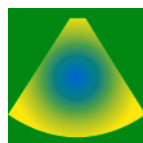




Terason Ultrasound System User Guide



terason
Division of **TERATECH** Corporation

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 for:

- Information about this user guide
- What you should know before you start
- Warnings for using the Terason Ultrasound System
- Cautions for using the Terason Ultrasound System
- Descriptions of labels that appear on the electronics envelope and transducers
- Instructions for printing this guide
- Directions for getting more help

For an introduction to the Terason Ultrasound System, see Chapter 1, “About the Terason Ultrasound System,” on page 21.

About this Guide

This guide shows you how to use the Terason software to conduct an ultrasound exam using a Terason transducer. This guide 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 screens that show scanned images were captured using a variety of transducers. Depending on the transducer you use, some of the images may look different on your computer than the ones in this book.

This guide uses the menus, windows, and dialog boxes of the Terason software version 3.6.5. If your application is a earlier 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.

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.

When you see the  icon, read the information closely. This icon indicates a caution or warning that helps you avoid the possibility of injury, death, or other serious adverse affects to you or your patients, or to prevent damage to equipment.

When you see the  icon, the guide provides a note or tip to help you use the Terason Ultrasound System more effectively.

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

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 the exam or for interpreting the ultrasound images.

You also need to know how to use the laptop or desktop computer. If you are new to the Windows 2000/XP operating system, Appendix A, “Working with Microsoft Windows,” on page 264 introduces the Windows features needed to use the Terason software.

Warnings

Closely review the following warnings 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.



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

Terason Transducer

Each transducer model has indications for use (see “Indications For Use” on page 222) concerning specific applications.

Laptop

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



Do not lift the laptop by the power cable or transducer. If either should disconnect, the laptop could fall on the patient.

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 termination points. Regularly inspect cables to detect damaged, frayed, or broken cables that might come into patient contact.



Do not use a transducer if the transducer or cable is damaged. Return damaged equipment to Terason for replacement. See “Contacting Terason” on page 20 for instructions on contacting Terason Support.

Damaged AC power adapters and improper grounds are shock hazards. 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.



Do not remove or try to circumvent the grounding wire.

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

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. In this case, the communication between the computer and the transducer will no longer work. 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 will be reset and will begin to function normally. You will also need to exit the Terason software, and restart it.

Surges to AC Power Mains

If the system is powered from AC Mains that could experience surge(s) 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 not closer than listed in the table on the next page to any part of RF communications equipment that may disturb functionality. If abnormal performance is observed, additional measures may be necessary such as re-orienting or relocating the equipment. The Terason Ultrasound System may need to be separated by no less than the distances specified in the table on the next page.

The Terason Ultrasound System is intended for use in an electromagnetic environment in which 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 as recommended below, according to the maximum output power of the communications equipment.

Recommended Separation Distances

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
	$1.75\sqrt{P}$	$1.17\sqrt{P}$	$2.33\sqrt{P}$
0.01	0.175 m	0.117 m	0.233 m
0.1	0.55 m	0.37 m	0.737 m
1	1.75 m	1.17 m	2.33 m
10	5.53 m	3.7 m	7.37 m
100	17.5 m	11.7 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.



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

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

Explosive

Equipment 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.



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

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 as well as general recyclable metals and plastics. This product should be recycled according to local and national guidelines for recycling electronic equipment.

Cautions

The following safety precautions should be adhered to 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 the proper training in the use and operation of an ultrasound system. This system will produce images based on sound echoes that 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, and IEC 60601-1-2 medical standards for the configuration as originally installed. To maintain compliance to 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 result in 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 result in the need to retest the complete system for compliance to these standards. The *Terason Ultrasound System User Guide* makes reference to the potential to hook up the Terason Ultrasound System to peripherals such as VCRs, TVs, and printers. It must be noted that Terason has not performed compliance tests to the stated standards with these types of devices connected to the system. If a peripheral device, such as a network connection, etc. is connected to the Terason Ultrasound System, it must conform to the IEC standards outlined above (i.e., IEC 60601-1, IEC 60601-1-1 2nd edition, and IEC 60601-1-2).

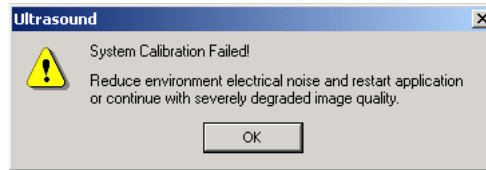
The Terason Ultrasound System (without peripherals) is suitable for use within the patient environment, as defined by the following:

THE USER SHOULD NEVER SIMULTANEOUSLY MAKE CONTACT TO THE PATIENT WHILE CONTACTING THE INSIDE OF ANY EQUIPMENT WHERE A PROTECTIVE COVER OF ANY KIND HAS BEEN REMOVED. THIS INCLUDES THE PROTECTIVE COVERS FOR THE PROBE HOLDERS CONTAINING THE ULTRASOUND PROBE AND POWER MODULES LOCATED AT THE PATIENT TABLE.

Electromagnetic Interference (EMI)

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.

The Terason Ultrasound System continuously checks for elevated electrical noise conditions. If noise level thresholds are exceeded to the point where image quality will be significantly degraded, the Terason Ultrasound System generates the following warning to the user:



System Calibration Warning

Electrostatic Discharge (ESD)

ESD, or static shock, is a naturally occurring phenomenon caused by a discharge of electrical energy from one body to another. ESD is common in conditions of low humidity, which can be caused by heating or air conditioning. To avoid damage to a transducer, electronics envelope, or system, use anti-static spray on carpets and linoleum, as well as anti-static mats.

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 251. If the computer is exposed to liquids or moisture, purchase a keyboard drape.

Couplants

Only use couplants specifically designed for ultrasound examinations. Do not use mineral or vegetable-based couplants, which can adversely affect transducers.

Heat

Do not expose transducers to direct heat such as strong sunlight or local heat sources. This exposure 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 computer are fragile. Handle with care. If the transducer appears to be damaged, or misuse of the electronics envelope causes a malfunction, please return the equipment to 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.

High-Level Disinfection

The 8B4S and 8EC4 transducers are not delivered sterilized. High-level disinfection before use is required. Refer to “Cleaning and High-Level Disinfection of the 8EC4 and 8B4S Transducers” on page 251 for more information. The effectiveness of any disinfectant agent other than those listed in this guide for use with the 8B4S and 8EC4 transducers must be validated prior to clinical use.

The 8IOL4 transducer is not delivered sterilized. High-level disinfection before use is required. Refer to “Cleaning and High-Level Disinfection of the 8IOL4 Transducer” on page 253 for more information. The effectiveness of any disinfectant agent other than those listed in this guide for use with the 8IOL4 transducer must be validated prior to clinical use.

The 10LAP4 transducer is not delivered sterilized. High-level disinfection before use is required. Refer to “Cleaning and High-Level Disinfection of the 10LAP4 Transducer” on page 255 for more information. The effectiveness of any disinfectant agent other than those listed in this guide for use with the 10LAP4 transducer must be validated prior to clinical use.

The 10V5 transducer is not delivered sterilized. High-level disinfection before use is required. Refer to “Cleaning and High-Level Disinfection of the 10V5 Transducer” on page 257 for more information. The effectiveness of any disinfectant agent other than those listed in this guide for use with the 10V5 transducer must be validated prior to clinical use.

System Labels

The Terason electronics envelope has several labels attached to it. The following sections describe what each label means.

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.

CE Mark

The Terason Ultrasound System is in conformance with 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.

Environmental



The Terason Ultrasound System must be stored in the original shipping container in environments with 15% to 98% relative humidity and non-condensing.

Air Pressure



The Terason Ultrasound System must be stored in the original shipping container in environments between 238.25 hPa and 1015.08 hPa air pressure.

Temperature



The Terason Ultrasound System must be stored in the original shipping container in environments between -25° and 60° C (-13° and 140°F).

Terason Transducers

Each Terason transducer has a label that indicates its model number:

Terason Transducer Models

Label	Description
terason™ ultrasound system 128 4C2	Curved linear array transducer with a maximum depth of 240 mm and a user-controllable field-of-view
terason™ ultrasound system 128 4V2	Phased-linear array transducer with a maximum depth of 240 mm and a user-controllable field-of-view
terason™ ultrasound system 128 7L3	Linear wideband array transducer with a maximum depth of 120 mm and a user-controllable field-of-view
terason™ ultrasound system 128 8B4S	Biplanar wideband endorectal transducer, includes a curvilinear and a linear transducer array, with a maximum depth of 12 cm and a user controllable field-of-view
terason™ ultrasound system 128 8EC4	Convex-linear endocavity array transducer with a maximum depth of 140 mm and a 130° field-of-view
terason™ ultrasound system 128 8MC4	Tightly-curved wideband array transducer with a maximum depth of 15 cm and a 140° field-of-view

terason™ ultrasound system 128 8IOL4	Small footprint linear array transducer with a maximum depth of 90 mm and user-controllable field-of-view
terason™ ultrasound system 128 10L5	Linear wideband array transducer with a maximum depth of 80 mm and a user-controllable field-of-view
terason™ ultrasound system 128 10LAP4	Linear array on a four-way articulating laparoscopic transducer with a maximum depth of 90 mm and user-controllable field-of-view
terason™ ultrasound system 128 10V5	Phased array wideband transducer with a maximum depth of 14 cm and a user-controllable field-of-view

Printing the User Guide

Terason delivers the User Guide as a PDF (Portable Document Format) 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 need to 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.

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

1. Select **File > Print**.
2. Select a printer from the Name drop-down list.
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 system, select the **Help > Help Topics** menu. The Help window has three tabs on the left that you use to view information on the right:

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

Terason Ultrasound System User Guide

If you are reading this guide from a printed copy, you, can also read the User Guide online. You need to have Adobe Acrobat Reader installed on your computer to read the guide online.

To read the Terason Ultrasound User Guide online, follow 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 Acrobat Reader software.

3. Click on 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 more help in using 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 described above for the Terason online help.

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

You can also view contact information by selecting

Help > Technical Support.

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

The Terason Ultrasound System:

- Provides a selection of ultrasound modes
- Includes support for biopsies and other medical procedures
- Includes one or more Terason transducers
- Is controlled using the Terason main window

If you need to install the Terason Ultrasound System, see Chapter 2, “Installing Software,” on page 33.

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 exam for all image modes.

The Terason Ultrasound System comes in a standard (ST) or advanced (AD) version. This table lists which scan modes come with each version.

Terason Scan Mode Availability

Mode	Standard	Advanced	Optional
B-Mode	X	X	
M-Mode	X	X	
Directional Power Doppler	X	X	
Power Doppler	X	X	
Color Doppler		X	

Mode (Continued)	Standard	Advanced	Optional
Pulsed Wave Spectral Doppler		X	
Triplex			X

Triplex scan mode is available only with the AD version. Triplex combines the scanning ability of Pulsed Wave Doppler with either Power Doppler, Color Doppler, or Directional Power Doppler in the same Image Display window.

B-Mode

The Terason Ultrasound System delivers 2-dimensional digital imaging using 128 digital beam-forming channels. This imaging mode delivers excellent image uniformity, tissue contrast resolution, and steering flexibility in frequencies from 2 MHz to 10 MHz. The high channel count supports true phased-array and high-element-count imaging transducers.

The B-Mode scan data is displayed in the 2D Image Display window. The following figure shows a sample B-Mode obstetrical scan.



Example B-Mode Scan

To use B-mode, see:

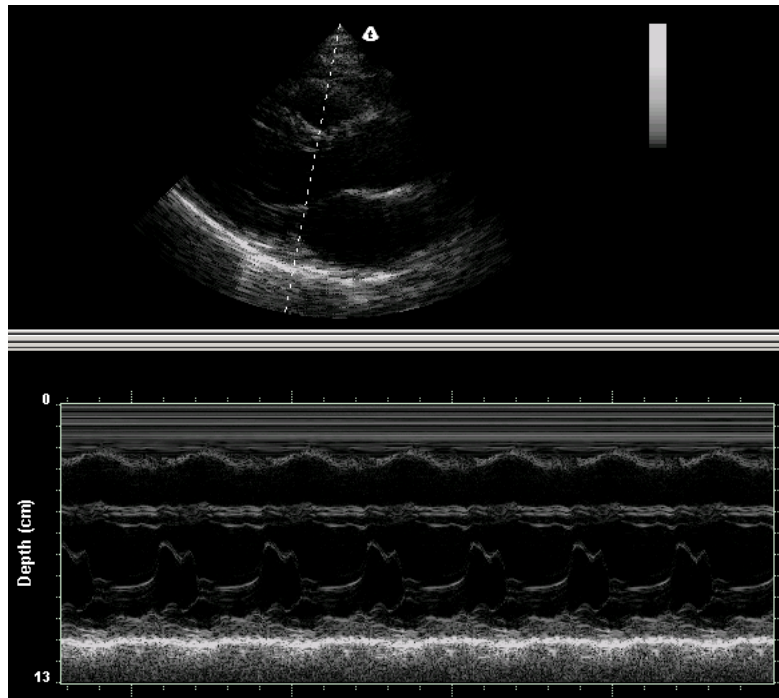
- Chapter 3, “Acquiring Images,” on page 53
- “Using 2D Controls” on page 89
- “Using I.Q. (Image Quality) Controls” on page 95

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.

The M-Mode scan data displays the anatomy in the 2D Image Display window, and the motion scan in the Time Series window. This figure shows a sample M-Mode scan.



Example M-Mode Scan

For more information on using M-mode, see:

- Chapter 3, “Acquiring Images,” on page 53
- “Using M-Mode Image Controls” on page 101
- “Measuring in the M-Mode Window” on page 185

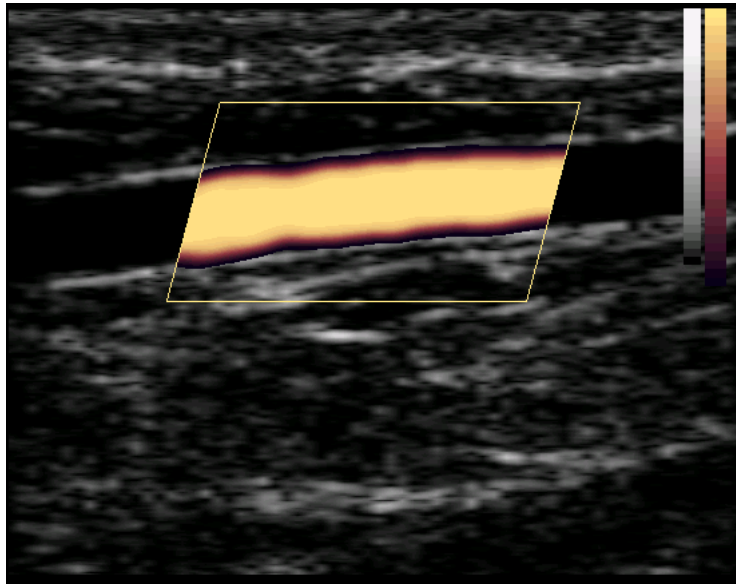
Power Doppler

Conventional Power Doppler images 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 flow is displayed in shades of the same color; no directional information is provided.

In general, the sensitivity of Power Doppler is greater than Color Doppler. Amplitude estimation is less noisy than a mean frequency estimate; therefore, more real signal is detected and displayed with Power Doppler. Power Doppler is more sensitive to low flow than Color or Directional Power Doppler. The increase in 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 is displayed in the 2D Image Display window as shown in this figure.



Example Power Doppler Scan

For more information on using Power Doppler mode, see:

- Chapter 3, “Acquiring Images,” on page 53
- “Using Color and Power Doppler Image Controls” on page 113

Color Doppler

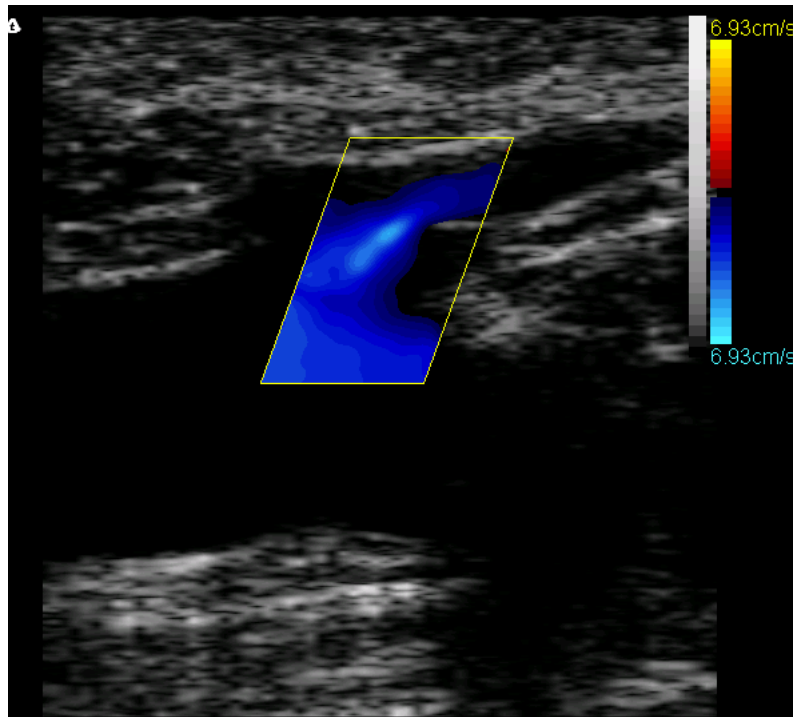
Color Doppler mode, sometimes referred to as duplex mode, is used to detect the presence, direction, and relative velocity of blood flow by assigning color-coded information to these parameters. The color is depicted in a region of interest (ROI) that is overlaid on the B-Mode image. Flow towards the transducer is assigned shades of red, and flow away from the transducer is displayed 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 echo signal that is received in response to the transmitted signal. The primary characteristics of this signal are its frequency and its amplitude

(or power). The frequency shift is determined by the movement of the red blood cells, and the amplitude depends on the amount of moving blood present within the volume that is sampled by the ultrasound beam.

Higher frequencies are displayed in lighter colors, and lower frequencies in darker colors. For example, the proximal carotid artery is normally displayed in hues of 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 is displayed as blue because it flows away from the transducer.

The Color Doppler scan data is displayed in the 2D Image Display window. This figure shows a sample Color Doppler scan.



Example Color Doppler Scan

For more information on using Color Doppler, see:

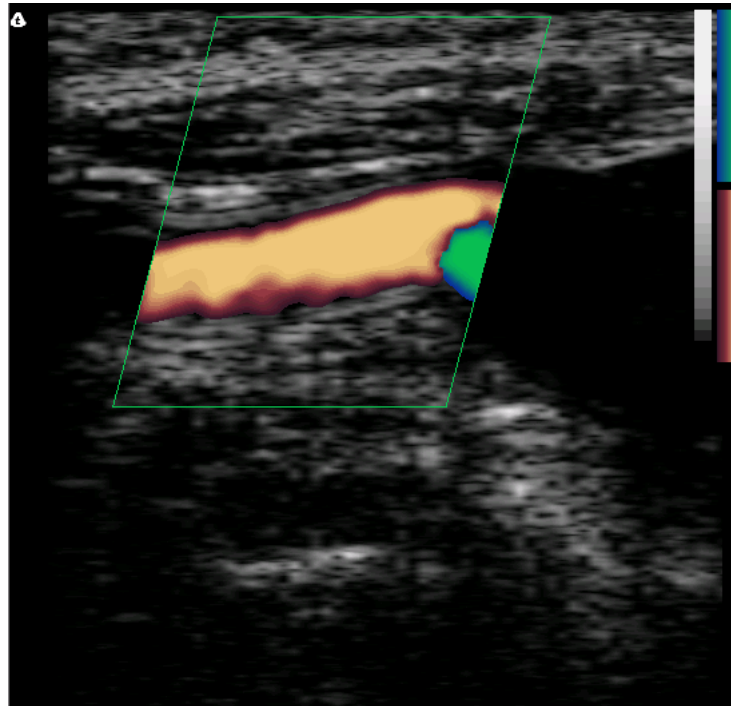
- Chapter 3, “Acquiring Images,” on page 53
- “Using Color and Power Doppler Image Controls” on page 113

Directional Power Doppler

Directional Power Doppler (DirPwr) can be viewed as a combination of conventional Power Doppler and Color Doppler. It provides the same increased sensitivity as conventional Power Doppler, plus the directional information derived from Color Doppler.

Directional Power Doppler does not provide an estimate of the frequency (velocity) of blood flow. The color palette is proportional to the strength of the Doppler signal. This mode allows you to achieve good image quality 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 is displayed in the 2D Image Display window.



Example Directional Power Doppler Scan

For more information on using Directional Power Doppler, see:

- Chapter 3, “Acquiring Images,” on page 53
- “Using Color and Power Doppler Image Controls” on page 113

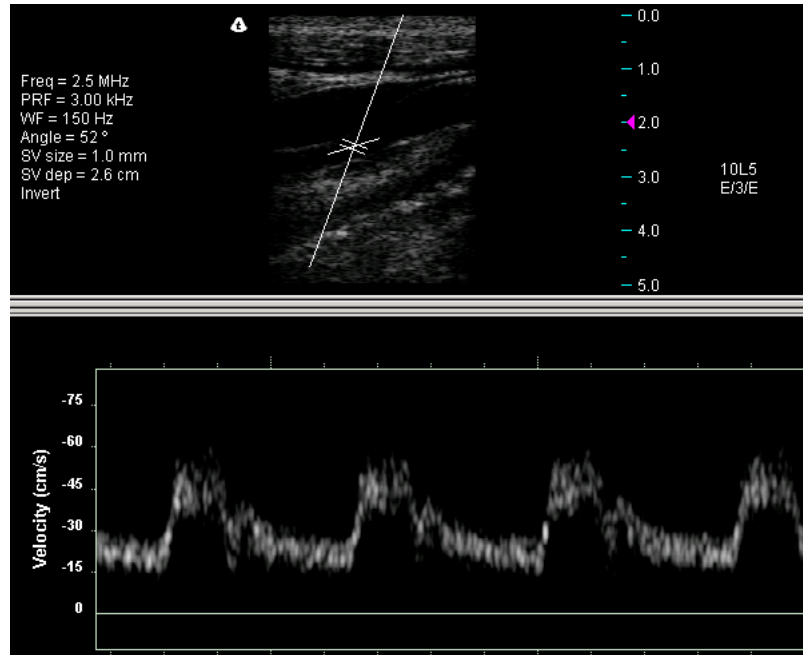
Pulsed Wave Doppler

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 while 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.

The strength of the signal appears as shades of gray in the spectral display. 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 B-Mode are shown together in a mixed-mode display. This combination lets you monitor the exact location of the sample volume on the B-Mode 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 B-Mode 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.

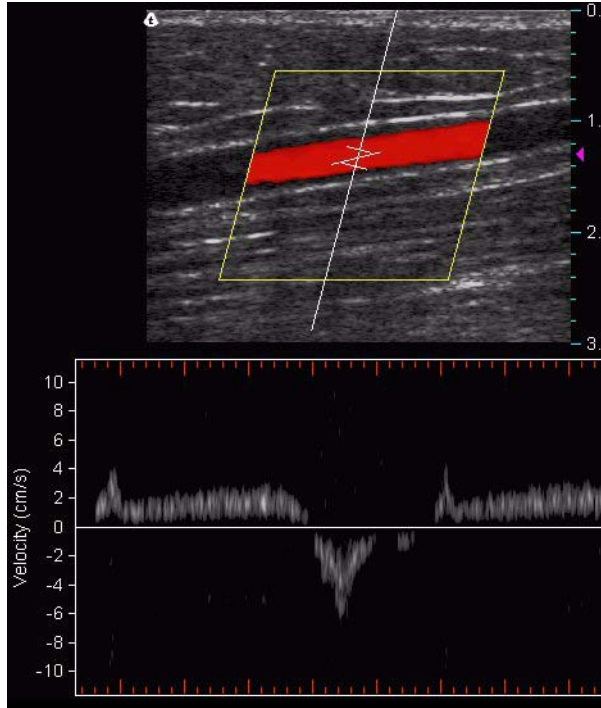
For more information on using Pulsed Wave Spectral Doppler, see:

- Chapter 3, “Acquiring Images,” on page 53
- “Using the PWD Image Controls” on page 103
- “Measuring in the PWD Window” on page 187

Triplex

Triplex scan mode combines Doppler imaging (Color Doppler, Directional Power Doppler, or Power Doppler) of the target anatomy 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. This example triplex image shows the carotid artery.



