter	p <sub>r,3</sub>	(MPa)	#					
	W <sub>o</sub>	(mW)		—	99.63		75.97	44.98
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA-3</sub> (Z <sub>1</sub> )]	(mW)				#		
	Z <sub>1</sub>	(cm)				#		
	Z <sub>bp</sub>	(cm)				#		
	Z <sub>sp</sub>	(cm)	#				3.12	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					0.29	
	f <sub>c</sub>	(MHz)	#	—	4.97	#	3.02	3.98
	Dim of A <sub>aprt</sub>	X (cm)		—	1.29	#	1.11	0.15
	Y (cm)		—	0.70	#	0.70	0.70	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII <sub>max</sub>	(MPa)	#					
	deq@PII <sub>max</sub>	(cm)					0.28	
	Focal Length	(cm)		—	8.00	#		0.80
	IP <sub>A,3</sub> @ MI <sub>max</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1				X			
	Control 2						X	X
	Control 3							
	Control n							

**Note:** Maximum free air surface temperature of the lens is 41.1° C for this operating mode)

(a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.



Acoustic Output Reporting Table for Track 3 for the 7L3V Transducer (Terason t3000 Ultrasound System in Color Flow Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 7L3V Operating Mode: Color Flow								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	2.62	–	(c)	(a)	3.13
Associated Acoustic Parameter	p <sub>r,3</sub>	(MPa)	#					
	W <sub>o</sub>	(mW)		109.93	–		#	109.93
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]	(mW)				#		
	Z <sub>1</sub>	(cm)				#		
	Z <sub>bp</sub>	(cm)				#		
	Z <sub>sp</sub>	(cm)	#				#	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					#	
	f <sub>c</sub>	(MHz)	#	4.99	–	#	#	4.99
	Dim of A <sub>aprt</sub>	X (cm)		0.87	–	#	#	0.87
	Y (cm)		0.70	–	#	#	0.70	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@P <sub>llmax</sub>	(MPa)	#					
	deq@P <sub>llmax</sub>	(cm)					#	
	Focal Length	(cm)		1.50	–	#		1.50
	IP <sub>A.3</sub> @ MI <sub>max</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1			X				X
	Control 2							
	Control 3							
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 8EC4 Transducer (Terason t3000 Ultrasound System in Pulsed-Wave Doppler Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 8EC4 Operating Mode: Pulsed-Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	—	1.02	(c)	2.12	(b)
Associated Acoustic Parameter	p <sub>r,3</sub>	(MPa)	#					
	W <sub>o</sub>	(mW)		—	42.79		31.52	#
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]	(mW)				#		
	Z <sub>1</sub>	(cm)				#		
	Z <sub>bp</sub>	(cm)				#		
	Z <sub>sp</sub>	(cm)	#				1.83	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					0.20	
	f <sub>c</sub>	(MHz)	#	—	4.98	#	4.00	#
	Dim of A <sub>aprt</sub>	X (cm)		—	1.11	#	0.55	#
	Y (cm)		—	0.70	#	0.70	#	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@P <sub>Ilmax</sub>	(MPa)	#					
	deq@P <sub>Ilmax</sub>	(cm)					0.20	
	Focal Length	(cm)		—	6.0	#		#
	IP <sub>A.3</sub> @ M <sub>lmax</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1				X			
	Control 2						X	
	Control 3							
	Control n							

**Note:** Maximum free air surface temperature of the lens is 41.1° C for this operating mode)

(a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 8EC4 Transducer (Terason t3000 Ultrasound System in Color Flow Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 8EC4 Operating Mode: Color Flow								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	1.19	–	–	(a)	(b)
Associated Acoustic Parameter	p <sub>r,3</sub>	(MPa)	#					
	W <sub>o</sub>	(mW)		50.08	–		#	#
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]	(mW)				–		
	Z <sub>1</sub>	(cm)				–		
	Z <sub>bp</sub>	(cm)				–		
	Z <sub>sp</sub>	(cm)	#				#	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					#	
	f <sub>c</sub>	(MHz)	#	4.98	–	–	#	#
	Dim of A <sub>aprt</sub>	X (cm)		0.78	–	–	#	#
	Y (cm)		0.70	–	–	#	#	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII <sub>max</sub>	(MPa)	#					
	deq@PII <sub>max</sub>	(cm)					#	
	Focal Length	(cm)		2.5	–	–		#
	IP <sub>A.3</sub> @ MI <sub>max</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1			X				
	Control 2							
	Control 3							
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 12HL7 Transducer (Terason t3000 Ultrasound System in Pulsed-Wave Doppler Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 12HL7 Operating Mode: Pulsed-Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	–	< 1.0	(c)	1.40	(b)
Associated Acoustic Parameter	p <sub>r,3</sub>	(MPa)	#					
	W <sub>o</sub>	(mW)		–	#		10.65	#
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]	(mW)				#		
	Z <sub>1</sub>	(cm)				#		
	Z <sub>bp</sub>	(cm)				#		
	Z <sub>sp</sub>	(cm)	#				0.85	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					0.12	
	f <sub>c</sub>	(MHz)	#	–	#	#	6.03	#
	Dim of A <sub>aprt</sub>	X (cm)		–	#	#	0.38	#
	Y (cm)		–	#	#	0.35	#	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@P <sub>llmax</sub>	(MPa)	#					
	deq@P <sub>llmax</sub>	(cm)					0.12	
	Focal Length	(cm)		–	#	#		0.80
	IP <sub>A.3</sub> @ M <sub>lmax</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1						X	
	Control 2							
	Control 3							
	Control n							

**Note:** Maximum free air surface temperature of the lens is 41.1° C for this operating mode)

(a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 12L5V Transducer (Terason t3000 Ultrasound System in Color Flow Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 12L5V Operating Mode: Color Flow								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	1.91	–	(c)	(a)	2.28
Associated Acoustic Parameter	P <sub>r,3</sub>	(MPa)	#					
	W <sub>o</sub>	(mW)		67.77	–		#	67.77
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]	(mW)				#		
	Z <sub>1</sub>	(cm)				#		
	Z <sub>bp</sub>	(cm)				#		
	Z <sub>sp</sub>	(cm)	#				#	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					#	
	f <sub>c</sub>	(MHz)	#	5.91	–	#	#	5.91
	Dim of A <sub>aprt</sub>	X (cm)		0.87	–	#	#	0.87
	Y (cm)		0.50	–	#	#	0.50	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@P <sub>llmax</sub>	(MPa)	#					
	deq@P <sub>llmax</sub>	(cm)					#	
	Focal Length	(cm)		1.30	–	#		1.30
	IP <sub>A.3</sub> @ MI <sub>max</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1			X				X
	Control 2							
	Control 3							
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 12L5V Transducer (Terason t3000 Ultrasound System in Pulsed-Wave Doppler Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 12L5V Operating Mode: Pulsed-Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					Aaprt≤1	Aaprt>1		
Global Maximum Index Value			(a)	-	2.01	(c)	2.31	2.38
Associated Acoustic Parameter	pr.3 (MPa)		#					
	Wo (mW)			-	63.97		49.66	27.29
	min of [W.3(z1), ITA.3(z1)] (mW)					#		
	z1 (cm)					#		
	zbp (cm)					#		
	zsp (cm)		#				1.43	
	deq(zsp) (cm)						0.30	
	fc (MHz)		#	-	6.65	#	5.01	5.95
	Dim of Aaprt X (cm)			-	1.29	#	0.90	0.12
	Y (cm)			-	0.50	#	0.50	0.50
Other Information	PD (µsec)		#					
	PRF (Hz)		#					
	pr@Pllmax (MPa)		#					
	deq@Pllmax (cm)						0.24	
	Focal Length (cm)			-	6.50	-		0.60
	IPA.3 @ Mlmax (W/cm2)		#					
Operating Control Conditions	Control 1				X			
	Control 2						X	
	Control 3							X
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

## Acoustic Output Tables for Echo Systems

Acoustic Output Reporting Table for Track 3 for the 4V2 Transducer (Terason Echo Ultrasound System in 2D Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0)									
Transducer Model: 4V2 Operating Mode: 2D									
Index Label			M I	TIS		TIB	TIC		
				scan	non-scan			non-scan	
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1			
Global Maximum Index Value			1.70	1.26	–	–	–	2.25	
Associated Acoustic Parameter	Pr,3	(MPa)	2.41						
	W <sub>o</sub>	(mW)		113.82	–		–	113.82	
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]		(mW)				–		
	Z <sub>1</sub>		(cm)				–		
	Z <sub>bp</sub>		(cm)				–		
	Z <sub>sp</sub>		(cm)	4.90				–	
	d <sub>eq</sub> (Z <sub>sp</sub> )		(cm)					–	
	f <sub>c</sub>		(MHz)	2.00	2.33	–	–	–	2.33
	Dim of A <sub>aprt</sub>		X (cm)		0.90	–	–	–	0.90
			Y (cm)		1.40	–	–	–	1.40
Other Information	PD	(μsec)	1.41						
	PRF	(Hz)	30						
	pr@PII <sub>max</sub>	(MPa)	3.28						
	deq@PII <sub>max</sub>	(cm)					–		
	Focal Length	(cm)		3.0	–	–		3.0	
	IP <sub>A.3</sub> @ MI <sub>max</sub>	(W/cm2)	266.67						
Operating Control Conditions	Control 1		X						
	Control 2			X				X	
	Control 3								
	Control n								