Example Triplex Scan

For more information on using Triplex mode, see:

- Chapter 3, “Acquiring Images,” on page 53
- “Scanning in Triplex Mode” on page 122

Support for Medical Procedures

The Terason Ultrasound System can be configured with needle guides that can be used for tissue biopsy, fluid aspiration, amniocentesis, and catheter placement. The Terason Ultrasound System may also be incorporated into cryoablation (or targeted ablation) and brachytherapy products available from other vendors. The Terason Ultrasound System scans the anatomy or vessel for size, location, and patency, and tracks the location of the needle.

For biopsy and vascular puncture applications, you use a needle guide kit to direct 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 you 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 from which you purchased 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 these modes:

- B-Mode
- Color Doppler
- Directional Power Doppler
- Power Doppler

See “Performing Medical Procedures” on page 124 for information on using the Terason Ultrasound System to perform biopsies.

See “Using the Biplanar Transducer Options” on page 133 for information on using an insertion grid with the Terason Ultrasound System.

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.

This table describes the supported transducers.

Terason Transducer Specifications

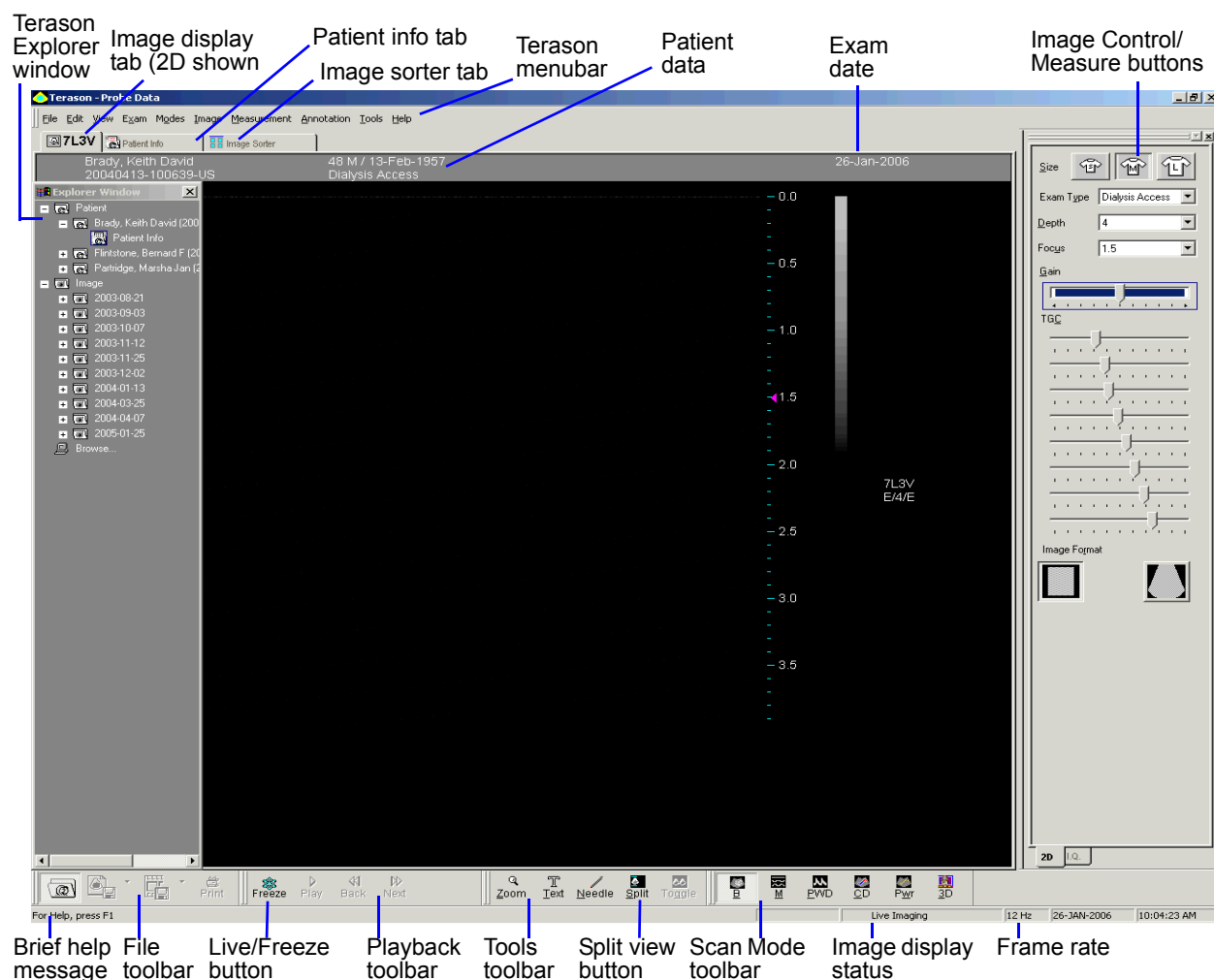
Transducer	Elements	Array Type	Applications	
4C2	128	Curved Linear	Adult abdominal OB/GYN Fetal heart	Abdominal vascular Renal Contrast agent general imaging
4V2	64	Phased	Adult abdominal OB/GYN	Abdominal vascular Fetal heart Renal
7L3	128	Linear	Small parts Musculoskeletal Peripheral vascular Extracranial vascular	Medium depth arterial and venous studies Breast
8B4S	128 X 128	Biplanar: Curvilinear and linear	Prostate (cryoablation and brachytherapy therapeutic procedures)	
8EC4	128	Tightly curved	Endovaginal Infertility Early OB	General GYN Prostate
8IOL4	128	Linear	Intraoperative	
8MC4	128	Curvilinear	Pediatrics	Neonatal Cephalic Renal
10L5	128	Linear	Small parts Musculoskeletal Peripheral vascular Extracranial vascular	Medium depth arterial and venous studies Breast

Transducer	Elements	Array Type	Applications	
10LAP4	128	Linear	Laparoscopic	
10V5	128	Phased	Pediatrics Cardiac	Neurosurgery

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

About the Terason Main Window

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



Terason Window

If a control, button, or menu shows in gray, it means that the function is not available for the current circumstances. For example, you cannot use the Toggle function unless you have used the Split Screen function, so that button is gray until you do. You can add additional toolbars to the window using the **View > Toolbars** menu.

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 271 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,” on page 272.

Terason Explorer Window

The **Terason Explorer** window lets you locate 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. The files you see listed here are stored at this default location on your computer’s hard disk:

C:\Program Files\Teratech\Terason 2000

This folder includes these folders that show in the Terason Explorer window:

- Patient
- Image





To view the contents of a folder, click on the  sign to expand the folder. The  changes to a  and shows a list of files. To hide the contents of a folder, click on the  sign. 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 144.

Image Display, Patient Info, and Image Sorter Windows

These windows share the same space. Click on a tab to bring the window associated with that tab to the front. The name of the Image Display window is the model number of the connected transducer.

The tab for the Image Display window shows the name of the connected transducer (4V2 in the example). You could see any of the Terason transducer models as the name of this tab. If you have more than one transducer connected to the computer, you will see a tab for each transducer.



When using the 8B4S biplane transducer, the Image Display uses VBMC as the name of the Image Display tab for the curvilinear array, and VBML as the name of the Image Display tab for the linear array. The curvilinear array (VBMC) of the 8B4S biplanar transducer can acquire an ultrasound scan in the transverse (side-to-side) direction; the linear array (VBML) can acquire a scan in the sagittal (front-to-back) direction.

The Image Display window consists of the 2D window (top) and Time Series window (bottom). The 2D window displays for all scan modes; the Time Series window only displays when scanning in M-Mode, PWD mode, or Triplex mode.

To use these windows, see:

- Chapter 5, “Working with Scan Modes,” on page 88
- “Finding Stored Images and Loops” on page 143
- Chapter 4, “Setting Up Patient Information,” on page 78
- “Finding Files in the Image Sorter Window” on page 147

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. The Terason window shown earlier shows the default set of toolbars. You can also show the Exit, Full, and Transducer toolbars.

You can hide or show any toolbar using the **View > 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 quick key. See “Toolbar Reference” on page 286 for a description of the available toolbars.

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.

2 Installing Software

When you purchase the Terason Ultrasound System, it comes with all the needed software already installed on the laptop. You may never need to use 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 need to install, uninstall, or configure part of the Terason Ultrasound System, follow the instructions for what you need to do:

- Install the Terason software
- Upgrade the Terason software
- Uninstall the Terason software
- Install the Terason transducer driver
- Install the DICOM utility
- License the Terason software



Before installing the Terason software, Terason recommends that you install anti-virus software to protect your system. A virus is a program designed to inconvenience you or to destroy information stored on your computer. When an infected program is started, so is the embedded virus. Consult your site's system administrator for the recommended anti-virus software to use.

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

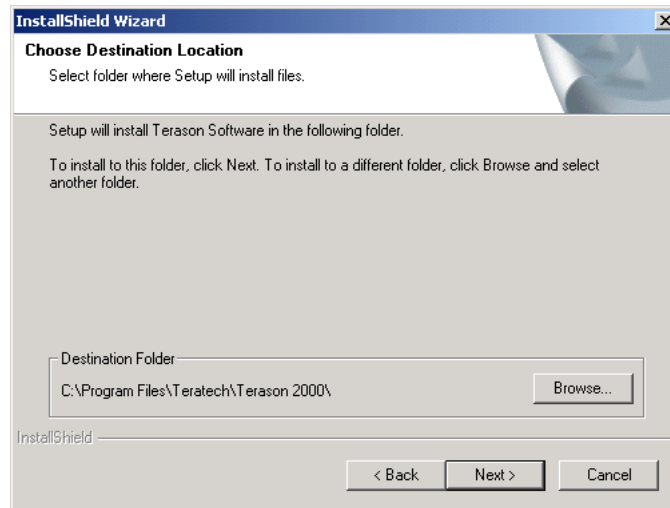
Installing Terason Software

When you purchase the Terason Ultrasound System, it comes with all the needed software already installed on the laptop. You do not need to follow this procedure unless you want to install the Terason Ultrasound System on a computer that was not provided by Terason.

When ready, follow these steps:

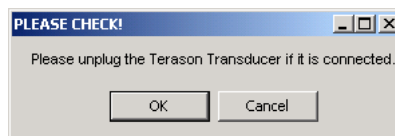
1. Exit all applications including email and unplug the Terason transducer from the media bay or EDCM if it has already been installed.

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 appears. Read the License Information carefully.
4. Click **Yes**. The Choose Destination Location dialog box opens.



InstallShield Wizard for Choosing the Destination

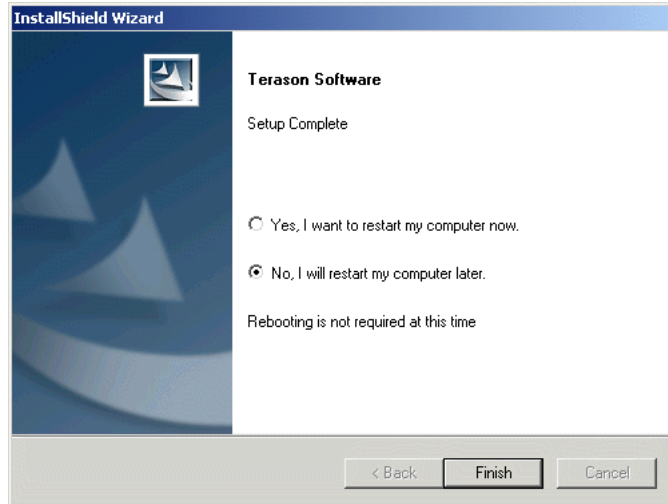
5. Click **Next** to install the application in the default location. To select a different location, click Browse and navigate to a different folder (not recommended). The wizard reminds you to unplug the Terason Transducer.



Reminder to Unplug the Transducer

6. Click **OK**. The installer copies the files from the CD to the computer. The installer displays this message:

System registry entries have been removed and the INI file (if any) was deleted.
7. Click **OK**. 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.

8. Click **Finish**.

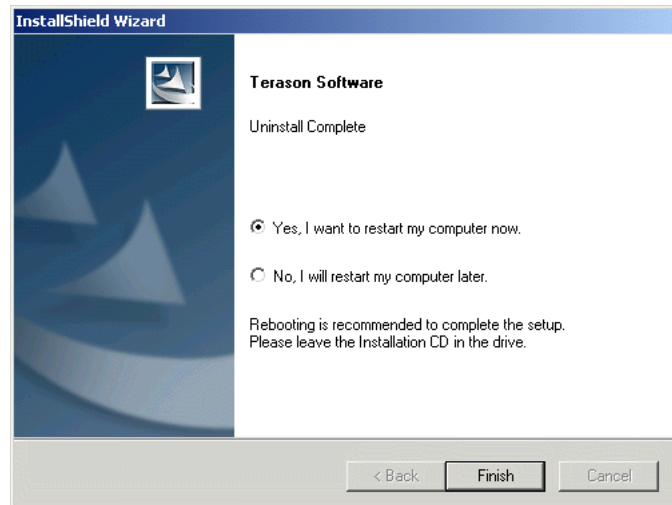
Upgrading Terason Software

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

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

1. Exit all applications and unplug the Terason transducer from the media bay or EDCM.
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 check box “Don’t display this message again” and click **Yes**.

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

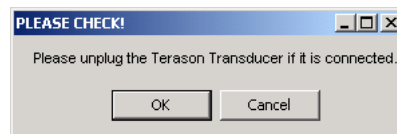
**Uninstall Complete Dialog Box**

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

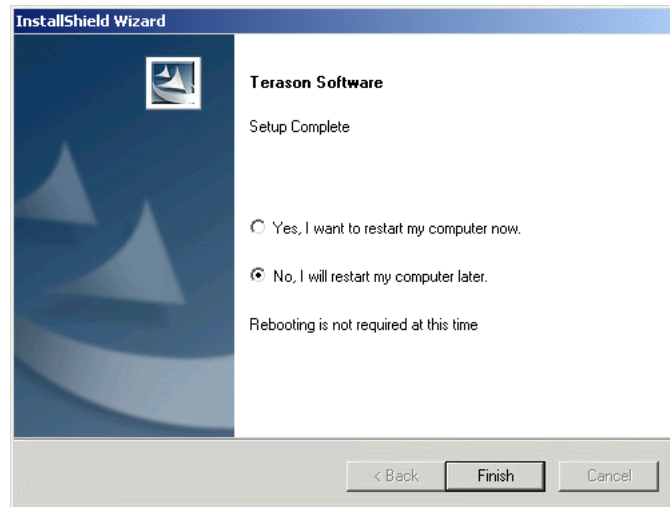
After the computer completes its startup process, you may need to log onto the computer before proceeding.

When 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 plug the transducer back in.

Uninstalling Terason Software

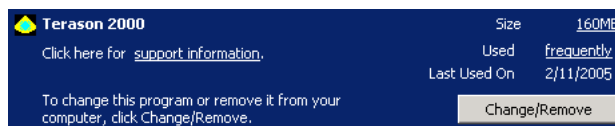
You do not need to manually uninstall the current version of software when you upgrade software. If you want to permanently remove the Terason application, follow these steps:

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 until you see Terason 2000 and click on it to highlight it.



Selecting to Uninstall the Terason Software

When you select an application, the list 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. A confirmation dialog box opens.
7. Click **OK** to confirm.

If another dialog box opens, check the box next to “Don’t display this message again” and click **Yes**.

A ScTTPProxy message box opens.

8. Click **OK**. The installer displays a completed message.
9. Click **Finish** to complete the uninstall process.

Installing the Terason Transducer (FireWire) Driver

If you purchased the laptop from Terason, all needed drivers are already installed and you do not need to follow the procedure in this section. If you installed the Terason software on a computer or laptop purchased from another source, the steps you need to take will 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 do not need to follow this procedure. Only follow these instructions if you see a “Digital Signature Not Found” or “New Hardware Found” message.

Once the Terason transducer is connected to your PC, you may need to install the device driver so that the operating system can 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 was previously installed and you can skip this procedure
- If you see a “Digital Signature Not Found” message, go to Step 11
- If you see a “Found New Hardware” window, start with Step 1



Found New Hardware Wizard

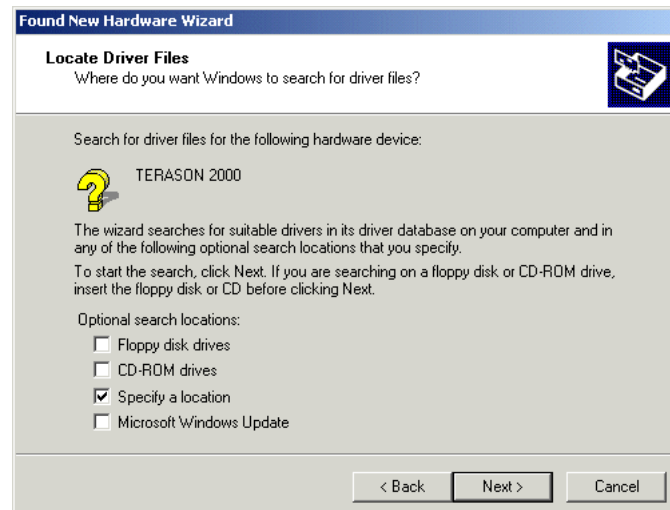
Follow these steps to install the driver (starting from the Found New Hardware window):

1. Click **Next**. The wizard advances to the Install Hardware Device Drivers dialog box.



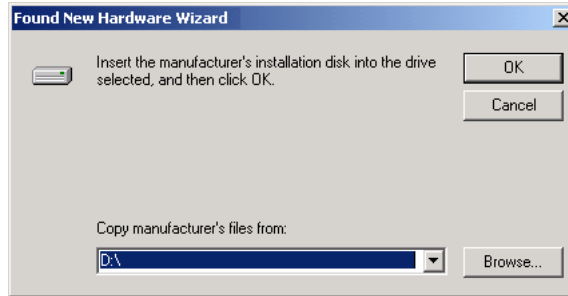
Install Hardware Device Drivers Dialog Box

2. Verify that the option button for “Search for a suitable driver for my device” is selected and click **Next**. The wizard advances to the Locate Driver Files dialog box.

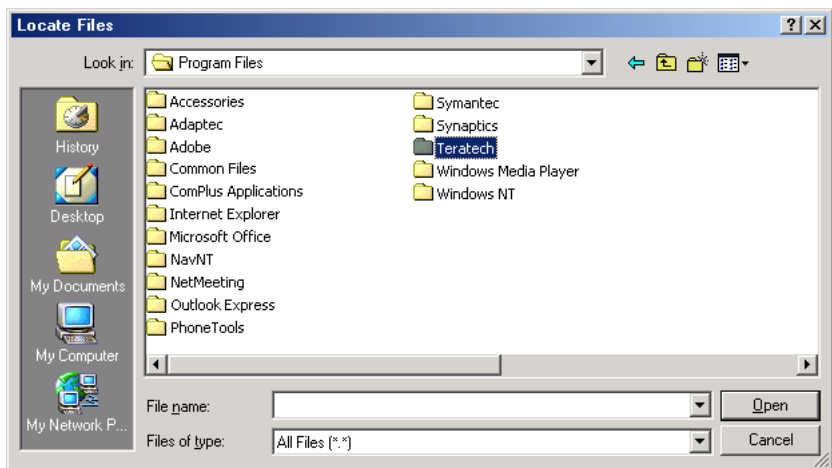


Locate Driver Files Dialog Box

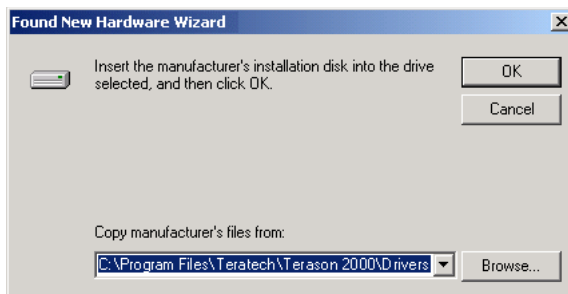
3. Clear the “Floppy disk drives” and the “CD-ROM drives” check boxes.
4. Select the “Specify a Location” check box.
5. Click **Next**. The wizard advances to the Insert Disk dialog box.

**Insert Disk Dialog Box**

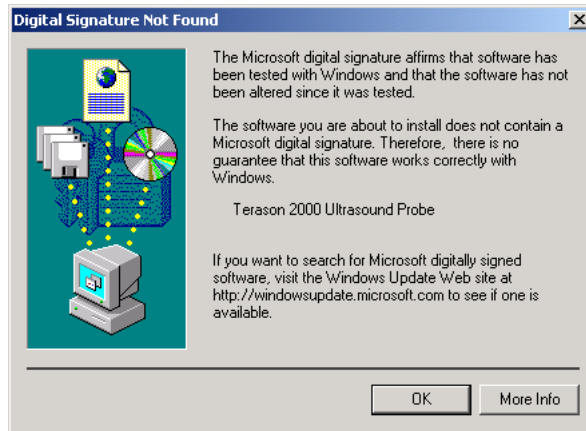
6. Click **Browse**.
7. Navigate to the Program Files folder on the C:\ drive.

**Locate Files Dialog Box**

8. Double-click the Teratech folder; double-click the Terason 2000 folder. The complete path to the required folder is:
C:\Program Files\Teratech\Terason 2000\Drivers
9. Click the Drivers folder to highlight it, then click **Open**.

**Insert Disk Dialog Box with Path to Drivers**

10. Click **OK**. The system displays the Digital Signature Not Found dialog box.




Digital Signature Not Found Dialog Box

11. Verify that "Terason 2000 Ultrasound Probe" displays in the middle of the window.
12. Click **OK**.
13. Click **Finish**.



Installing the Terason DICOM Utility

The Terason software must be installed before you can install the DICOM Send/Print utility. See "Installing Terason Software" on page 33 for instructions on installing the Terason software.

The DICOM utility requires the presence of a dongle (sometimes called a security 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: .

After installing the driver, you need to configure it to set up the destination DICOM server and printer. After the utility has been configured, follow the instructions in "Printing Files to a DICOM Printer" on page 166 or "Sending Files to a DICOM Server" on page 167 to use the DICOM print/export functionality.

To install the DICOM utility, follow these steps:

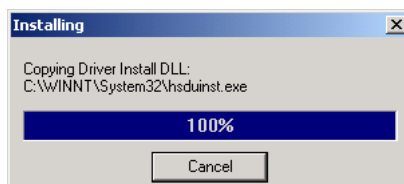
1. If necessary, save the active image or image loop. See "Saving Images and Loops" on page 141 for instructions.
2. Exit the Terason software using one of these methods:
 - Click  on the toolbar at the bottom of the window
 - Click  in the upper right corner of the window
 - Select **File > Exit**
3. Install the HASP Dongle Driver:

- a. Insert the installation disk into the CD drive.
- b. Open the HASP Dongle Driver folder.
- c. Double-click on the hdd32.exe file. The Welcome Screen opens.



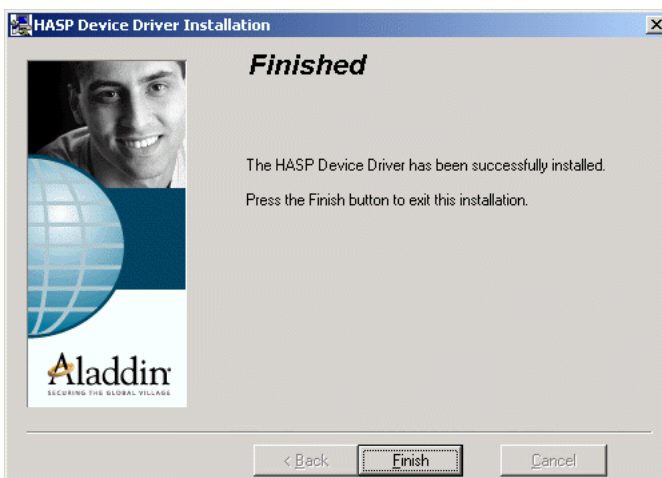
HASP Welcome Screen

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



HASP Installing Message

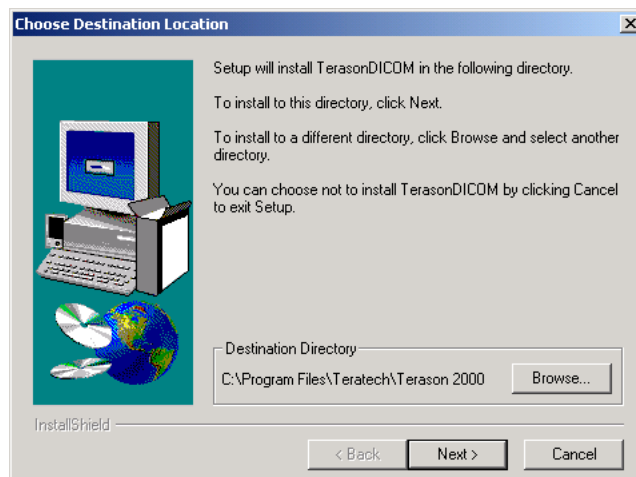
When complete, the installation program displays the Finished message.



HASP Installation Finished Screen

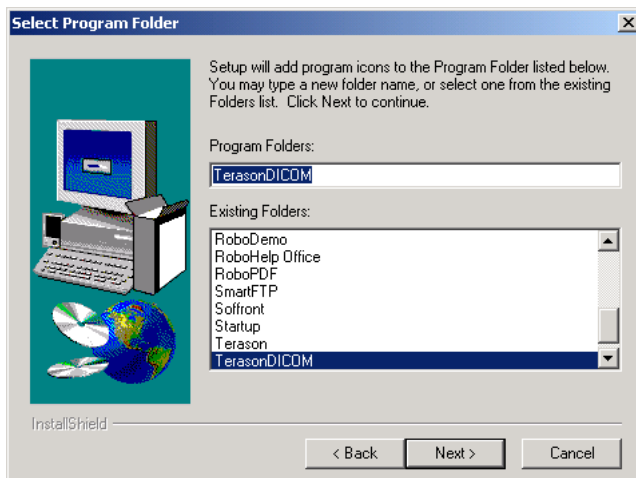
- e. Click **Finish**.
4. Plug the dongle into one of the computer's USB ports.

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.



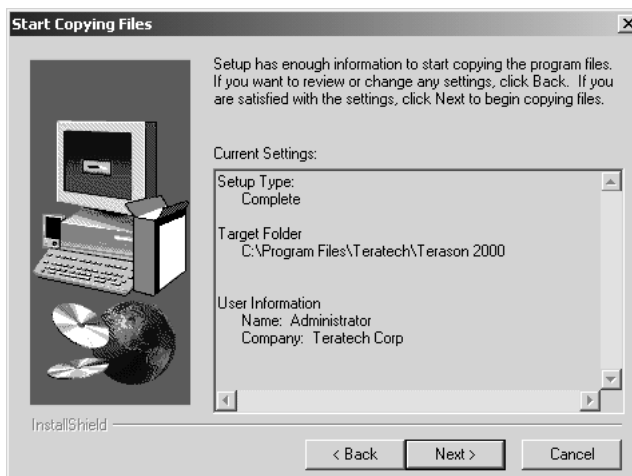
Choosing Directory for Installation

- c. Click **Next**. The installation program prompts you to select a program folder (for using the Windows 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 needed files, then exits.

6. Restart the computer.

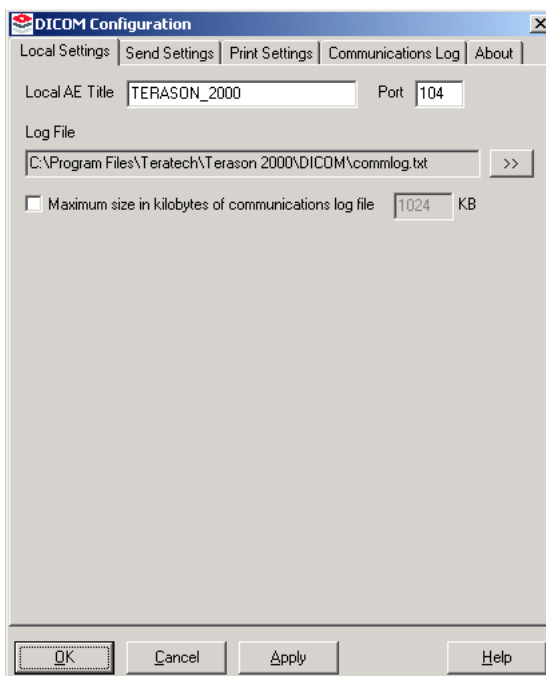
When configuring the DICOM utility, you need to enter network names, addresses, and other network details. Contact your network system administrator to get the needed information.

To configure the DICOM utility, follow these steps:

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

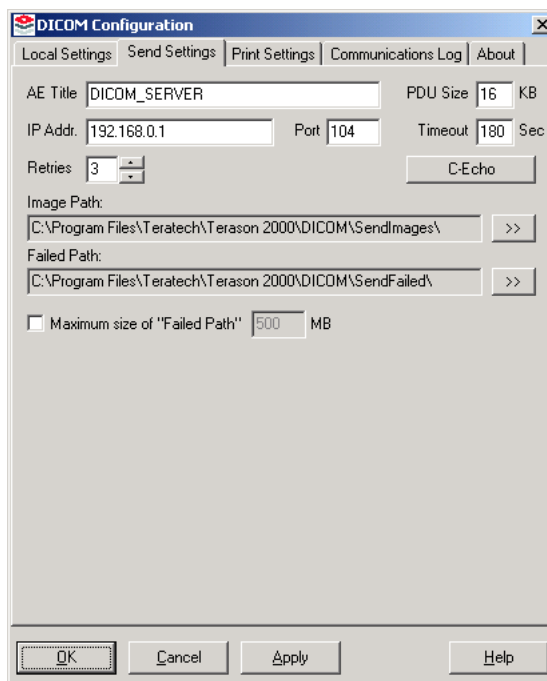
- Double-click the DICOM icon, , in the taskbar
- Select **Start > Programs > TerasonDICOM > Terason**

The system opens the DICOM Configuration dialog box.





DICOM Configuration Dialog Box: Local Settings Tab

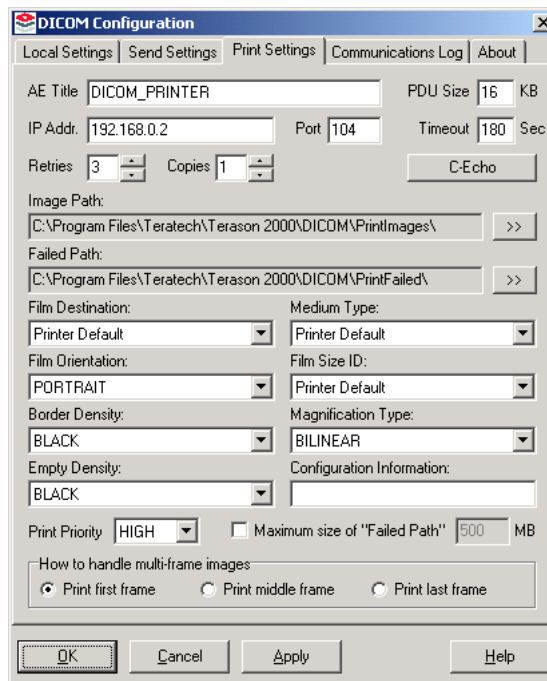
2. Configure the Local Settings tab:
 - a. Verify that the Local AE Title and port number are correct for your DICOM server. The default values are TERASON_2000 and 104, respectively. Your server or network configuration may require different values, especially if your facility has more than one Terason 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. If you want 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 will be stored):
 - a. Click the **Send Settings** tab to bring it to the front.



DICOM Configuration Dialog Box: Send Settings Tab



- b. Enter the name of your DICOM server in the **AE Title** text box.
- c. Enter the IP address or DNS node name of the DICOM server in the **IP Address** text box.
- d. Enter the DICOM server's port number in the **Port** text box.
- 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. If you want 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 Dialog Box: Print Settings Tab

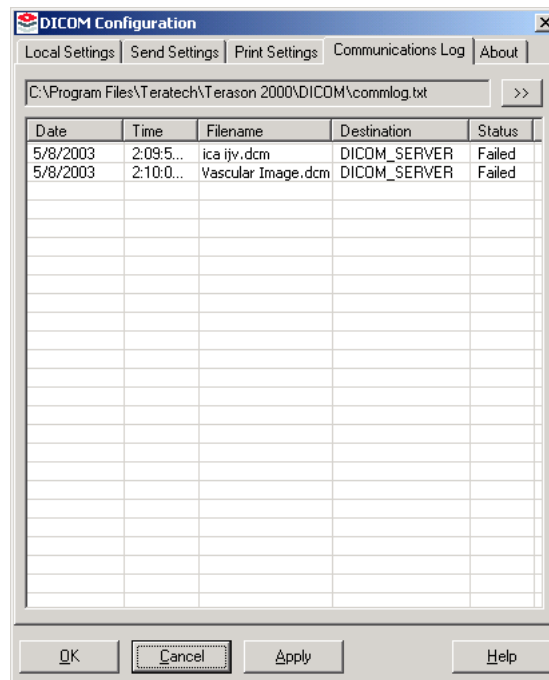
- b. Enter the name of your DICOM printer in the **AE Title** text box.
- c. Enter the IP address or DNS node name of the DICOM printer in the **IP Address** text box.
- d. Enter the DICOM printer's port number in the **Port** text box.
- e. If your DICOM printer requires different values, edit the PDU 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 do not need to configure the Communications log. You can click on the Communications Log tab to review the contents of the log file:



DICOM Configuration Dialog Box: 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 167 for instructions.

Licensing the Terason Software

When installed, the Terason software requires that you enter an unlock code. You can obtain the license number by phone or email.

If agreed to by Terason, you can use the ultrasound software for a 30-day evaluation period. You still need to obtain an unlock code as described here, however, after 30 days the software will no longer run.

The Terason software allows you to:

- Enter the unlock code
- Extend the evaluation period
- Transfer the license to a different computer
- Upgrade with new or additional features

Entering the Unlock Code

To license the Terason software, follow these steps:

1. Start up the Terason software using either of these methods:

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

The Ultrasound License dialog box opens.

Ultrasound License Registration

License Details

License Status: NO LICENSE

Serial Number: I2OFFCU2A1

Unlock Level:

Your license is not valid.
Please contact Teratech
Technical Support for
assistance at:
(866) 837-2766

License Actions

☒ Register Unlock Code:

☐ Evaluation

Unlock 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. Type the unlock code into the text field and click **Unlock**. The Terason software updates the status to Licensed.
5. Click **Unlock**. The Terason software starts up.

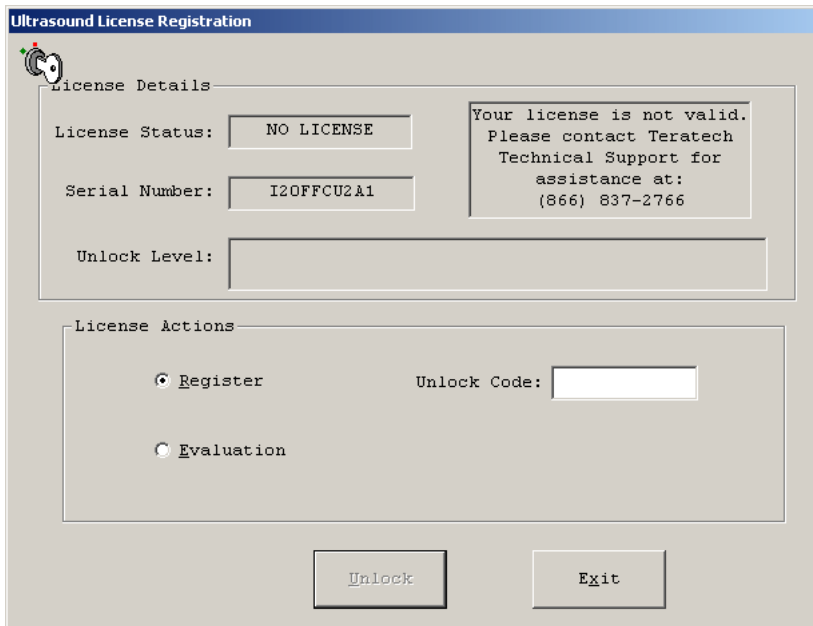
Transferring the License

The Terason software allows you to transfer the 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 where you will transfer the license.

Before you start this procedure, you need to 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, follow these steps:

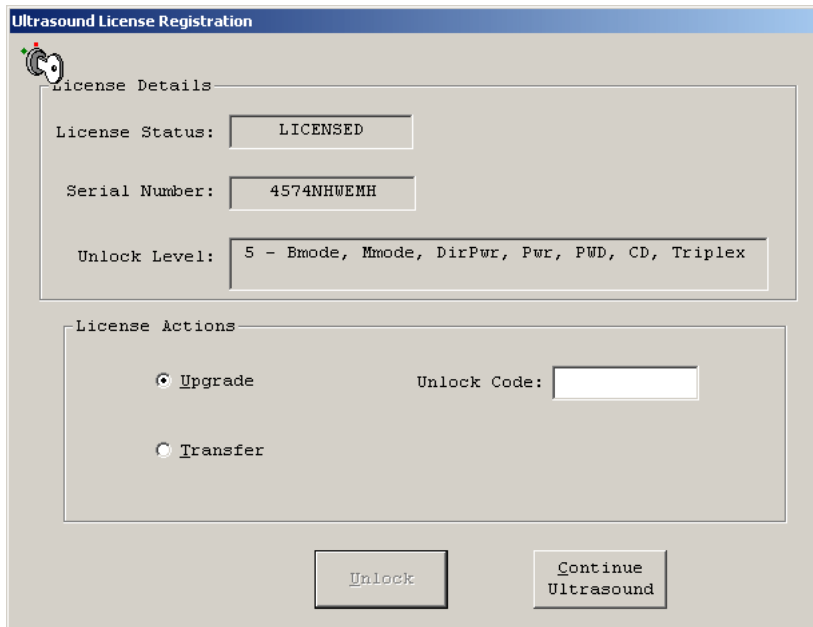
1. On the second computer, install the Terason software as described in “Installing Terason Software” on page 33.
2. Double-click the short-cut icon, , on your computer desktop. The software shows the license dialog box.



The screenshot shows the 'Ultrasound License Registration' dialog box. It has a title bar with the text 'Ultrasound License Registration'. Below the title bar is a small icon of a mouse cursor. The dialog is divided into two main sections: 'License Details' and 'License Actions'. In the 'License Details' section, there are three fields: 'License Status' with the value 'NO LICENSE', 'Serial Number' with the value 'I2OFFCU2A1', and 'Unlock Level' which is empty. To the right of these fields is a text box containing the message: 'Your license is not valid. Please contact Teratech Technical Support for assistance at: (866) 837-2766'. In the 'License Actions' section, there are two radio buttons: 'Register' (selected) and 'Evaluation'. To the right of the radio buttons is an 'Unlock Code' field which is empty. At the bottom of the dialog are two buttons: 'Unlock' and 'Exit'.

License Registration Dialog Box

3. Write down the Serial Number. Do **not** close the dialog box.
4. On the first computer, start the Terason software.
5. Select **Help > License**. The Terason Ultrasound License Registration dialog box opens.



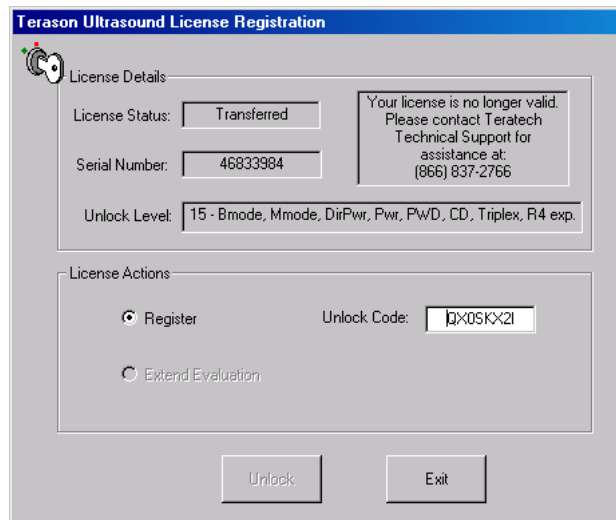
The screenshot shows the 'Ultrasound License Registration' dialog box. It has a title bar with the text 'Ultrasound License Registration'. Below the title bar is a small icon of a mouse cursor. The dialog is divided into two main sections: 'License Details' and 'License Actions'. In the 'License Details' section, there are three fields: 'License Status' with the value 'LICENSED', 'Serial Number' with the value '4574NHUEMH', and 'Unlock Level' with the value '5 - Bmode, Mmode, DirPwr, Pwr, PWD, CD, Triplex'. In the 'License Actions' section, there are two radio buttons: 'Upgrade' (selected) and 'Transfer'. To the right of the radio buttons is an 'Unlock Code' field which is empty. At the bottom of the dialog are two buttons: 'Unlock' and 'Continue Ultrasound'.

License Registration Dialog Box

6. Click the **Transfer** radio button.
7. Enter the number you wrote down in step 3 in the Transfer PC Serial Number text box. The Transfer button remains gray until you enter the correct number of digits in the text box.
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 need to 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 this computer again, you will see the License dialog shown here. The unlock code shown above will not enable the software on this computer. You will need to 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.

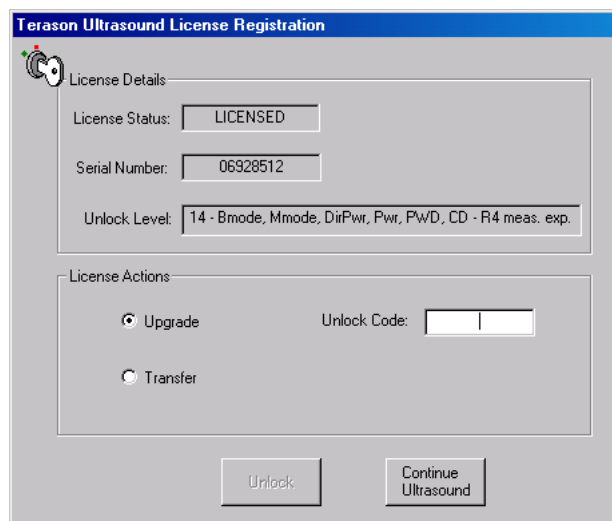
See “Uninstalling Terason Software” on page 37 for instructions on removing the Terason software from the first computer.

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 need to contact Terason Technical Support to obtain a new unlock code.

To upgrade the Terason Ultrasound System, follow 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 option 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 a 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 Acquiring Images

To support image acquisition, you need to know how to:

- Start and exit the Terason software
- Conduct an exam
- Determine the current image status
- Freeze the image display during the ultrasound scan
- View loops and frames
- Adjust the Image Display window size
- Display additional information with the acquired image
- Change the text size
- View the patient using different views (split view)
- Add text or body markers (annotations)
- Switch transducers
- Launch the Sonocubic 3-D imaging application (if purchased)

To adjust the acquired scan data, see Chapter 5, “Working with Scan Modes,” on page 88.

Starting/Exiting the Software



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

- Double-click the short-cut icon, , on your computer desktop
- Select **Start > Programs > Terason > Terason**



For laptops running 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’s manual.

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, follow these steps to conduct an exam:

1. Load or create patient information.
2. Start live imaging.
3. Select an exam.
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, follow the steps for the type of exam you need to conduct:

- 2D (B-Mode, Color Doppler, Power Doppler, Directional Power Doppler) or M-mode
- PWD
- Triplex

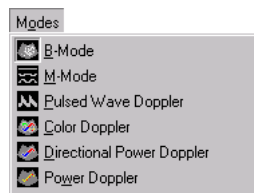
Conducting a 2D or M-Mode Exam

To conduct an ultrasound exam for B-Mode, Color Doppler, Power Doppler, Directional Power Doppler, or M-mode, follow 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 4, “Setting Up Patient Information,” on page 78 for instructions.
3. Click the icon for the needed scan mode:

- Click  for B-Mode
- Click  for M-Mode
- Click  for Color Doppler
- Click  for Power Doppler

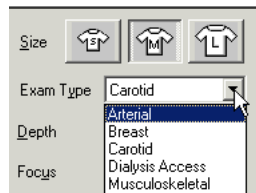
If you hid the Modes toolbar, you can also select the needed scan mode from the **Modes** menu.



Selecting a Scan Mode from the Modes Menu

You can also use quick-keys to start scanning:


- **B** for B-Mode
 - **M** for M-Mode
 - **C** for Color Doppler
 - **P** for Pulsed Wave Doppler
 - **D** for Directional Power Doppler
 - **W** for Power Doppler
4. In the 2D Image Control tab, select an exam type from the Exam drop-down list.



Choosing an Exam Type

The Terason software loads preset image control settings optimized for the selected exam and the connected transducer. See Chapter 9, “Working with Exams,” on page 198 for more details 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 Controls” on page 89 for instructions.
6. If necessary, adjust the I.Q. image controls. See “Using I.Q. (Image Quality) Controls” on page 95 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 101
 - For Color Doppler, Power Doppler or Directional Power Doppler scan modes, see “Using Color and Power Doppler Image Controls” on page 113
8. Click . The Terason software automatically adds measure tabs to the Image Control window appropriate for the scan mode (see Chapter 8, “Working with Measurements,” on page 168 for instructions on using the measurement tools).
9. Add annotations (see “Working with Annotations” on page 66) as needed.
10. Save and/or print the ultrasound image. See “Saving Images and Loops” on page 141 and “Printing Images” on page 162.

Conducting a PWD Exam


To conduct a Pulsed Wave Doppler exam, follow these steps:

1. Conduct a B-Mode exam as described in “Conducting an Ultrasound Exam” on page 54 (do not freeze the scan).
2. Position the cursor in the 2D image where you want to set the range gate, then double-click.

As an alternative, you can use either of these methods:

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

then 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 103 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 168 for instructions on using the measurement tools).
5. Add annotations (see “Working with Annotations” on page 66) as needed.
6. Save and/or print the ultrasound image. See “Saving Images and Loops” on page 141 and “Printing Images” on page 162.

Conducting a Triplex Exam

To conduct a Triplex exam, follow these steps:


1. Conduct a Color Doppler, Directional Power Doppler, or Power Doppler exam as described in “Conducting an Ultrasound Exam” on page 54 (do not freeze the scan).
2. Position the cursor in the 2D image where you want to set the range gate, then double-click.

As an alternative, you can use one of these methods:

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

then 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 “Scanning in Triplex Mode” on page 122 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 168 for instructions on using the measurement tools).
5. Add annotations (see “Working with Annotations” on page 66) as needed.
6. Save and/or print the ultrasound image. See “Saving Images and Loops” on page 141 and “Printing Images” on page 162.