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 4V2 Transducer (Terason Echo Ultrasound System in M-Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0)								
Transducer Model: 4V2 Operating Mode: M-Mode								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			1.70	1.10	–	(c)	<1.0	2.13
Associated Acoustic Parameter	Pr,3	(MPa)	2.41					
	W <sub>o</sub>	(mW)		116.74	–		–	157.89
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]	(mW)				#		
	Z <sub>1</sub>	(cm)				#		
	Z <sub>bp</sub>	(cm)				#		
	Z <sub>sp</sub>	(cm)	4.90				#	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					#	
	f <sub>c</sub>	(MHz)	2.00	2.33	–	#	#	2.00
	Dim of A <sub>aprt</sub>	X (cm)		1.20	–	#	#	1.92
		Y (cm)		1.40	–	#	#	1.40
Other Information	PD	(μsec)	1.41					
	PRF	(Hz)	240					
	pr@PII <sub>max</sub>	(MPa)	3.28					
	deq@PII <sub>max</sub>	(cm)					#	
	Focal Length	(cm)		4.0	–	#		7.0
	IP <sub>A.3</sub> @ MI <sub>max</sub>	(W/cm2)	266.67					
Operating Control Conditions	Control 1		X					
	Control 2			X				
	Control 3							X
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.



Acoustic Output Reporting Table for Track 3 for the 4V2 Transducer (Terason Echo Ultrasound System in Color Flow Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 4V2 Operating Mode: Color Flow								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	1.47	–	–	(a)	2.27
Associated Acoustic Parameter	Pr.3 (MPa)		#					
	W <sub>o</sub> (mW)			114.76	–		#	114.76
	min of [W.3(Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )] (mW)					–		
	Z <sub>1</sub> (cm)					–		
	Z <sub>bp</sub> (cm)					–		
	Z <sub>sp</sub> (cm)		#				#	
	d <sub>eq</sub> (Z <sub>sp</sub> ) (cm)						#	
	f <sub>c</sub> (MHz)		#	2.64	–	–	#	2.64
	Dim of A <sub>aprt</sub> X (cm)			0.90	–	–	#	0.90
	Y (cm)			1.40	–	–	#	1.40
Other Information	PD (μsec)		#					
	PRF (Hz)		#					
	pr@PII <sub>max</sub> (MPa)		#					
	deq@PII <sub>max</sub> (cm)						#	
	Focal Length (cm)			3.0	–	–		3.0
	IP <sub>A.3</sub> @ MI <sub>max</sub> (W/cm2)		#					
Operating Control Conditions	Control 1			X				X
	Control 2							
	Control 3							
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 4V2 Transducer (Terason Echo Ultrasound System in Pulsed-Wave Doppler Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0)								
Transducer Model: 4V2 Operating Mode: Pulsed-Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	–	–	1.06	3.96	2.25
Associated Acoustic Parameter	Pr.3	(MPa)	#					
	W <sub>o</sub>	(mW)		–	–		125.50	108.49
	min of [W.3(Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]		(mW)			84.08		
	Z <sub>1</sub>	(cm)				2.50		
	Z <sub>bp</sub>	(cm)				2.50		
	Z <sub>sp</sub>	(cm)	#				4.23	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					0.40	
	f <sub>c</sub>	(MHz)	#	–	–	2.65	2.00	2.64
	Dim of A <sub>aprt</sub>	X (cm)		–	–	1.56	1.32	0.90
		Y (cm)		–	–	1.40	1.40	1.40
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII <sub>max</sub>	(MPa)	#					
	deq@PII <sub>max</sub>	(cm)					0.38	
	Focal Length	(cm)		–	–	7.0		3.0
	IP <sub>A.3</sub> @ MI <sub>max</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1					X		
	Control 2						X	
	Control 3							X
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 4V2 Transducer (Terason Echo Ultrasound System in Continuous-Wave Doppler Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0)								
Transducer Model: 4V2 Operating Mode: Continuous-Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	–	–	<1.0	4.03	2.44
Associated Acoustic Parameter	Pr.3	(MPa)	#					
	W <sub>o</sub>	(mW)		–	–		117.33	117.33
	min of [W.3(Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]		(mW)			#		
	Z <sub>1</sub>	(cm)				#		
	Z <sub>bp</sub>	(cm)				#		
	Z <sub>sp</sub>	(cm)	#				1.80	
	d <sub>eq</sub> (Z <sub>sp</sub> )	(cm)					0.51	
	f <sub>c</sub>	(MHz)	#	–	–	#	2.00	2.00
	Dim of A <sub>aprt</sub>	X (cm)		–	–	#	0.81	0.81
		Y (cm)		–	–	#	1.40	1.40
Other Information	PD	(µsec)	#					
	PRF	(Hz)	#					
	pr@PII <sub>max</sub>	(MPa)	#					
	deq@PII <sub>max</sub>	(cm)					0.50	
	Focal Length	(cm)		–	–	#		4.0
	IP <sub>A.3</sub> @ MI <sub>max</sub>	(W/cm2)	#					
Operating Control Conditions	Control 1						X	X
	Control 2							
	Control 3							
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 12L5V Transducer (Terason Echo Ultrasound System in 2D Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0)								
Transducer Model: 12L5V Operating Mode: 2D								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			<1.0	1.19	–	–	–	1.54
Associated Acoustic Parameter	Pr.3 (MPa)		2.41					
	W <sub>o</sub> (mW)			41.72	–		–	41.72
	min of [W.3(Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )] (mW)					–		
	Z <sub>1</sub> (cm)					–		
	Z <sub>bp</sub> (cm)					–		
	Z <sub>sp</sub> (cm)		#				–	
	d <sub>eq</sub> (Z <sub>sp</sub> ) (cm)						–	
	f <sub>c</sub> (MHz)		#	5.98	–	–	–	5.98
	Dim of A <sub>aprt</sub> X (cm)			0.72	–	–	–	0.72
Y (cm)			0.50	–	–	–	0.50	
Other Information	PD (μsec)		#					
	PRF (Hz)		#					
	pr@PII <sub>max</sub> (MPa)		#					
	deq@PII <sub>max</sub> (cm)						–	
	Focal Length (cm)			2.0	–	–		2.0
	IP <sub>A.3</sub> @ MI <sub>max</sub> (W/cm2)		#					
Operating Control Conditions	Control 1			X				X
	Control 2							
	Control 3							
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 12L5V Transducer (Terason Echo Ultrasound System in Color Flow Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 12L5V Operating Mode: Color Flow									
Index Label			M I	TIS		TIB	TIC		
				scan	non-scan			non-scan	
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1			
Global Maximum Index Value			(a)	1.90	–	–	(a)	2.61	
Associated Acoustic Parameter	Pr,3	(MPa)	#						
	W <sub>o</sub>	(mW)		67.17	–		#	51.87	
	min of [W <sub>.3</sub> (Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )]		(mW)			–			
	Z <sub>1</sub>		(cm)			–			
	Z <sub>bp</sub>		(cm)			–			
	Z <sub>sp</sub>		(cm)	#			#		
	d <sub>eq</sub> (Z <sub>sp</sub> )		(cm)				#		
	f <sub>c</sub>		(MHz)	#	5.91	–	–	#	5.81
	Dim of A <sub>aprt</sub>		X (cm)		0.87	–	–	#	0.39
			Y (cm)		0.50	–	–	#	1.50
Other Information	PD	(μsec)	#						
	PRF	(Hz)	#						
	pr@PII <sub>max</sub>	(MPa)	#						
	deq@PII <sub>max</sub>	(cm)					#		
	Focal Length	(cm)		1.3	–	–		0.6	
	IP <sub>A.3</sub> @ MI <sub>max</sub>	(W/cm2)	#						
Operating Control Conditions	Control 1			X					
	Control 2							X	
	Control 3								
	Control n								