When you switch to Triplex mode, both the original 2D scan mode and PWD mode are active. See “Scanning in Triplex Mode” on page 122 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, B-Mode allows you to capture up to 60 frames 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.


This table shows frame limits in a Cine loop.

Number of Frames in an Image Loop


Mode	Frame Maximum
B-Mode	60
M-Mode	30
Pulse Wave Doppler	30
Color Doppler	25
Directional Power Doppler	25
Power Doppler	25

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, 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 menu). You can then use the Playback toolbar to move through the frames acquired during the scan (see “Working with Image Loops”).

To start a new scan, you can:

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

The Terason software starts acquiring new image frames.



If you do not save the frozen image or loop, the frame data is available only until 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.





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 70 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. Once you freeze an image, you can use the buttons on the Playback toolbar 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.



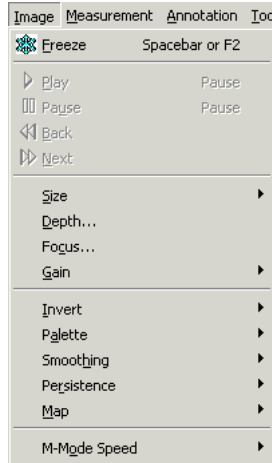
Playback Toolbar Buttons

If you want to select a specific frame to save as an image (not as a loop), click  or  until the needed frame displays, then click . You do not need to select a different frame if you want to save the scan as a loop: all acquired frames are saved in the loop when you click .

To view a loop, click . The Play button changes to the Pause button. The loop plays continuously until you click the Live or Pause button. 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 access 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 this example, the message shows beneath the Modes toolbar.



Location of Image Status Message

You could see any of the statuses in this 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
Simulated Live Imaging	No transducer is connected; displayed image is simulated
Frozen Simulated Image	With no transducer attached, the scan was frozen
Playing Simulated Loop	With no transducer attached, a simulated loop is playing

Image Display Window Status	Description
Paused Simulated Loop	With no transducer attached, a simulated 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 what displays in the Image Display window. You can:

- Zoom in on an area
- Resize the window
- Use the full screen
- Hide windows and toolbars

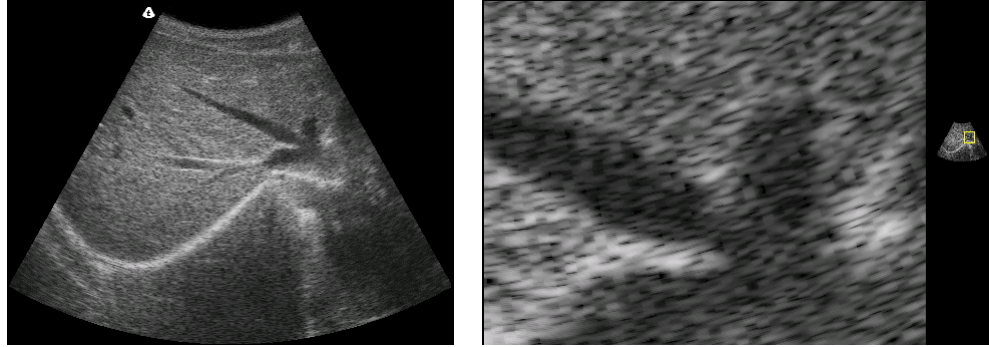
Zooming in on an Area of the Image

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, follow these steps:

1. Click  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.

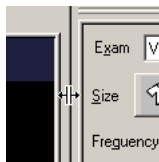
If you do not see the thumbnail or you want to hide it, choose **View > Image Display Properties > Zoom Thumbnail**. Each time you select this menu item, the Terason software toggles between showing and hiding the thumbnail. The Large Thumbnail option in this menu works with the Image Sorter tab, not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

Use the scroll bars if you need to 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.

In addition, you can 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 all the available space.

Displaying the Image Using the Full Screen

You can set the Image Display window to use 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 will 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. If you want 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 just need to use the menus to select them.


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

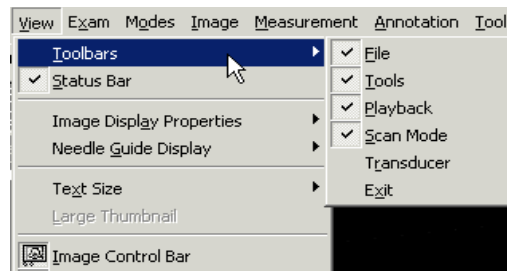
When you hide windows or toolbars, the Image Display window expands to fill the additional area.

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 bar 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 Explorer**, **Image Control Bar**, or **Annotation 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 Terason software hides or shows the window depending on its current state.

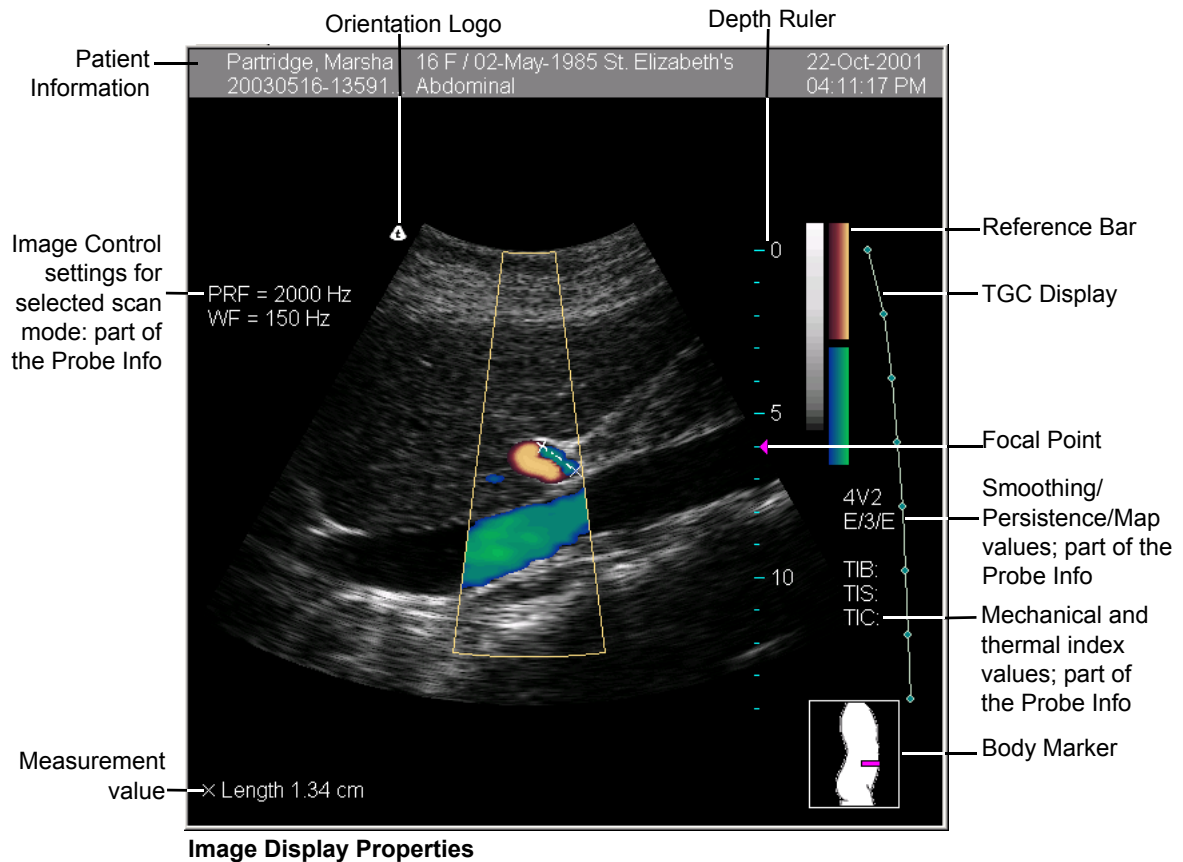
The **Status Bar** menu item hides or shows the status bar at the bottom of the Terason window.

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

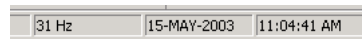
See Appendix B, “Menu and Toolbar Reference,” on page 272 for a quick description of each toolbar.

Displaying Additional Guides on the Image Display

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



The Zoom thumbnail only shows when you enter zoom mode. The Frame Rate (in Hz) displays at the bottom right of the Terason window.



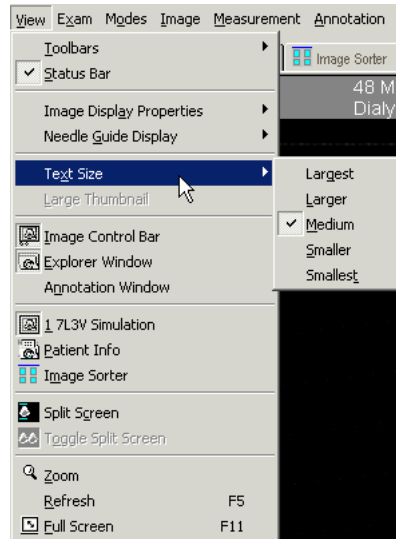
Frame Rate (Hz value)

See Chapter 5, "Working with Scan Modes," on page 88 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 smaller text size, the text will not overlap the image, but will be more 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

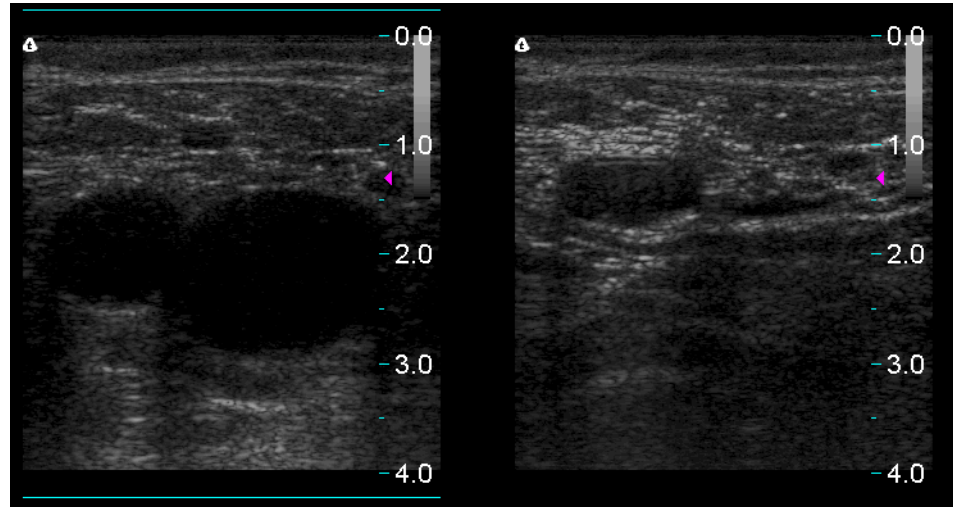
Using Split Screen Mode

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 (B-Mode, Color Doppler, Directional Power Doppler, To enter split screen mode, you:

- Click 
- 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 B-mode scan, enter split screen mode, then acquire a Color Doppler scan in the second screen.


This figure shows an example of a split screen.




Split Screen

The cyan bars at the top and bottom 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 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.



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 198 for information on saving custom exams.

Working with Annotations

To add annotations to a scan, you can:

- Add text
- Display body markers

Working with Text

To place text on an image, you first need to 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 143 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, you can:

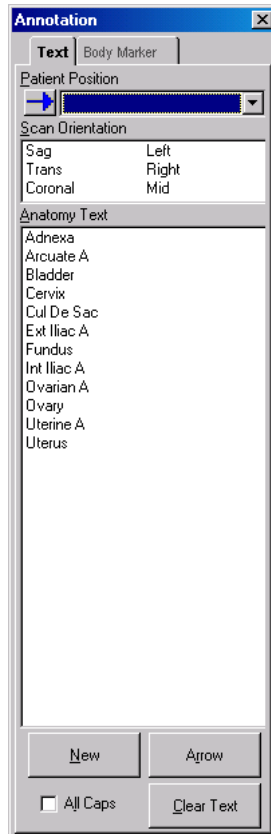
- Choose exam-specific text to display on the image
- Set a home position for the text
- Place arrows on the image
- Move text to a different location
- Type text on an image
- Edit text already added to an image
- Delete text from an image

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)

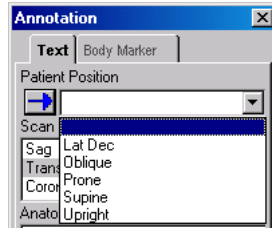
If you added custom text using the Options dialog box (see “Adding Custom Text to the Annotation Window” on page 219), that text shows at the bottom of the list.

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 69).
- The **Clear Text** button deletes all text (including manually typed text) from the image.
- The **ALL CAPS** check box adds text in all upper case letters. You must select the check box *before* you select the text. This check box has no affect on text already added to the image.

Click on 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)

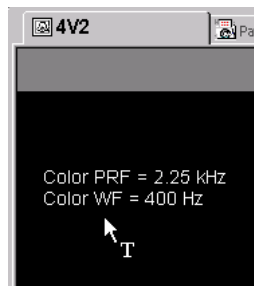
After you click on a position, the Terason software adds that text at the home position. On subsequent scans, you can click the blue arrow to add the shown patient position to the image.

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, follow 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.

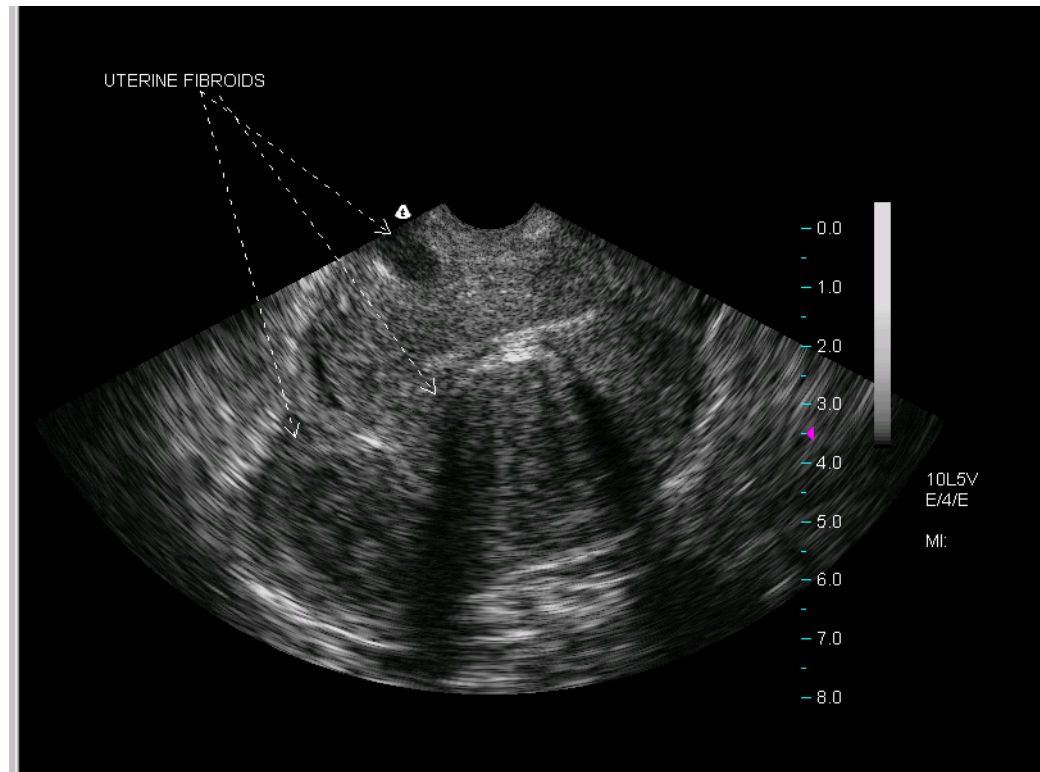
The Terason software will use this location when adding text from the Annotation Window, and as the cursor location when typing text. You can always move text after placing it.

Placing Arrows on the Image

You can draw an arrow from text to the anatomy indicated by that text. You can also add an arrow without adding text.

To place an arrow on an image, follow 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 on the arrow head 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 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 on 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, follow 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 on 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 edit.
3. Right-click on the text and select New Text to add a new line.
4. Double-click on 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 “Displaying Additional Guides on the Image Display” on page 63), but you cannot delete it.

To delete text, perform one of these actions:

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

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

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

Using Body Markers

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

To work with body markers, you need to know how to:

- Add a body marker
- Move the body marker to a different location in the Image Display tab
- Change the icon shown in the body marker
- Move the indicator within the body marker
- Change the orientation of the indicator
- Rotate the indicator
- Remove the body marker

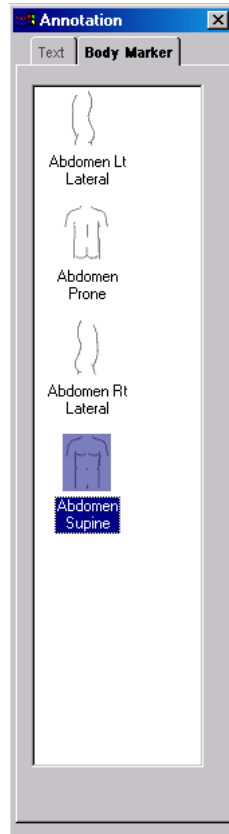


Body markers are not available with the Veterinary version of the Terason Ultrasound System.

Adding a Body Marker

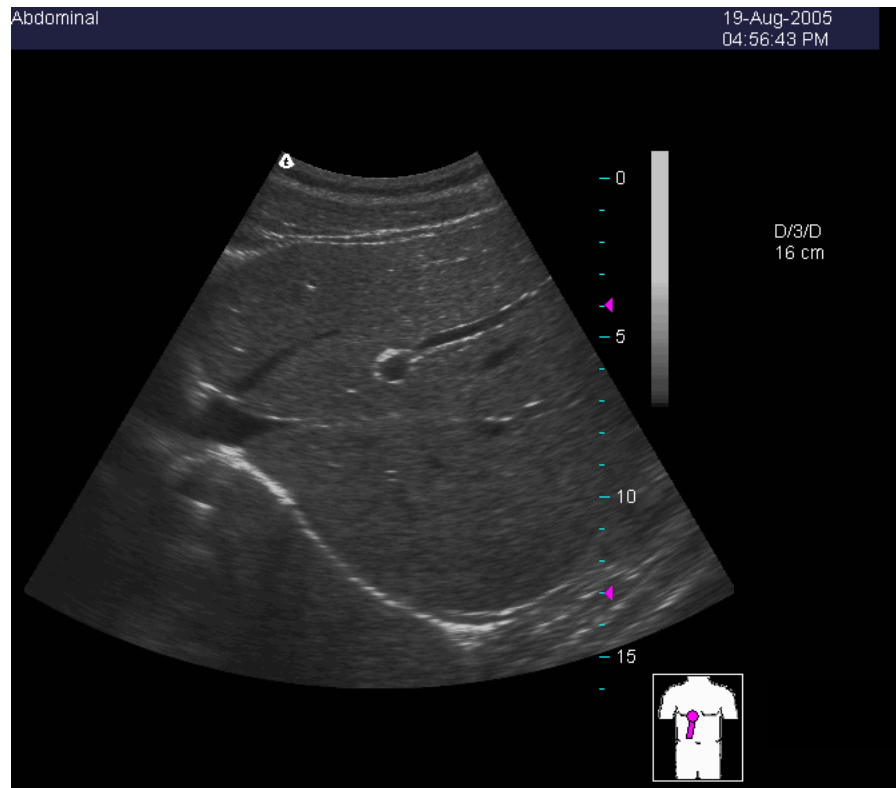
To add a body marker to an image, follow these steps:

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

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 do so, click on the body marker, move to a new location, and click to lock it in place.

Changing the Icon in the Body Marker

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

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

Moving the Indicator

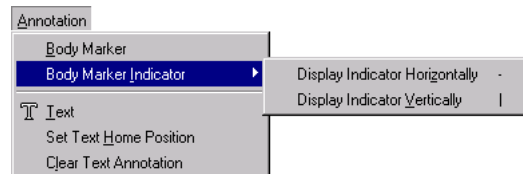
You can move the pink marker to anywhere on the icon to more precisely indicate the scanned anatomy. To do so, follow these steps:

1. Click the pink rectangle.
2. Move the cursor to the needed location.

3. Click to lock the indicator in position.

Changing the Indicator's Direction

You can use the **Annotation > Body Marker Indicator** menu item if you need to adjust the orientation of the pink rectangle.



Changing the Orientation of the Body Marker Indicator

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

Rotating the Indicator

You can also rotate the pink rectangle by following these steps:

1. Move the cursor near the top or right edge 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 needed orientation.
3. Click to lock the rectangle in position.

Removing the Body Marker


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

Switching Transducers

How you switch between transducers depends on your system configuration. When using multiple transducers or a biplanar transducer, you can switch between transducers with a single mouse click. If your configuration only allows one transducer to be connected at a time, you need to perform several steps.




Switching to an Alternate Transducer or Biplanar Transducer

If your Terason Ultrasound System includes the 8B4S biplanar transducer or a hub connected to multiple transducers, then the Terason software shows an Image Display tab for each connected transducer. You can use any of these methods to switch from one transducer to another:

- Click  Switch
- Click the Image Display tab with the needed transducer model number
- Select **View >** and the transducer model number


Removing a Transducer and Connecting a Different Transducer

If your Terason Ultrasound System only allows you to plug in a single transducer at a time (you only see one Image Display tab), then you need to follow these steps to switch between transducers:

1. If necessary, save the active image or image loop. See “Saving Images and Loops” on page 141 for instructions.
2. Exit the Terason software using one of these methods:
 - Click  Exit on the toolbar at the bottom of the window
 - Click  in the upper right corner of the window
 - Select **File > Exit**
3. Carefully pull back the silver connector sleeve to unplug the transducer connector from the EDCM or media bay. Do not pull on the cable.
4. Plug the new Terason transducer cable into the EDCM or media bay.
5. Double-click  on the Windows desktop to restart the program.

Launching Sonocubic 3-D Imaging Software

If you purchased the Sonocubic software, you can use the Terason software to acquire an obstetrical exam, and then launch the Sonocubic software to create a 3-D image based on the Terason ultrasound image.

After starting an exam, click  . The Terason software launches the Sonocubic software. Refer to the Sonocubic documentation for instructions on using the software. When finished, click the Return to Terason button. The Sonocubic software closes and you can continue your ultrasound scanning session.

This button shows on the Scan Modes toolbar only if the Sonocubic software is installed on the computer.

4 Setting Up Patient Information

Although you can scan a patient without entering any information about that patient, Terason recommends that you take the time to 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.

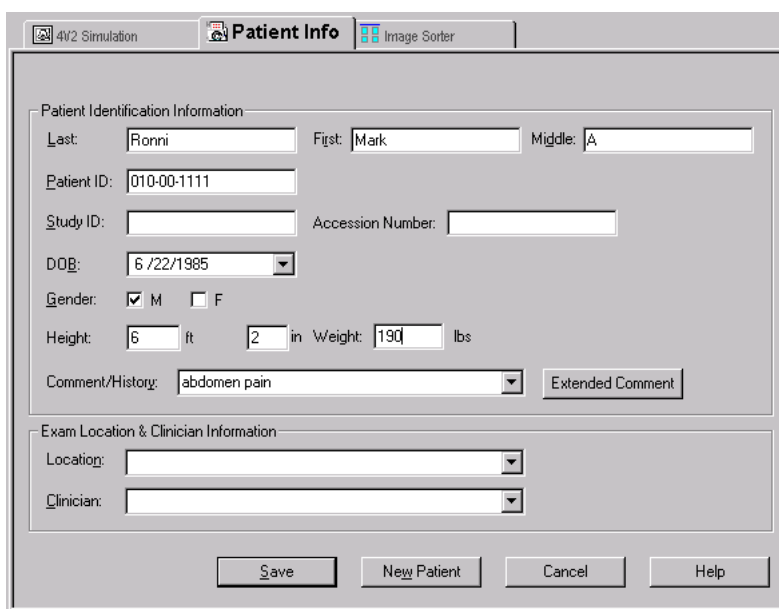
When you save an image, the Terason software puts it in a folder for the specific patient, along with a patient information file. If you do not enter patient details, the image is stored in a folder with other images and is not associated with a specific patient.

The Patient Info window is customized for either human or animal patients, depending on the system you purchased.

To work with patient information, you need to know how to:

- Use the Patient Info window
- Add a new human patient
- Add a new animal patient (veterinary version only)
- Prepare for an exam
- Update patient information
- Delete a patient folder

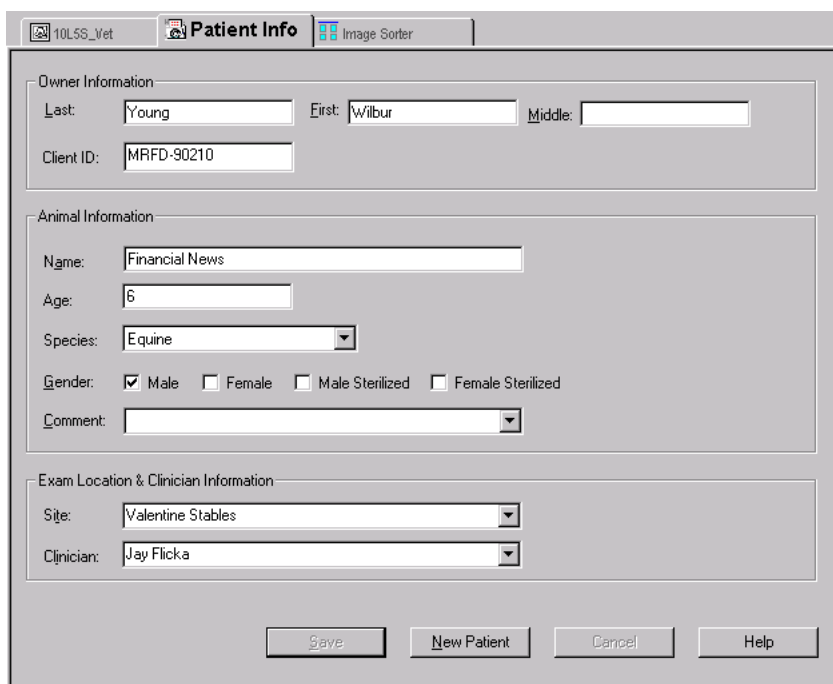
To view the Patient Info window, click the Patient Info tab.



The screenshot shows the 'Patient Info' window in a software application. The window has three tabs: '4V2 Simulation', 'Patient Info' (selected), and 'Image Sorter'. The 'Patient Identification Information' section contains fields for Last Name (Ronni), First Name (Mark), Middle Name (A), Patient ID (010-00-1111), Study ID, Accession Number, DOB (6/22/1985), Gender (Male checked), Height (6 ft 2 in), Weight (190 lbs), and Comment/History (abdomen pain). The 'Exam Location & Clinician Information' section has dropdown menus for Location and Clinician. At the bottom are buttons for Save, New Patient, Cancel, and Help.

Patient Info Window for Human Patients

The veterinarian version of the Terason Ultrasound System uses a Patient Info window that identifies both the owner and the animal being examined.



The screenshot shows the 'Patient Info' window in a software application. The window has three tabs: '10L5S_Vet', 'Patient Info' (selected), and 'Image Sorter'. The 'Owner Information' section contains fields for Last Name (Young), First Name (Wilbur), Middle Name, and Client ID (MRFD-90210). The 'Animal Information' section contains fields for Name (Financial News), Age (6), Species (Equine), Gender (Male checked), and Comment. The 'Exam Location & Clinician Information' section has dropdown menus for Site (Valentine Stables) and Clinician (Jay Flicka). At the bottom are buttons for Save, New Patient, Cancel, and Help.

Patient Info Window for Animal Patients

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; can be pasted into any text 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; can be pasted into any text 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

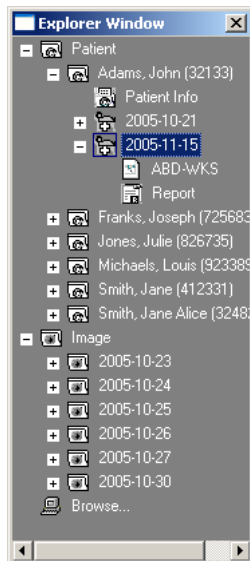
You can also use the **File** menu to access the Save Patient and New Patient functions.

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

Adding a New Human 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.

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 Mark A. Ronni contains the Patient Info file, and three dated folders, each containing one or more scans saved on the indicated date.

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 will display an error message when you try to save the patient information.

To add a new patient, follow these steps:

1. Click the **Patient Info** tab.
2. Click **New Patient**. If unsaved data has been entered, the Terason software prompts you to save your changes.



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 **cannot** use any of these characters in this 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.



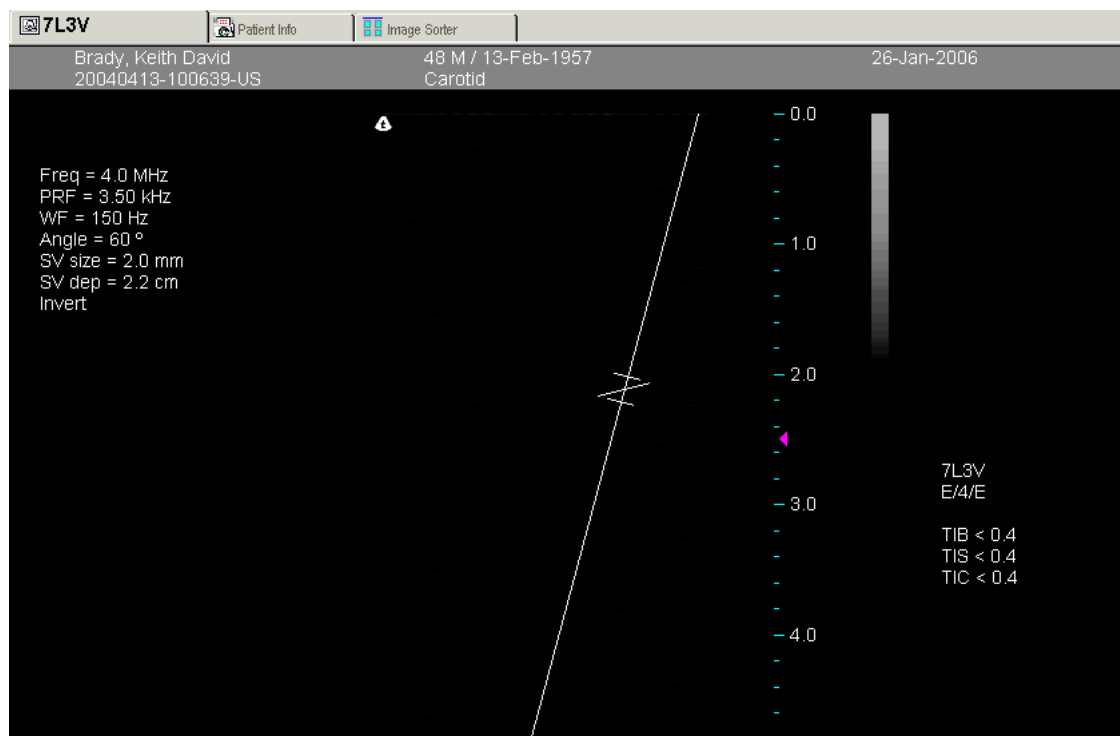
Calendar Tool

- b. Click the outside left or right double arrows to choose a different year.
 - c. Click the inside left or right single arrow 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. If you want to change the units of measurements used, see “Setting the Units for Patient Measurements” on page 217.
 12. Enter any comments. You can type directly in the box, or click **Extended Comment** to type a longer comment.
 13. In the Location box, enter where the exam is taking place. You can enter up to 46 alphanumeric characters.
 14. In the Clinician box, 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 Image Display tab
 - Select **File > Save Patient**
 - Click the **Save** button

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.

Adding a New Animal Patient

If you need to start the ultrasound exam immediately, the Terason software lets you skip entering owner and patient information, however, if you save the image it will not be associated with this owner/patient, and no patient information will be saved with or displayed on the scan.

When you add a new patient, the Terason software creates a folder in the Patient folder with the owner's name and the animal's name in parentheses. 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

In this example, Wilbur Young is the owner, and Financial News is the patient. The folder contains the Patient Info file, and a dated folder. Dated folders contain one or more scans saved on the indicated date.

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 the owner's 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 will display an error message when you try to save the patient information.

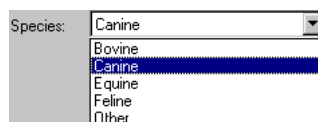
To add a new patient, follow these steps:

1. Click the **Patient Info** tab.
2. Click **New Patient**. If unsaved data has been entered, the Terason software prompts you to save your changes.



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

3. Enter the Owner's Last name.
4. Enter the Owner's First name.
5. Enter the Owner's Middle name.
6. Enter a Client ID. You can enter up to 64 alphanumeric or special characters.
7. Enter the Animal's Name. You can enter up to 64 alphanumeric characters. You **cannot** use any of these characters in this field:
* \ | : " < > / ?
8. Enter the patient's age.
9. Select a Species from the pull-down list.

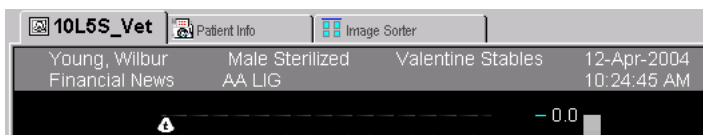


Selecting a Species

If the needed species is not listed, choose Other and use the Comment box to enter the animal's species.

10. Click in the check box for the patient's gender: Male, Female, Male Sterilized, or Female Sterilized.
11. Enter any comments. You can enter up to 46 alphanumeric or special characters (not all special characters are supported).
12. In the Site box, enter where the exam is taking place. You can enter up to 46 alphanumeric characters.
13. In the Clinician box, enter the name of the clinician performing the exam. You can enter up to 46 alphanumeric characters.
14. Use one of these methods to save your entries:
 - Click the Image Display tab
 - Select **File > Save Patient**
 - Click the **Save** button

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



Animal Patient Information at the Top of the Image Display Window


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.

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

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, follow these steps:

1. Locate the patient in the Terason Explorer window.
2. 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

3. 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.




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

4. If necessary, click the Patient Info tab to make it active.
5. Optional: In the Location box, 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 box).
6. Optional: In the Clinician box, 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 box).
7. Optional: Enter Comments about the current exam.
8. Click **Save**.

You are now ready to scan the patient.

Updating Patient Information

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

1. Click  in front of the patient's name in the Patient folder in the Terason Explorer window.
2. Double-click the Patient Info file.
3. If necessary, click the Patient Info tab to make it active.
4. Enter the new information in the appropriate fields.
5. To edit the comment, click **Extended Comment** and make any needed changes.
6. 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 the Patient Info file within that folder. If the folder contains any saved images, those files will also be deleted.

If you want to archive the patient information file and its associated images before you delete them, see “Backing Up Files on a CD” on page 150.



You cannot recover files deleted using the Terason software like you can when using the Windows Explorer. Make sure you really want to delete all the information in the folder, including saved scans, before you follow this procedure.

To delete a patient folder, follow these steps:

1. In the Terason Explorer window, locate the patient's name.
2. Right-click on 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**.

5 Working with Scan Modes

When you select a scan mode, the Image Control bar shows up to four tabs. You will always see the **2D** and **I.Q.** tabs associated with B-Mode imaging. All other modes available in the Terason Ultrasound System software include the B-Mode functionality. For other modes, you will see an additional tab with image controls for the selected scan mode. In Triplex mode, you will see the **2D**, **I.Q.**, and **PWD** tabs, plus the selected Doppler mode tab.

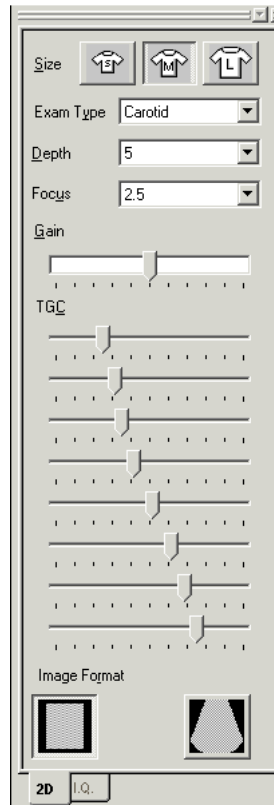
In general, follow these guidelines to choose which scan mode to use for an exam:

- Select B-Mode when you want to view a two-dimensional display of the anatomy; B-Mode controls allow you to adjust the size, depth, focus, overall image gain, brightness, and exam type
- Select M-Mode when you want to evaluate motion over time, such as viewing motion patterns of the heart
- Select Pulsed Wave Doppler mode when you want view the motion of blood flow at a small region along a desired scan line
- Select Color Doppler when you need to view the relative velocity of blood flow
- Select Power Doppler when you want 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
- Select Directional Power Doppler when you want to combine the density information provided by Power Doppler with the directional information of Color Doppler. The Directional Power button is on the Pwr window.

In addition, you can configure image controls for Triplex scanning using the PWD tab with the CD or Pwr tabs.

Using 2D Controls

This 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 removes the 2D tab.



2-D Tab in the Image Control Window

Adjusting the Size (T-Shirt Buttons)

The size buttons load the preset values that optimize the scan for the size of the patient, or 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).

When choosing a size for a patient, choose the smallest reasonable size to maximize the frame rate. The size setting also controls the B-Mode transmit frequency for some transducers. The highest transmit frequency is used with the small size to provide the best B-Mode resolution; the mid-range frequency is used for the medium size; and a lower frequency is used for the large size to provide the best penetration.

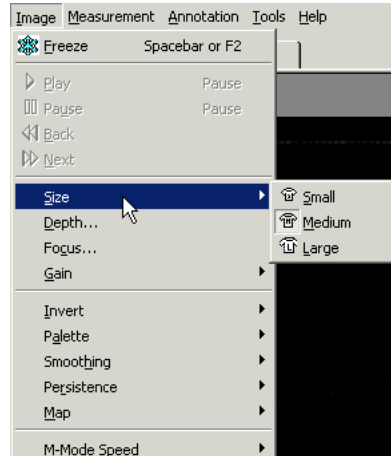
Other B-Mode settings such as gain, focus, and depth have been optimized according to the size. When you choose a size, you also load baseline settings for the other 2D controls.

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



Setting the Patient Size

Alternatively, you can access the size option from the **Image** menu and choose the size from the pop-out menu.



Using the Menus to Set the Patient Size

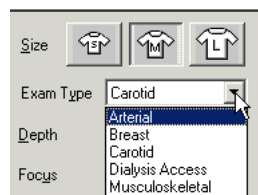


After you select the size that suits the clinical situation, you can modify any available controls to further optimize the image.

Choosing an Exam

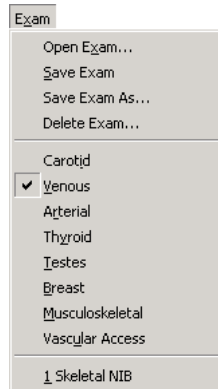
Terason provides customized exams for scanning different types of anatomy. When you choose an exam, the Terason software loads image controls settings for the 2D and I.Q. tabs customized for that anatomy and the connected transducer.

To select an exam, choose one from the drop-down list.



Choosing an Exam

You only see the exams supported by the connected transducer. You can also select an exam from the **Exam** menu.



Selecting an Exam from the Menu Bar

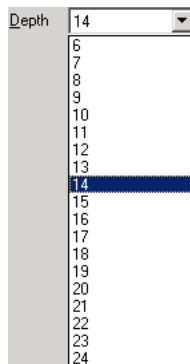
The top group of menu items are used to work with custom exam types; the next group of menu items load the presets for the indicated exam type. If you created any custom exams, they show at the bottom of the Exam menu. See Chapter 9, “Working with Exams,” on page 198 for more details about exam types and defining your own exams.

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 if there is a large part of the exam display that is unused or not necessary at the bottom of the window.

When you select an exam type, the Terason software enters the preset depth value for the specific exam type, transducer, and patient size.

To select the depth, choose a depth (in cm) from the drop-down list.

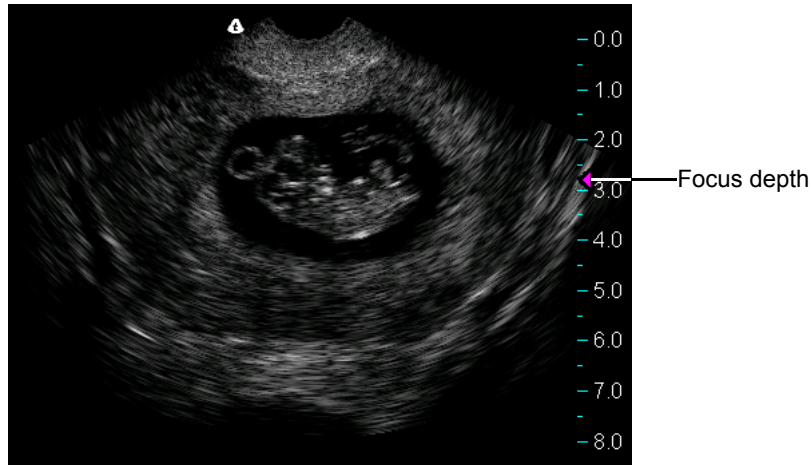


Choosing the Depth (Values in cm)

The values in this list 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**. This example shows the depth ruler along the right side of the image.

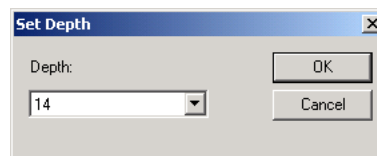


Example Depth Ruler

The pink triangle along the depth ruler (above the 3.0 value) indicates the focus depth.

Alternatively, you can use the menu bar to set the depth. To do so, follow these steps:

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



Set Depth Dialog Box

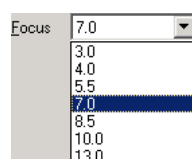
2. Select a depth value from the drop-down list.
3. Click **OK**.

Adjusting the Focus

Focus optimizes the image by increasing the resolution for a specific area. The depth ruler indicates the focus using a pink triangle. 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.

You can change the position of the focal zone to define a location for the optimal area of focus. To adjust the focus, choose a value from the focus drop-down list.



Setting the Focus

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

Adjusting the Gain

B-Mode 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 have the effect of brightening or darkening 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 93 for more information on TGC settings.

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

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



Changing the Gain

You can also adjust the gain by clicking in the 2D Image Control tab and pressing the left (decreases the gain) and right (increases the gain) arrow keys. As an alternative, 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.

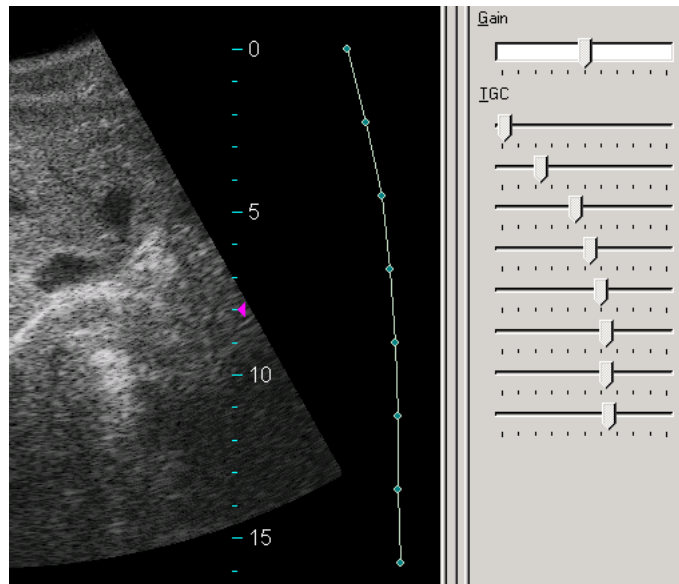
Adjusting Time Gain Compensation (TGC)

The TGC sliders adjust how returning signals are amplified to correct for the attenuation caused by tissues being scanned at increasing depths. 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:

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

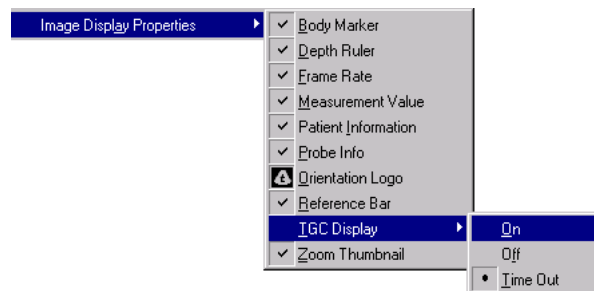
The TGC slider bars are spaced proportionately to the depth. The TGC curve on the image display shows the TGC settings.



Example TGC Curve on an Image

Each dot on the curve corresponds to one of the sliders. You can adjust the TGC sliders individually as needed. Like adjusting the gain, drag a slider to the left to decrease the gain, and drag it to the right to increase the gain.

To show or hide the TGC curve, select **View > Image Display Properties > TGC Display**.



Viewing the TGC Curve

Select **On** to show the curve; 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 the Sector Width or Image Format

The Sector Width option lets you select how wide an image scan to acquire. Decreasing the size of the sector increases lateral resolution; increasing the size of the sector decreases lateral resolution.

For the phased array and curvilinear array transducers, you can choose a small, medium, or large sector width; for the 4V2 transducer, you can select a small or large sector width.



Sector Width Choices

For the linear transducers, Sector Width is replaced with Image Format. You can choose an Image Format of linear or sector.



Image Format Choices

For the 8B4S transducer, the linear probe shows sector width and the curvilinear probe shows image format choices.

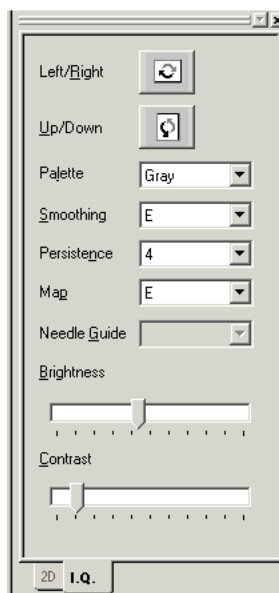
To change the shape or size of the sectors, click the needed button.

See “Changing the Display Mode Defaults” on page 214 for information on choosing defaults associated with sector width and image format.

Using I.Q. (Image Quality) Controls

The I.Q.preset values that load when you choose an exam have been optimized for the specific 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.

This figure shows the controls on the I.Q. tab.

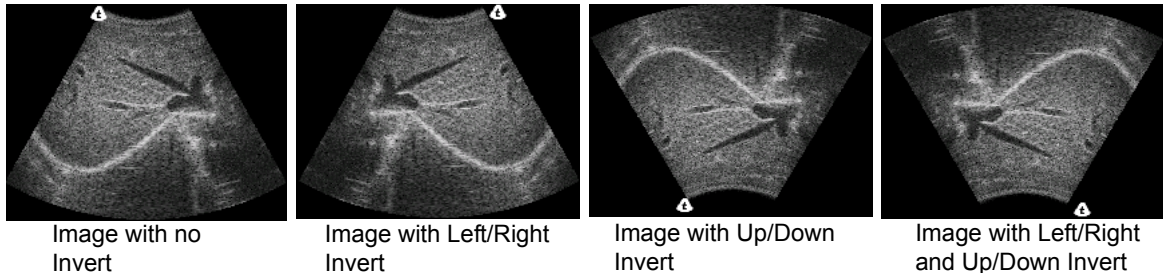


I.Q. Tab in the Image Control Window

Inverting Images

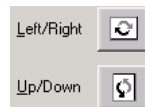
The Left/Right and Up/Down choices change the orientation of the scanned image.