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

Acoustic Output Reporting Table for Track 3 for the 12L5V Transducer (Terason Echo Ultrasound System in Pulsed-Wave Doppler Mode)

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0)								
Transducer Model: 12L5V Operating Mode: Pulsed-Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	–	1.98	–	2.25	2.40
Associated Acoustic Parameter	Pr.3 (MPa)		#					
	W <sub>o</sub> (mW)			–	62.64		51.94	38.18
	min of [W.3(Z <sub>1</sub> ), I <sub>TA.3</sub> (Z <sub>1</sub> )] (mW)					–		
	Z <sub>1</sub> (cm)					–		
	Z <sub>bp</sub> (cm)					–		
	Z <sub>sp</sub> (cm)		#				1.15	
	d <sub>eq</sub> (Z <sub>sp</sub> ) (cm)						0.32	
	f <sub>c</sub> (MHz)		#	–	6.65	–	5.95	5.81
	Dim of A <sub>aprt</sub> X (cm)			–	1.29	–	0.90	0.39
	Y (cm)			–	0.50	–	0.50	0.50
Other Information	PD (μsec)		#					
	PRF (Hz)		#					
	pr@PII <sub>max</sub> (MPa)		#					
	deq@PII <sub>max</sub> (cm)						0.23	
	Focal Length (cm)			–	6.5	–		0.6
	IP <sub>A.3</sub> @ MI <sub>max</sub> (W/cm2)		#					
Operating Control Conditions	Control 1				X			
	Control 2						X	
	Control 3							X
	Control n							

**Note:** (a) This index is not required for this operating mode.

(b) This probe is not intended for transcranial or neonatal cephalic uses.

(c) This formulation for TIS is less than that for an alternate formulation in this mode.

(#) No data are reported for this operating condition since the global maximum index value is not reported for the reason listed.

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