This 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.



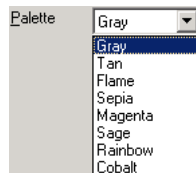
Inverting Images

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

Adjusting the Palette

By default, the Terason software uses the gray palette for B-Mode images, where images are displayed in shades of gray over a range of light (white) to dark (black). The Terason software provides several alternate palettes. To determine if another palette will improve visibility of the anatomy being scanned, cycle through the available options. The palette that produces the best image depends on the anatomy that is being scanned.

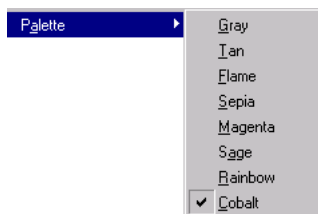
To select a different palette, click the down arrow next to the Palette field in the I.Q. tab and select a palette from the drop-down list.



Selecting a Different Palette

The Terason software updates the image display using the colors defined by the selected palette.

Alternatively, you can select **Image > Palette** to choose a palette.



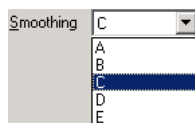
Selecting a Palette from the Image Menu

Adjusting Smoothing

You can make an image appear smoother by changing the value in the smoothing field. The smoothing values are letters from A to E and represent different algorithms. Generally, the amount of smoothness increases as you select higher letters. Please 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.

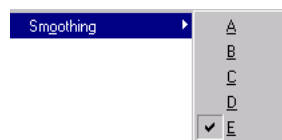
When you increase the value in the field, it increases the amount of interpolation between scan lines to make the image appear smoother. It also decreases the frame rate. When you decrease the amount of smoothing, the amount of interpolation between scan lines is decreased to make the image appear rougher,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

To adjust the smoothness of the image, click the down arrow to the right of the smoothing field, and select a value from the drop-down list.



Selecting a Smoothing Option

Alternatively, you can select **Image > Smoothing** to choose a different smoothing option.



Selecting a Smoothing Option from the Image Menu

If you want to view the smoothing setting on the image display, select **View > Image Display Properties > Probe Info** from the menu bar.



Example Scan Showing Probe Info

In this example, the transducer model is the 4V2. A code, such as C/2/A, displays beneath the transducer model number and represents the Smoothing/Persistence/Map settings, respectively. The probe information may also include labels for these indices depending on the selected scan mode:

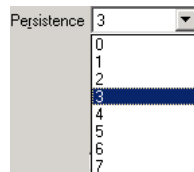
- Mechanical Index (MI)
- Soft Tissue Thermal Index (TIS)
- Bone Tissue Thermal Index (TIB)
- Cranial Thermal Index (TIC)

See “General Description of Indices” on page 233 for more information.

Adjusting the Persistence

Persistence refers to image frame averaging and only applies to 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 that the image will appear to be blurred if the tissue is moving when you freeze the image. When the persistence is low, the opposite is true.

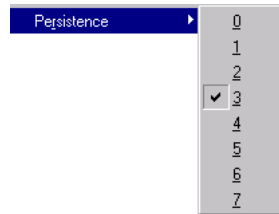
To indicate the amount of frame averaging you want, click the down arrow to the right of the persistence field and select a value from 0 to 7.



Choosing a Persistence Value

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

Alternatively, you can select **Image > Persistence** to choose a different setting.



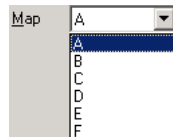
Choosing Persistence from the Image Menu

If you want 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 option lets you change the number of gray levels in the image. This feature is useful for close viewing of certain anatomical features or detecting subtle pathologies. Depending on the current scan, different image maps may or may not visibly alter the appearance of the image.

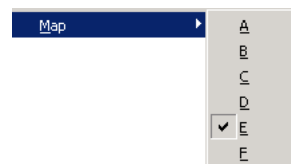
To change the number of gray levels, click the down-arrow next to the map field. You can choose from A to F.



Choosing an Image Map

To view the effect of your choice, the reference bar should be visible on the image. To show the reference bar, select **View > Image Display Properties > Reference Bar**.

Alternatively, you can select **Image > Map** to choose a different image map setting.



Choosing an Image Map from the Image Menu

The probe information includes a code such as C/2/A, where the third item (A in this example) is the Map value.

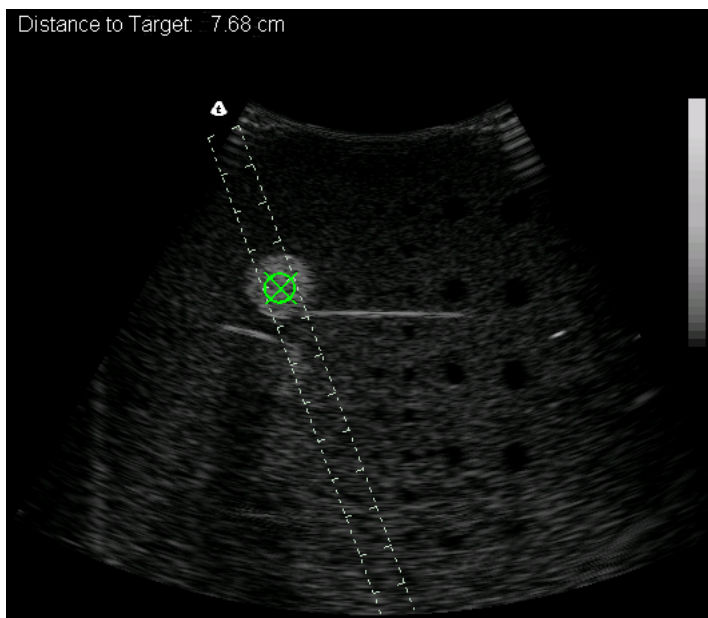
Selecting the Needle Guide

The needle guide control is only available if you are using a transducer that supports biopsies or other medical procedures. When performing the procedure, select the correct needle guide from the drop-down list.



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, you will see an option for each angle.



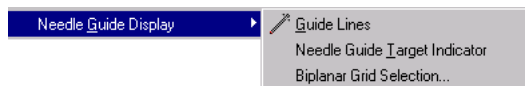
Needle Guides and Target for a Biopsy

On the 2D image, the white dashed lines are the guide lines, and the green circle with the X 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

The Biplanar Grid Selection menu option only works with the 8B4S transducer as described in “Using the Biplanar Transducer Options” on page 133.

See “Using Needle Guidelines” on page 130 for more information on using this option to perform a biopsy or other medical procedure.

Adjusting Image Brightness

The brightness value determines the overall brightness of the image.

To adjust the brightness, drag the slider to the left to darken the image, and drag the slider to the right to brighten the image.



Adjusting the Image Brightness

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

Adjusting Image Contrast

The contrast slider adjusts the contrast of the display's image tone. Increasing the contrast decreases the amount of levels of gray in the image and provides more contrast in the image. Decreasing the contrast diminishes the contrast in the image. Terason recommends that you adjust the contrast to correspond with and complement the brightness and map values.

To increase the contrast, drag the slider to the right. To decrease the contrast, drag the slider to the left.

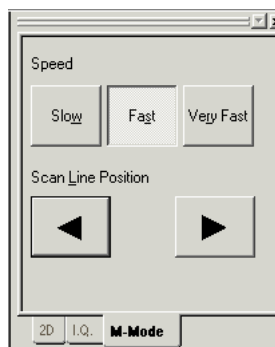


Changing the Image Contrast

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

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 Control Settings

In addition to the options in the M-Mode tab, you can set the display mode to scroll or sweep.

Adjusting the Time Line Speed

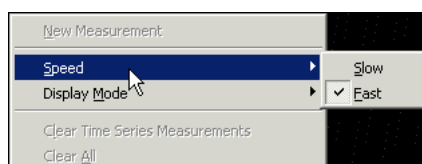
The speed buttons set how fast the timeline is scanned across the Time Series window.

To set the speed, click on the Slow, Fast, or Very Fast button.



Setting the Speed

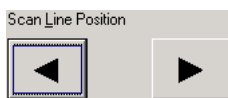
You can also choose the speed selecting **Image > M-Mode Speed** and choosing a speed, or by right-clicking in the M-Mode window and choosing a speed. The tick marks in the Time Series window show closer or farther apart depending on the speed. Each tick mark represents one second.



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

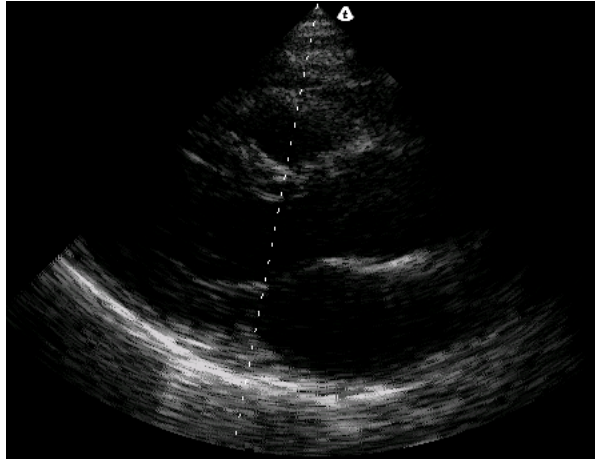
Adjusting the Scan Line Position

To adjust the scan line in the B-Mode image display, click on the left or right arrows under Scan Line Position. The scan line moves accordingly to the left or the right.



Adjusting the Scan Line

This figure shows the scan line:



Scan Line

You can also move the scan line using these methods:

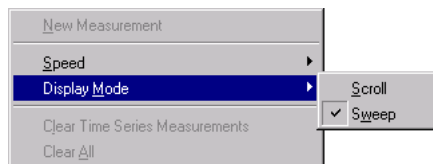
- Click on it, move your cursor to a new location, and click again
- Type a . (period) to select the scan line and use the keyboard left and right arrows to move it
- Click on the scan line and use the keyboard left and right arrows to move it
- Double-click on the image where you want to move the scan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

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

Changing the Display Mode

The Terason software can build the Time Series window from left-to-right (sweep) or from right-to-left (scroll). To change the Display Mode for the current scanning session, follow these steps:

1. Right-click in the Time Series window.
2. Highlight Display Mode, and choose Scroll or Sweep.

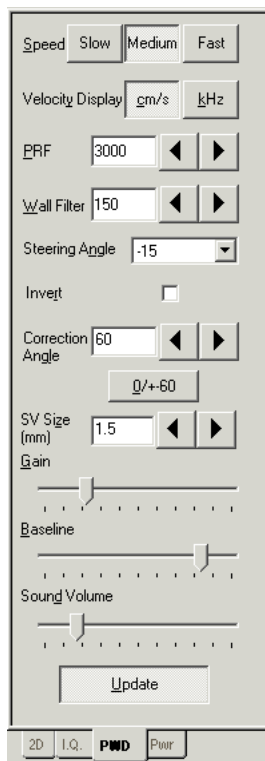


Shortcut Menu in the Time Series Window

This method changes the display mode temporarily. The next time you start the Terason software, it uses the default display mode. To change the default display mode, see “Changing the Display Mode Defaults” on page 214.

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 Control Settings

You can adjust any of the PWD settings as described in the following sections. In addition to these controls, you can also move the scan line position, set the PWD gate position, and choose a display mode.

Adjusting the Time Series Speed

The Terason software lets you choose the speed for Pulsed Wave Doppler mode. A medium speed is suitable for normal use. Fast speed shows fewer waveforms over time but with more detail.

The Time Series window indicates the speed by the spacing of the ticks along the top. 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 button.



Choosing a Speed

Alternatively, you can select **Image > PWD Speed** and then choose a speed, or right-click in the Time Series window and select Speed, then 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 whenever necessary. Centimeters per second (cm/s) is available only when the correction angle (see “Adjusting the Correction Angle” on page 108) 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.



Available Velocity Display Units

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 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, and/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 waveform on the display will alias, or wrap-around, the baseline.

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



Changing PRF Setting



For 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.

The increment value for each click depends on the current range, as defined in this 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 233 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 reduces the display of low velocity tissue motion. Lowering the wall filter, displays more information; however, more wall tissue motion will also be displayed.

Use a wall filter 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 value box.



Changing the Wall Filter Setting

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 this table. 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

Range (Hz)	Increment (Hz)
100-300	50
300-up	100

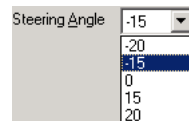
Adjusting the Steering Angle

To obtain accurate velocities, you need to 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 for flat linear array transducers (the 7L3, 8IOL4, and 10L5). This option does not display for all other transducers. Curved linear and phased array transducers do not have the capability of electronic steering.

In the Terason Ultrasound System, the maximum value for the correction angle is +/- 70°. The velocity display in centimeters per second (cm/s) is shown only in the range between 0 and +/- 70°. Above 70°, the error in the velocity calculation 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 drop-down list.



Choosing a Steering Angle

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 / (slash). When you type this key, the Terason software highlights the Steering Angle value and you can use the left and right arrow keys to change the value. If you type this 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 that extends across the width of the spectral display. The data above the baseline is classified as forward flow. The data below the baseline is classified as reverse flow.

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

To invert the waveform, click in the invert check box.

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, click on it, move it to the left or right as needed, and click again to lock it in position. As an alternative, you can:

- Click on the scan line and use the keyboard left and right arrows to move it.
- Use the keyboard up and down arrow keys to move the Sample Volume along the scan line.
- Type a . (period) to select the scan line, and then use the keyboard left and right arrows to move it.

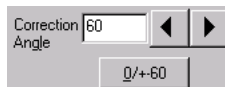
When the scan line remains in a fixed position for a few seconds, the Terason software locks it into position.

Adjusting the Correction Angle

To obtain accurate velocities, you need to 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 +/- 70°. The velocity display in centimeters per second (cm/s) is shown only in the range between 0 and +/- 70°. Above 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 is still shown 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.

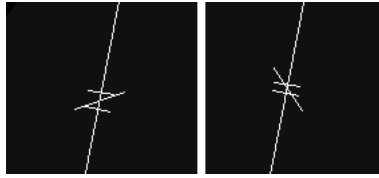


Adjusting the Correction Angle

You can also type the / (slash) key once (for non-linear transducers) or twice (for linear transducers) to select the Correction Angle value, then use the right and left arrow keys to select a different value.

If you want to set the correction angle to 0 or 60°, click the button. This button replaces the correction angle with either 0 or 60, whichever value is closer to the current value. The correction angle control is also active on frozen images.

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



60° Angle, 4.5 mm (Left) and 45° Angle, 2.0 mm (Right)

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

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 is displayed 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 right arrow to increase the volume or the left arrow to decrease the volume.



Adjusting the Sample Volume Size

You can set a value from 0.5 to 20 mm (in 0.5 mm increments). The value shows on the Image Display if the 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 on the indicator and move the cursor up or down until it is located properly, and click to lock the indicator in position.

You can adjust the position of the sample volume using the touchpad or mouse. Left-click the sample volume (the line becomes 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 in five seconds, it will be anchored in that position. Alternatively, you can 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.

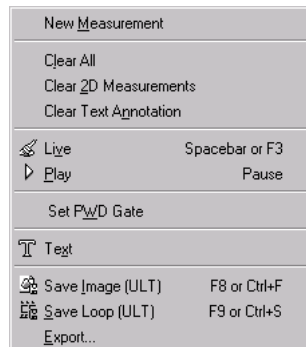
Modifying the depth location of the sample volume affects the Thermal Index (TI) value (refer to “General Description of Indices” on page 233 for more information about thermal indices).

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 will be locked in the needed position. When scanning in CD, DirPwr, or Pwr scan mode, this procedure switches to Triplex mode (if enabled by your license).

To locate the sample volume and switch to PWD or Triplex mode, follow these steps:

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 “Zooming in on an Area of the Image” on page 60) to have a better view.
3. Right-click on 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 then adjust the SV size, depth, or correction angle as needed for the scan.

As an alternative, you can double-click at the location in the 2D window to automatically set the gate position and switch to PWD or Triplex scanning.

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 on the slider and drag it to the left to decrease the gain, or drag it to the right to increase the gain.



Adjusting the Gain

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

The **Image > Gain** menu adjusts the B-mode 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

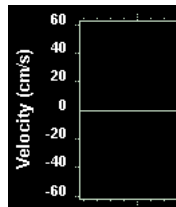
The baseline refers to the zero baseline within the Time Series Display window. Adjusting this control moves the zero baseline up or down. When you adjust the baseline, you can display more forward or reverse flow, taking advantage of the full scale available at that particular PRF value.

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

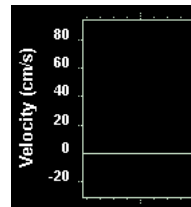


Adjusting the Baseline

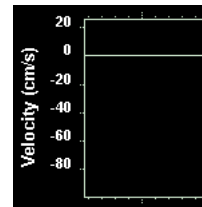
You can also adjust the baseline by clicking on the slider (a blue box is displayed around the slider) and using the left and right arrow keys. This figure shows a centered baseline (normal), and adjusted baselines.



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. To adjust the volume, drag the slider to the left to lower the volume; drag the slider to the right to raise the volume.



Changing the Volume

You can also adjust the volume by clicking on the slider (a blue box is displayed 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. Alternatively, you can use a high quality headphone or external speaker.

Controlling the 2D Scan

The **Update** button allows you to choose whether or not to continue scanning the anatomy (displayed in the 2D window) while acquiring PWD scan data. When 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.

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

When you de-select the **Update** button (but do not freeze the scan), you cannot adjust some of the 2D and IQ image controls. This table lists the image controls that can and cannot be adjusted when the 2D image is frozen.

Availability of Image Controls Available when Update Not Selected

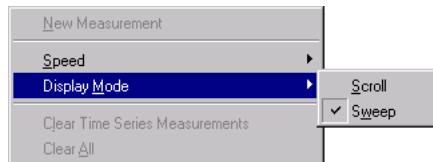
Image Control Tab	Available	Not Available
2D	Size Exam	Depth Focus Gain TGC curve Image format/sector width
IQ	Left/Right invert Up/Down invert Palette Smoothing	Persistence Map Brightness Contrast Needle Guide

All image control settings on the PWD tab remain available.

Setting the Display Mode

The Terason software can build the Time Series window from left-to-right (sweep) or from right-to-left (scroll). To change the Display Mode for the current scanning session, follow these steps:

1. Right-click in the Time Series window.
2. Highlight Display Mode, and choose Scroll or Sweep.

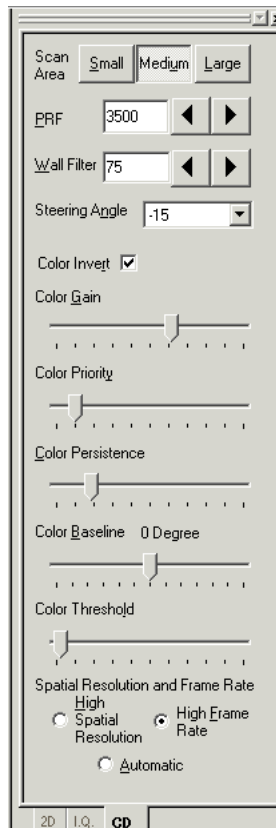


Shortcut Menu in the Time Series Window

This method changes the display mode temporarily. The next time you start the Terason software, it uses the default display mode. To change the default display mode, see “Changing the Display Mode Defaults” on page 214.

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.



Doppler Image Control Settings (Color Doppler Shown)

Although each mode adds a tab with the specific name of the selected mode, the tabs contain the same image control options.

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. Alternatively, 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 over time, or if you want to get a larger overall view of the blood flow.

When adjusting image controls, you should define the scan area before you make any other adjustments. You can choose a Small, Medium, or Large scan area by clicking the appropriate button.



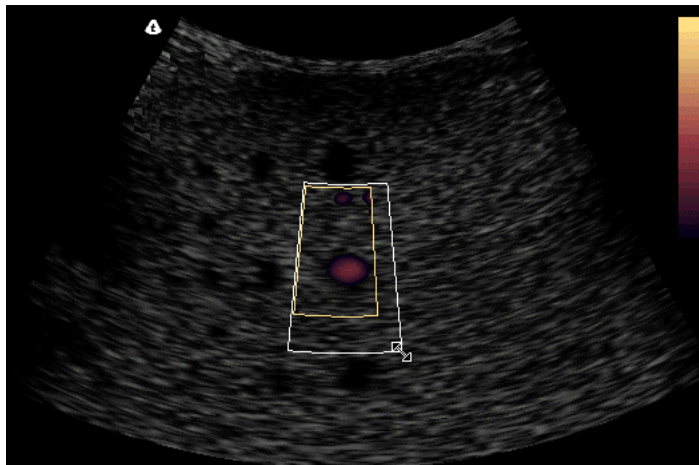
Choosing a Scan Area

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, move the cursor to a new position, and click 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 following these steps:

1. Position the cursor over one of the corners of the border defining the scan area.
2. Click on 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/increase the width, or the up/down arrow keys to increase/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, and/or if pathology is present.

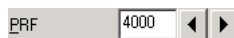
Aliasing occurs when the frequency of what you are observing exceeds one half of the sample rate. If the blood is moving faster than the pulse repetition rate, then the Doppler display will alias, or wrap-around, the baseline. Aliasing may occur for Color Doppler or Directional Power Doppler, but does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

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

As PRF increases, the maximum Doppler shift that can be displayed 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 value box.



Changing the PRF Setting

The increment value for each click depends on the current range, as defined in this 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)
200-500	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 233 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 reduces the display of low velocity tissue motion. Lowering the wall filter displays more information; however, more wall tissue motion will also be displayed.

The wall filter 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 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 lower for small parts or instances where flow is slow but there is not much tissue motion.

Use a wall filter 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.

**Changing the Wall Filter Setting**

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 this table. 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

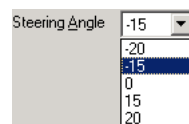
When using Color Doppler, be aware of the Doppler angle-to-flow. At a 90° angle-to-flow, an absent or confusing color pattern is displayed (even when the flow is normal). An adequate Doppler angle-to-flow is required in order to obtain useful Color Doppler information. In most instances, the lower the angle of the Color Doppler beam to flow, the better the received signal. Angles of 60° or less are recommended for the steering angle.

Electronic steering is useful in those instances where the flow is at a poor angle to the Color Doppler beam. However, in many instances it is also necessary to use the “heel and toe” technique, which involves using pressure on one end of the transducer or the other to improve the Doppler angle-to-flow.

Electronic steering is only available for flat linear array transducers (the 7L3, 8IOL4, and 10L5). This option will not display for all other transducers. Curved linear and phased array transducers do not have the capability of electronic steering and, depending on the clinical situation, may require you to use the “heel and toe” technique (described above) 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 drop-down list.

**Selecting a Steering Angle**

You can also adjust the steering angle by typing / (slash). When you type this key, 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)

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

Conventionally, 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 at your discretion by selecting the color invert check box. Whether or not you have inverted the display, 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.

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 is displayed in shades of red. The color bar then displays shades of blue on the top half, and shades of red on the bottom.

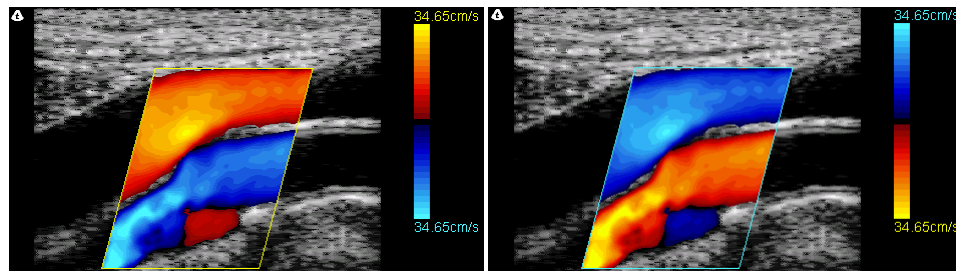
When you click the color invert box, the Color Doppler reference bar is inverted as well as the color of the scan data within the Region of Interest.

To invert the Color Doppler reference bar, click the Color Invert box.

Color Invert ☒

Color Invert Check Box

This figure shows the effect of using this check box:



Color Invert Not Selected

Color Invert Selected

Effects of the Color Invert Control

The above figure should be viewed in color; when printed in black and white, you may not be able to see the effect. Notice that the colors on the reference bar have also been inverted.

Adjusting the Color Gain

Color gain can be increased whenever the fill of color within a vessel is inadequate, and decreased whenever an unacceptable amount of color is seen 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.



Changing the Color Gain

You can also adjust the color gain by clicking on the slider (a blue box is displayed 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 will overwrite the B-Mode information. If you need to see more flow in an area of some significant B-Mode brightness, increase the color priority. If you want 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 will be displayed.

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



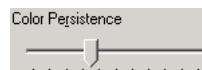
Changing the Color Priority

You can also adjust the color priority by clicking on the slider (a blue box is displayed 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 decisions. 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.

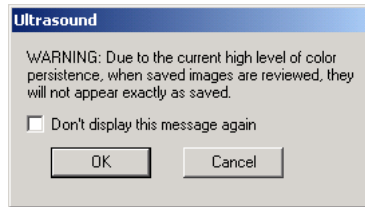


Changing the Color Persistence

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

When color persistence is set high, the 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, you will see this warning:

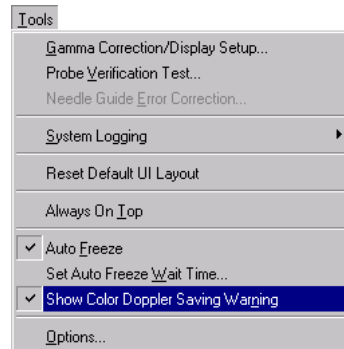


Color Doppler Save Warning

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 the **Tools > Show Color Doppler Save Warning** menu to enable or disable the warning. In this figure, the warning is enabled.



Tools Menu

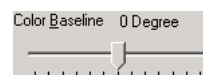
Click the “Show Color Doppler Saving Warning” menu item to toggle its setting between enabled (check mark) and disabled (no check mark).

Adjusting the Color Baseline

In general, it is not necessary to adjust the color baseline. The baseline refers to the zero baseline within the Color Doppler image. If you want 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.



Changing the Color Baseline

You can also adjust the color baseline by clicking on the slider (a blue box is displayed 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 works with Color Doppler only; 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 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.



Changing the Color Threshold

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

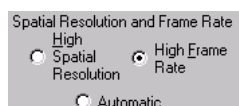
Choosing the Frame Rate/Spatial Resolution

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

- High Spatial Resolution
- High Frame Rate
- Automatic

High Spatial Resolution produces an image with higher line density (resulting in better spatial resolution); High Frame Rate uses a lower line density resulting in better frame rate; Automatic 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 which method you want by clicking on that method's option button.




Choosing the Spatial Resolution and Frame Rate

Scanning in Triplex Mode

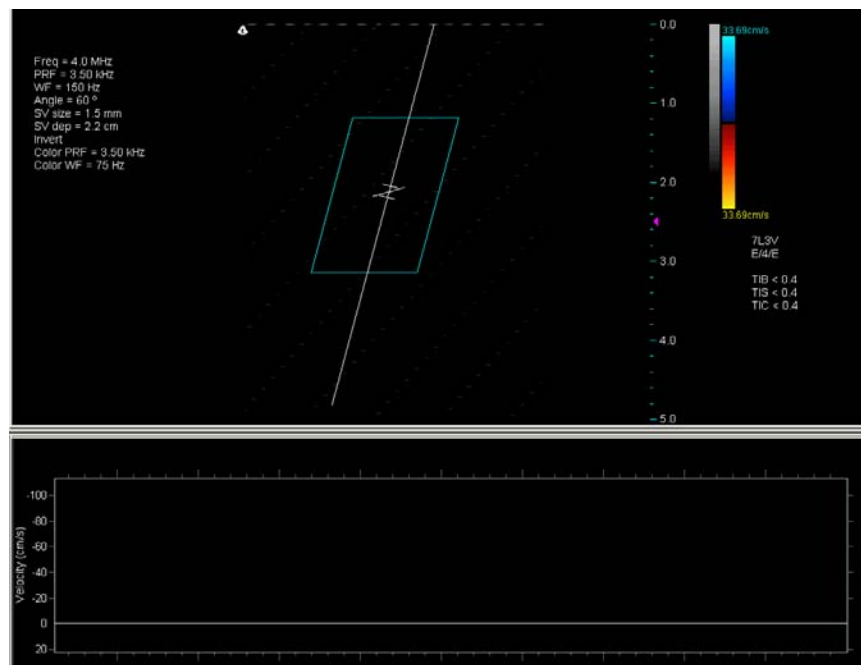
Triplex scan mode combines Color Doppler *or* Power Doppler *or* Directional Power Doppler scanning with Pulsed Doppler Wave scanning. To adjust image controls for Triplex scanning, you first adjust the image controls for the 2D scan mode, then add the Time Series window for PWD scanning and adjust the image controls for PWD.

Some of the 2D image controls cannot be adjusted when running in Triplex, so you need to adjust the image controls as described in “Using Color and Power Doppler Image Controls” on page 113 before you initiate Triplex scanning.

When ready, use one of these methods to initiate Triplex scanning:

- Click 
- Select **Modes > Pulsed Wave Doppler**
- Type **P** when not in Text mode
- Position the cursor in the 2D image where you want to set the range gate, then double-click

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 109. 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 updates that value on the other tab.

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

Controlling the 2D Scan

The **Update** button allows you to choose whether or not to continue scanning the anatomy (displayed in the 2D window) while acquiring PWD scan data. When selected, the Terason software continuously updates the 2D scan while acquiring PWD data. When not selected, the Terason software stops acquiring 2D data while continuing to acquire PWD data.

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

When you de-select the **Update** button (but do not freeze the scan), you cannot adjust some of the image controls on tabs other than the PWD tab. This table 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 Not Selected

Image Control Tab	Available	Not Available	
2D	Size Exam	Depth Focus Gain	TGC curve Image format/sector width
IQ	Left/Right invert Up/Down invert Palette Smoothing	Persistence Map Brightness	Contrast Needle Guides
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, or cryoablation. Depending if you purchased the additional equipment required for these procedures, you may need to know how to:

- Set up and perform biopsies
- Perform insertion grid procedures using the 8B4S biplanar transducer
- Adjust the error correction values (optional)
- Clean the transducers and brackets

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!

Support for Biopsies

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

- Obtain the correct needle guide kit and brackets
- Assemble the equipment for the biopsy
- Select a needle guide
- Perform the biopsy
- Periodically verify the guide alignment

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 need to 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 transducers:

- 4C2 (Sound and Vermon)
- 8EC4 (Thales and Vermon)
- 10L5 (Sound and Vermon)

Needle Guide Kits

A needle guide kit contains several pieces of equipment 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 or Protek:

- Starter needle guide kit
- Replacement needle guide kit

Starter needle guide kits contain both disposable and reusable parts that you need the first time you perform a biopsy. Replacement needle guide kits contain only disposable equipment. 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 starter and replacement needle guide kits that must be ordered for each transducer.

Terason Needle Kit Numbers

Model	Starter Kit Number and Contents	Replacement Kit Number and Contents
4C2 (Sound)	Civco 612-098 <ul style="list-style-type: none"> • Biopsy bracket (reusable) • Needle guide clip • Gauge insert pin • Sterile sheath • 2 rubber bands for attaching sheath • Acoustic gel 	Civco 610-579 <i>or</i> Civco 610-608 <ul style="list-style-type: none"> • Contains the same parts as Civco 612-098 except the reusable biopsy bracket • 610-579 contains a 24" sterile sheath • 610-608 contains a 36" sterile sheath
4C2 (Vernon)	Protek Ref #7138 <ul style="list-style-type: none"> • Reusable Non-sterile Bracket • Two Sterile Disposable 16 Ga. Needle Guide/Probe Cover Kits • Two Sterile Disposable 18 Ga. Needle Guide/Probe Cover Kits • Two Sterile Disposable 22 Ga. Needle Guide/Probe Cover Kits • One Non-sterile Guideline Verification kit 	Protek Ref #5231 <ul style="list-style-type: none"> • Sterile Disposable 16 Ga. Needle Guide/Probe Cover Kit Protek Ref #5232 <ul style="list-style-type: none"> • Sterile Disposable 18 Ga. Needle Guide/Probe Cover Kit Protek Ref #5233 <ul style="list-style-type: none"> • Sterile Disposable 22 Ga. Needle Guide/Probe Cover Kit
8EC4 (Thales)	Civco 610-588 <ul style="list-style-type: none"> • Disposable needle guide bracket • Disposable sterile cover 	Not applicable.
8EC4 (Vernon)	Civco 610-605 <ul style="list-style-type: none"> • Disposable needle guide bracket • Disposable sterile cover 	Not applicable.
10L5 (Sound Tech)	Civco 678-002 <ul style="list-style-type: none"> • Civco 478-002: Sound Tech. L6 Bracket, with three angles A, B, C (reusable) 	Civco 300-260: <ul style="list-style-type: none"> • Needle Guide Adaptors
10L5 (Vernon)	Civco 612-085 <ul style="list-style-type: none"> • Non-sterile L5, L7, 6L3, 8L5 single-angle bracket • Ultra-Pro II needle guide • CIV-Flex cover Protek 7137A	Not applicable.

The following warnings should be observed, with regard to the needle guide kits and their contents.



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.

If a needle guide kit has already been opened when you receive it, or if it has been damaged or has condensation inside, do not use it.

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



Always make sure to use the correct bracket with the proper transducer.

This figure shows the correct bracket for the 4C2 Sound transducer:



4C2 (Sound) Transducer (Left) and Bracket (Right)

This figure shows the correct bracket for the 4C2 Vernon transducer:



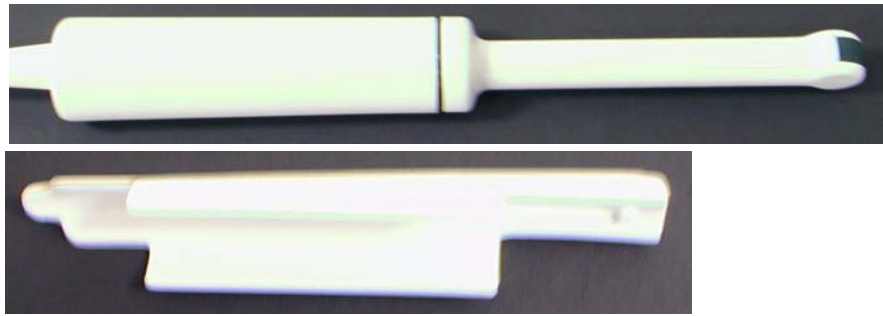
4C2 (Vernon) Transducer (Left) and Bracket (Right)

This figure shows the correct bracket for the 10L5 transducer:



10L5 Transducer (Left) and Bracket (Right)

This figure shows the correct bracket for the 8EC4 (Vermon) transducer:



8EC4 (Vermon) Transducer (Top) and Bracket (Bottom)

This figure shows the correct bracket for the 8EC4 (Thales) transducer:



8EC4 (Thales) Transducer (Top) and Bracket (Bottom)

Assembling the Bracket and Guide

Each transducer works with only one bracket. These instructions describe how to assemble the bracket for the 10L5 transducer (from Sound Tech). For the 4C2 and 8EC4 transducers, the bracket attaches in the same way as described here.

You can also follow the procedure provided in the biopsy kit to assemble the bracket and needle guide.

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



The following instructions describe the needle guide assembly for the 10L5 transducer; use these instructions as guidelines for the 4C2 and 8EC4 transducers.

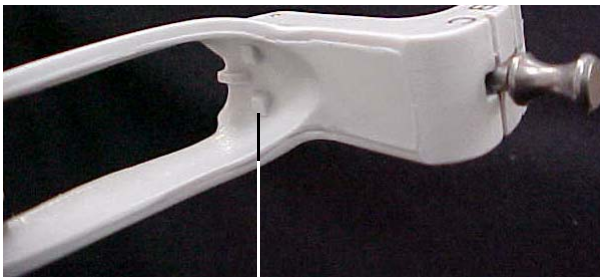
1. Collect these items required to complete the biopsy procedure:

- Transducer
- Bracket
- Needle
- Needle guide clip
- Gauge insert pin
- Sheath (8EC4 only)



Required Items 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 10L5 Bracket



Alignment Depressions on the 10L5 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 the gauge insert pin that you want to use.
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 in 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 that you purchase contains gauge insert pins ranging from gauges of 13 to 22.

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

Using Needle Guidelines

The Terason software lets you view guide lines for the specific transducer, bracket, and needle gauge to be used in a biopsy or other medical procedure. The Needle Guide drop-down list in the I.Q. tab lets you choose the guide attached to the transducer.



Needle Guide Choices (I.Q. Tab)

Only the guides that work with that transducer display in the list. Some transducers only support one needle guide; others, like the 10L5, support more guides.

The needle 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.

The needle guides work only in these modes:

- B-Mode
- Color Doppler mode
- Directional Power Doppler
- Power Doppler mode

You **cannot** use the needle guides in:


- M-Mode
- Pulsed Wave Doppler mode
- Split Screen mode

Also, the guides and target indicator do not appear in Zoom mode.

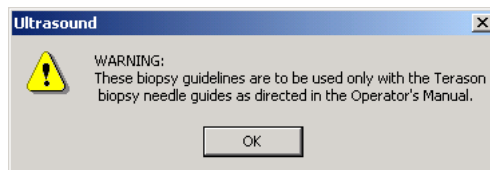
To display the needle guide lines and target indicator, follow these steps:

1. Use one of these methods to display the needle guides:



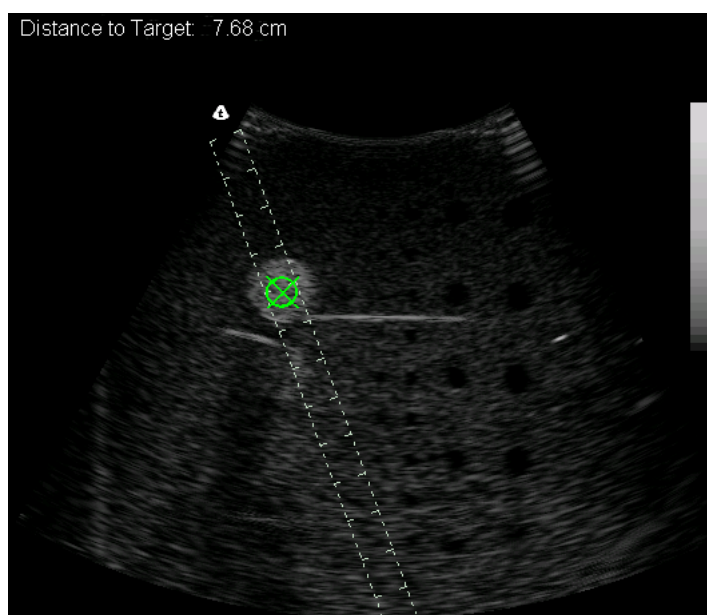
- Click  on the Tools toolbar.
- Select **View > Needle Guide Display > Guide Lines**
- Type **N** when not in Text mode

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



Biopsy Warning

2. Click **OK**. The warning closes and the Terason software displays the needle guides and target indicator.



Needle Guides and Target Indicator

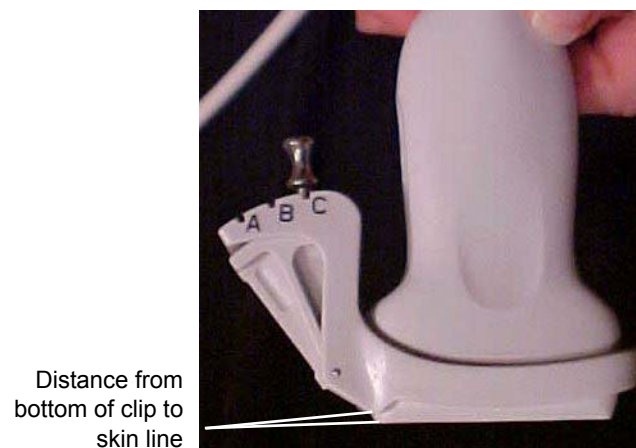
The ticks on the guide lines are at 1 cm intervals, and the distance between the guide lines is fixed at 1 cm.

3. 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.


4. 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.

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.



Distance to Skin Line

You can only see the target indicator on a live image.

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.



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. Contact your Terason representative.

Performing a Biopsy

Once all of the preparatory steps have been completed, and you have recently verified the alignment, perform the biopsy on the patient. Note the following warnings that pertain to the biopsy procedure.



For each procedure, use a straight, new needle.

If the needle strays outside of the guide lines, no warning is displayed.

The biopsy guide lines provide only an indication of the expected path of the needle. Verify the actual position by identifying the echoes from the needle.

If the needle is not following the expected path, discontinue the biopsy 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 simulated test. To conduct this test, you must have an assembled biopsy bracket, needle guide, and a water tank.

Use B-Mode to verify the alignment and do not use the Zoom tool; the needle guides do not display in Zoom mode.

To verify the alignment of the transducer and biopsy attachment, follow these steps:

1. If not visible, select **View > Needle Guide Display > Guide Lines**. The biopsy guides appear in the Image Display window.
2. From the Needle Guide drop-down list box 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 127.
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 (it can bend the needle and result in 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.

Using the Biplanar Transducer Options

The Terason Ultrasound System may be included in a system designed for cryoablation or brachytherapy procedures. These systems include a biplanar transducer, and may also include an insertion template, stepper, and stabilizer to guide the needles used in the procedures.



This user guide does not provide instructions for performing medical procedures or for using components sold in addition to the Terason Ultrasound System. Refer to the proper medical protocols for the procedure you need to perform.

This procedure shows you how to use the Terason software with the biplanar transducer in support of certain therapeutic procedures:

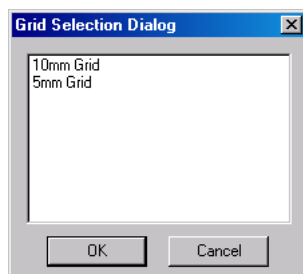
1. Click the tab for the probe you want to use (VBMC or VBML). The curvilinear probe (VBMC) provides a transverse (side-to-side) view; the linear probe (VBML) provides a sagittal (front-to-back) view.
2. To display the insertion grid template on the Image Display window, select **View > Needle Guide Display > Biplanar Grid Selection**.



Choosing the Biplanar Grid Selection Option

3. If the selected probe supports a single grid, the grid displays on top of the Image Display window.

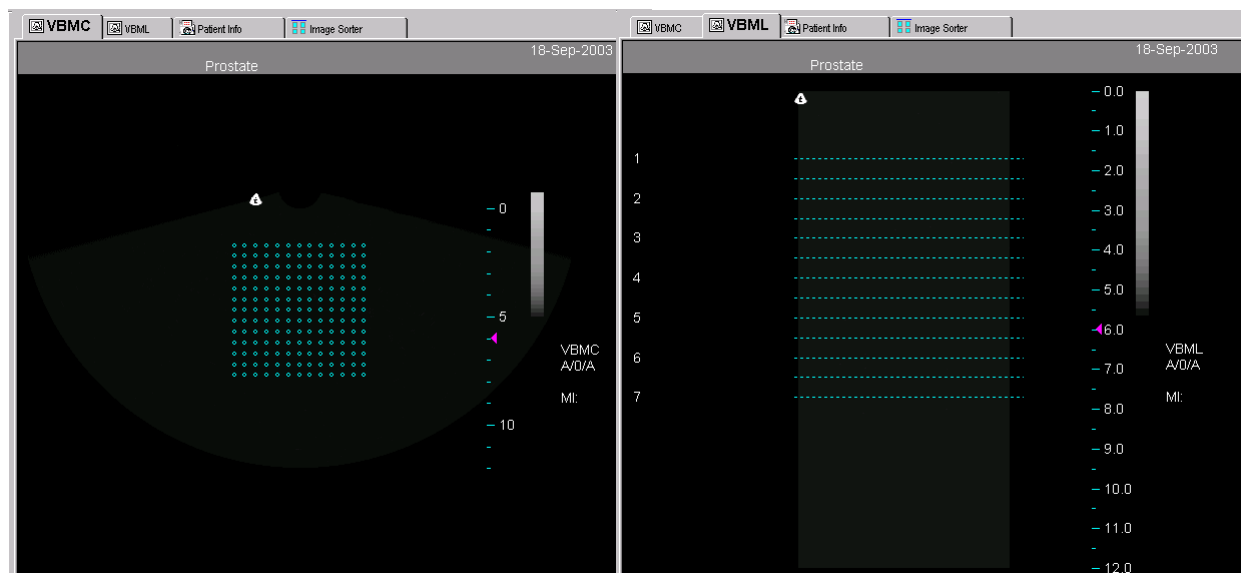
If the selected probe supports more than one grid, the Grid Selection Dialog box opens.



Grid Selection Dialog Box

Click on the needed grid name, then click **OK**.


This figure shows the transverse grid (for the VBMC probe) and the sagittal grid (for the VBML probe). Your vendor may not support both views.



Biplanar Grid: VBMC (Curvilinear) and VBML (Linear) Views

4. Refer to your vendor's documentation for configuring the insertion grid, stepper, and stabilizer (if any).
5. Refer to the proper medical protocols for performing the procedure.
6. If you need to switch views during the procedure, use one of these methods:



- Click 
- Click the tab name for the needed transducer
- Select the **View > VBMC** or **View > VBML** menu option

Setting the Error Correction

The Terason software allows you to enter small adjustments to the positioning for the needle guides (used in biopsies) or the insertion grid (used for cryoablation or brachytherapy).

When you select the **Tools > Needle Guide Error Correction** 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 have already been 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.

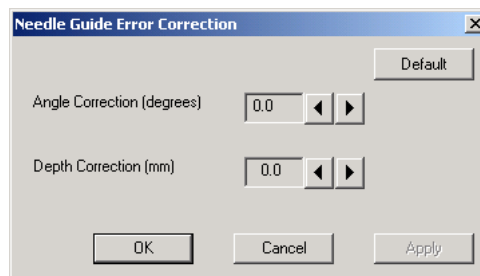
You can make marginal changes to the upper and lower limits for angle and depth on the Needle Guide Error Correction dialog box. Your changes to these settings are visible in the needle guidelines, and will be saved by the system and used for all biopsies until you change them again.

You can enter a value within these ranges:

- Angle: -2 to 2 °
- Depth: -1 to 1 mm

To change the needle guide error correction values for any transducer except the biplanar transducer, follow 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.

Correcting Needle Guide Positioning for the Biplanar Transducer

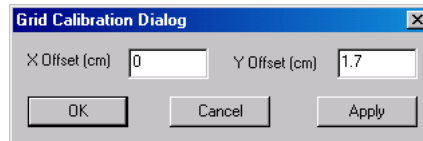
The Grid Calibration dialog box determines the distance the grid is offset from the Terason orientation logo (A). This offset should match the physical offset of the insertion grid and is initially set by your vendor. You should not change these values without consulting your vendor.



For safety reasons, some vendors may have disabled your ability to change the offset values.

To change the needle guide error correction values for the 8B4S biplanar transducer, follow these steps:

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



Grid Calibration Dialog Box

2. Enter any offset values required.
3. Click **OK**.

Cleaning the Transducers and Brackets

The transducer must be cleaned and high-level disinfected between patients. For instructions, refer to “Terason Transducer Processing Between Use” on page 247.

To sterilize the brackets, follow 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. You can:

- Store images and loops
- Find and open a saved image or loop file
- Copy, archive, move, rename, or delete files
- Edit images and loops
- Print images
- Send images and loops to DICOM printers or servers

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 need to know how to:

- Check disk space
- Select file types
- Save an image or image loop using defaults
- Save a Split Screen image
- Export an image or image loop

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

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

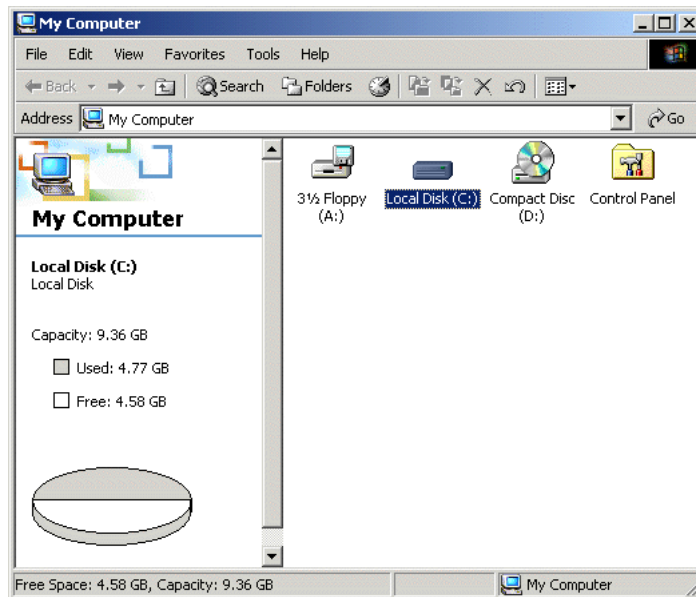
Checking Disk Space

You should periodically check the amount of disk space available on your C: drive, the default drive where the application is installed. If the hard drive becomes 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) could be anywhere from 300Kb to 700Kb; an image loop could be anywhere from 2 Mb to 18 Mb.

To check disk space, follow these steps:

1. Double-click the My Computer icon on the Desktop. Windows opens this 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, perform the following steps:

1. Select **Tools > Folder Options**.
2. Click the **Restore Defaults** button, and click **OK**.

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 need to move files to a backup CD (see “Backing Up Files on a CD” on page 150) or delete unimportant files (see “Deleting Files” on page 159).

Selecting File Types

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

- Terason Image File (.ult file extension)
- AVI
- Bitmap and Bitmap with Spatial Info
- DICOM
- JPEG
- TIFF

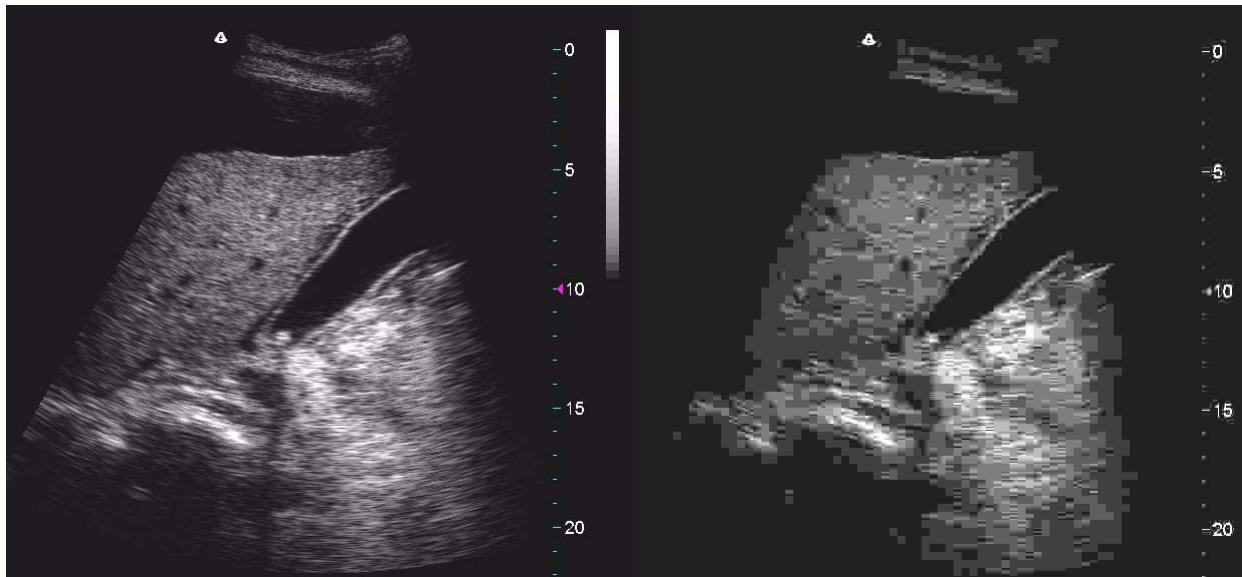
You might want to use a format other than the Terason format (*.ult) so that the images can be viewed by others who do not have the Terason software. You can email image and loop files or include them as graphics in other applications. If you will only use the image with the Terason software, you should not change the format.

When using the DICOM format, you can choose whether or not to compress the images. The default format is to compress DICOM images; you need to use the Options dialog box (see “DICOM Image Format” on page 214) if you do not want to compress DICOM images.

If you save images using the JPEG format, you should 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 and when viewed, that 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, this 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, you should interpret them as JPEG artifacts.

Saving Images and Loops

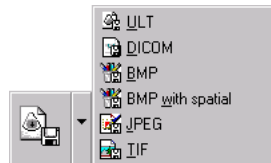
Images and loops are saved to the Patient directory in the appropriate patient folder, or in the Image directory, if not associated with a patient.

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.”

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


1. Click  if viewing a live image.
2. To save an image, perform one of these steps:

- Click  (Save Image)
- Click the arrow on the Save Image button and click a file type:



- Press the F8 key
- Select **File > Save Image (ULT)**
- Select **File > Save Image As >** and click a file type

3. To save an image loop, perform one of these steps:

- Click  (Save Loop)
- Click the arrow on the Save Loop button and click a file type



- Press the F9 key
- Select **File > Save Loop (ULT)**
- 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 212).

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

C:\Program Files\Teratech\Terason 2000

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.

You can view the contents of these folders in the Terason Explorer window as described in "Finding Files in the Terason Explorer" on page 144.

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. If you want to overwrite the original file, use the **File > Export** menu option and select the original file before you click the Save button.

Saving in 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 (the one with cyan bars across the top and bottom) is saved.

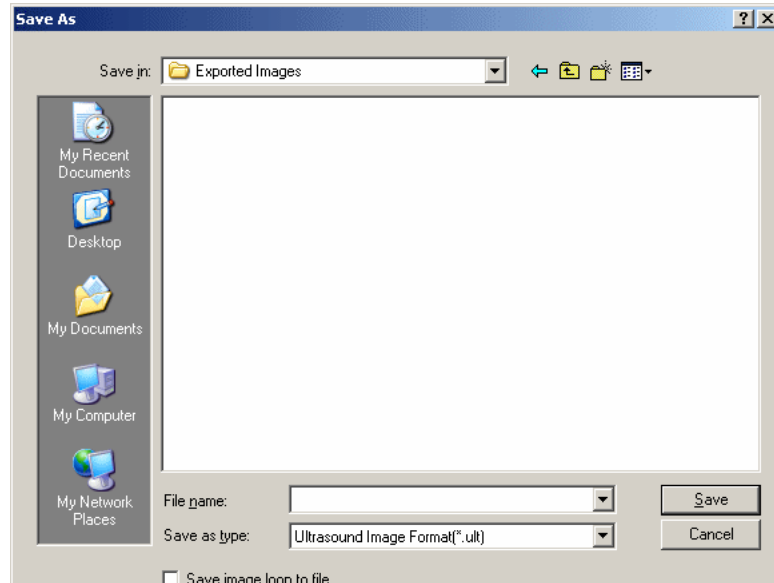
You can save the Split Screen image as a loop file using the DICOM or AVI formats. When you do, the Terason software saves the active screen as an image loop, and the other screen as a single frame. When you save a Split Screen image to the Terason format (ULT), only the loop in the active screen is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

Exporting a File

If you want to save the image or loop in a different location or with a specific name, you can use the **File > Export** 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, follow 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 drop-down list.
4. Enter a filename in the File name text box.
5. Select a file format from the Save as type drop-down list.
6. If you want 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 pull-down list. The more pixels in an image, the larger the file size; the fewer pixels, the lower the quality and the smaller the file size.
8. Click **Save**.

Finding Stored Images and Loops

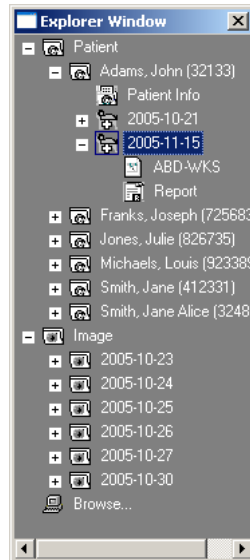
You can use these tools to find saved images and loops:

- Terason Explorer window
- Image Sorter window
- Browse function in the Terason Explorer window or **File > Open** menu

For archived images, insert the required CD and select **File > Open**.

Finding Files in the Terason Explorer

If you need to view a saved image or loop, you can use the Terason Explorer window to find it and open it. To open the Terason Explorer, click the icon at the bottom left corner of the screen, or select **E**xplorer Window in the **V**iew menu.



Locating Saved Images and Loops

To open a folder, click on the **+** symbol or double-click on the folder name. To open an image file, you can:

- Double-click the file name
- Right-click the file and select **O**pen

Images and loops have different icons in the Terason Explorer, so you can distinguish between them. Also, if you save files in formats other than the Terason ultrasound format, the icon shows the file format. This 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

To find a specific image or loop:

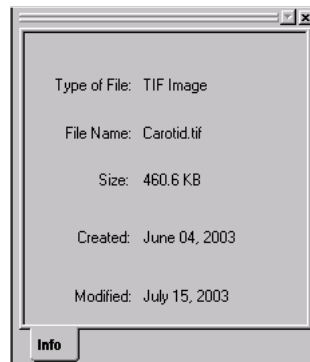
- If you loaded patient information prior to saving the file, look in the **Patient** folder for the patient's name, and then in the dated folder under that patient's name.

- 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 147).
- If you have moved, deleted, or renamed files using the Windows Explorer while the Terason software is running, right-click and select **Refresh** to update the Terason Explorer window.

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.

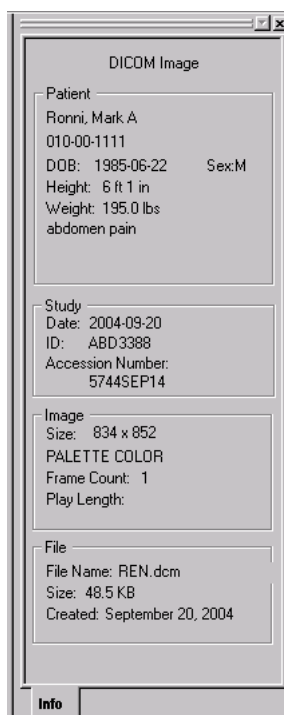
For ULT files (Terason ultrasound format), the image control settings are also loaded. You can edit those settings as described in “Editing Images and Loops” on page 161.

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

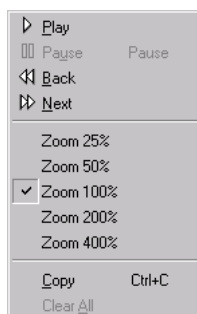
For DICOM files, the Info tab displays the data saved as part of the DICOM image.



Info Tab for a DICOM Image

If the image is larger than the Image Display window, you will see 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 on a scroll bar and drag it to a new location 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.

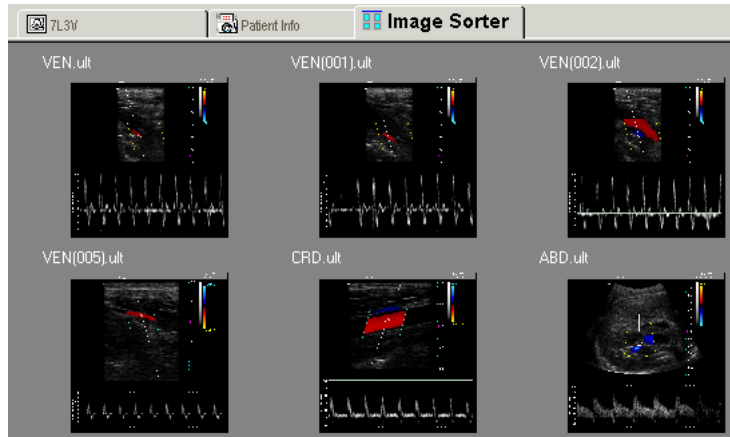


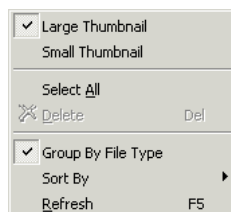
Image Sorter Tab (Large Thumbnails)

You can also use this window to print a set of ultrasound images instead of printing them one at a time (see “Printing Images” on page 162 for instructions).

To open an image or loop, double-click the thumbnail.

You can choose to view large thumbnails (easier to tell what the image is) or small thumbnails (more images visible at a time). Select **View > Large Thumbnail** to toggle between large (menu item is checked) and small (menu item is not checked) thumbnails. 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 the thumbnail size, large or small.



Shortcut Menu for the Image Sorter Window

The **Delete** item in the shortcut menu deletes the selected image(s) from the folder. Make sure you do not need the 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). The **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).

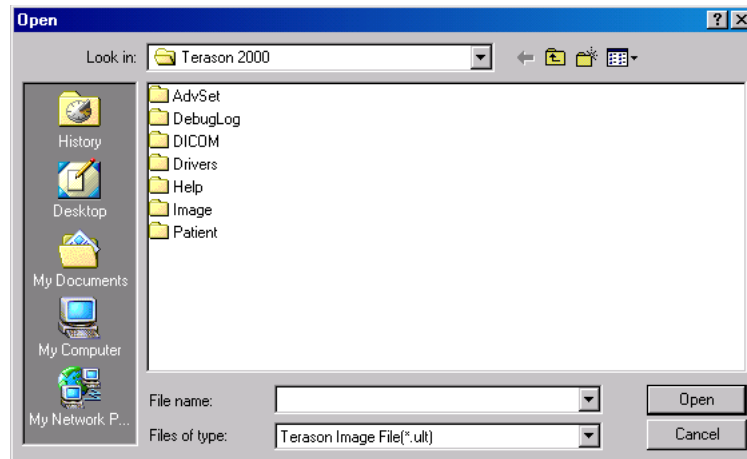
If you use the Windows Explorer to rename or delete files, you can select **Refresh** from the shortcut menu (or **View > Refresh**) to update the thumbnails displayed in the Image Sorter window.

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 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, follow 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 on the file name to highlight it.
4. Click **Open**.

The file displays in the Image Display window.

Managing Files

By using the Terason Ultrasound System, you will acquire hundreds of image files. To manage those files you should know how to:

- Copy files
- Archive files
- Move files
- Rename files
- Delete files

Copying Files

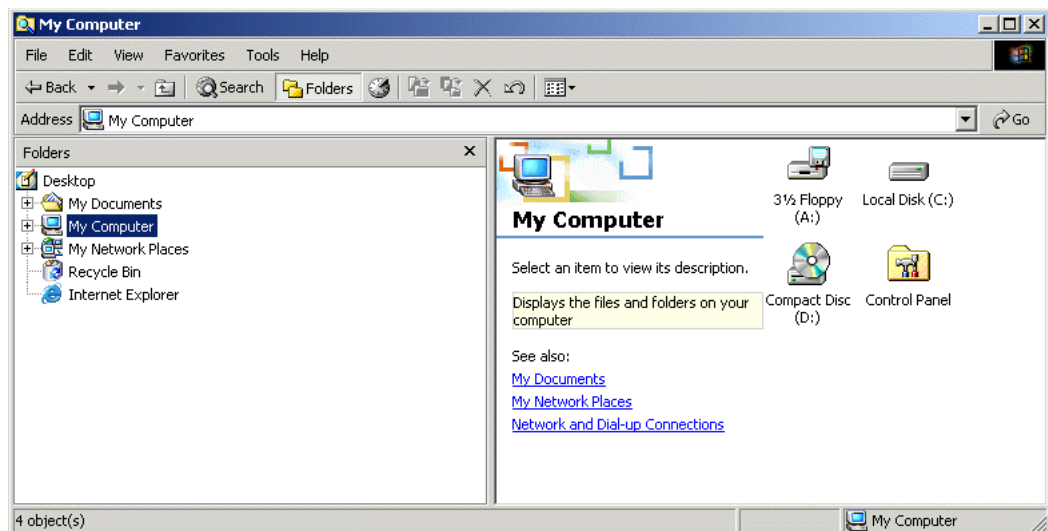
You can copy files to another folder or directory. The method described here is only one of the many ways you can use Windows to copy files from one location to another.



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, follow 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 is displayed.
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 to ensure that you do not lose important medical records. You can also archive files to be retrieved later if needed. You should back up files at regularly scheduled intervals such as weekly or at the end of each day.

When you back up files, you copy 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 the 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 them up. If your site does not support automatic backups, you may need to perform the backups yourself.

Use the CD writer software on your computer to back up files to a CD.


- If you have a Dell C840 laptop, see the instructions in “Using Roxio to Write to a CD” on page 150
- If you have a Gateway M505 laptop, see the instructions in “Using Nero to Write to a CD” on page 154

If you have a different CD-writer software, refer to its user guide or online help for instructions.

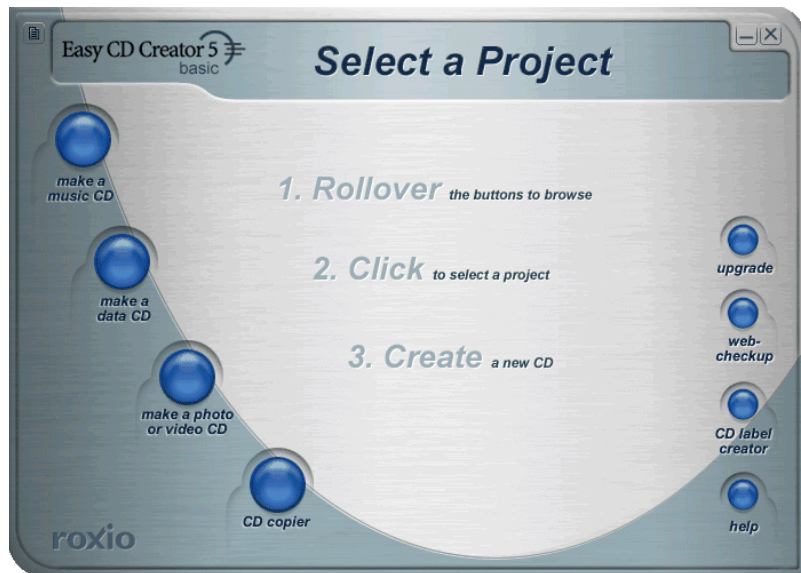
Using Roxio to Write to a CD

To copy images to a CD, follow these steps:

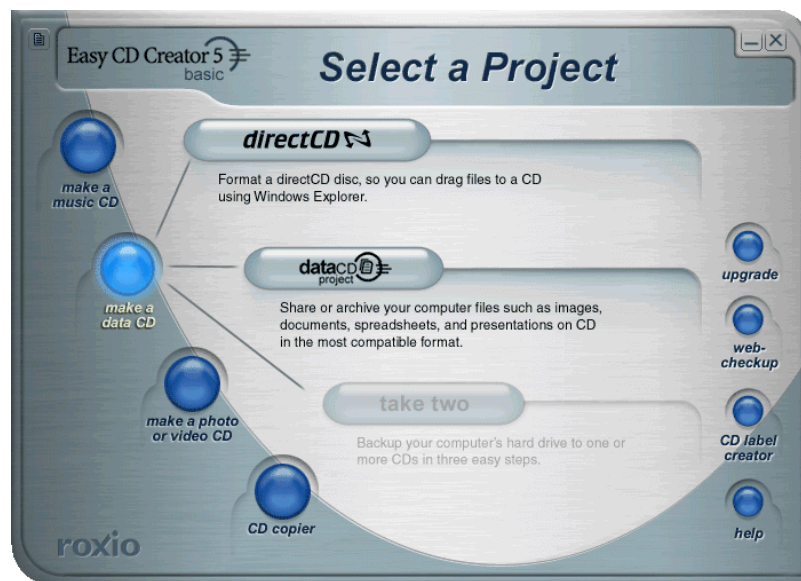
1. Close the Terason application.
2. Insert a writable CD into the CD drive.
3. Use one of these methods to start up Roxio:

- Double-click  on the desktop
- Select **Start > Programs > Roxio EasyCD Creator**

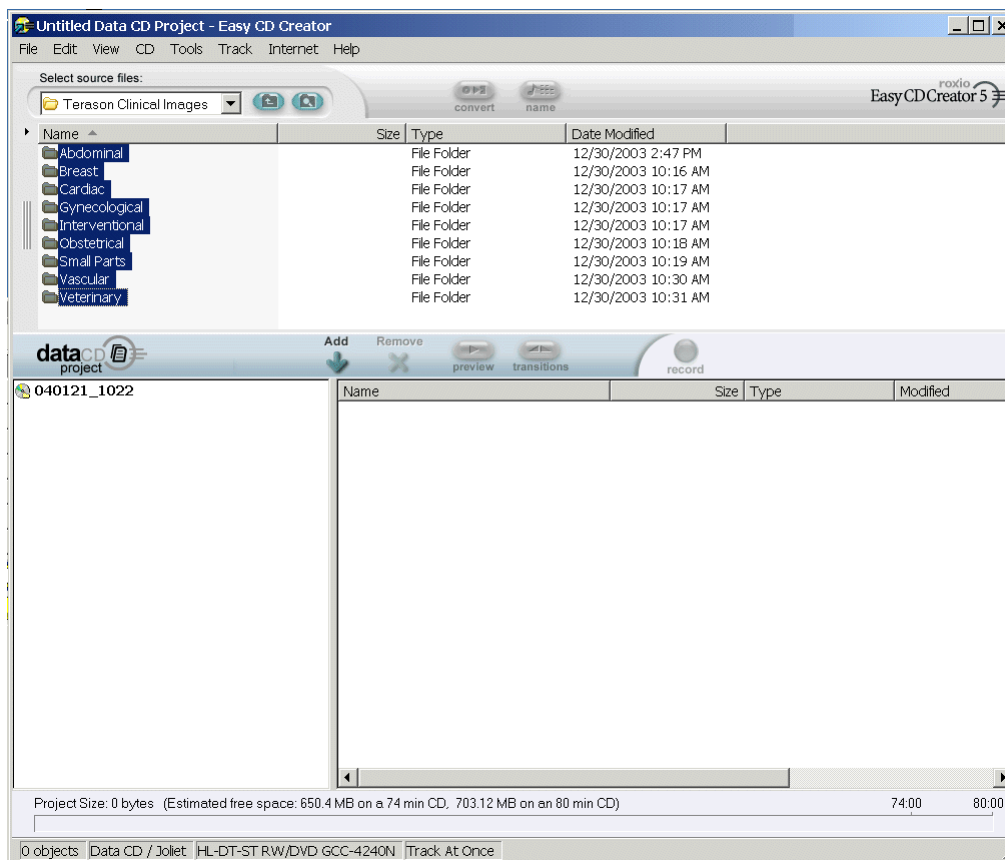
The Roxio CD creation application starts up.

**Roxio EasyCD Creator**

4. Click **make a data CD**.

**Easy CD Creator Window**

5. Click **data CD project**.
6. Expand the Program Files folder, the Teratech folder, and the Terason 2000 folder.



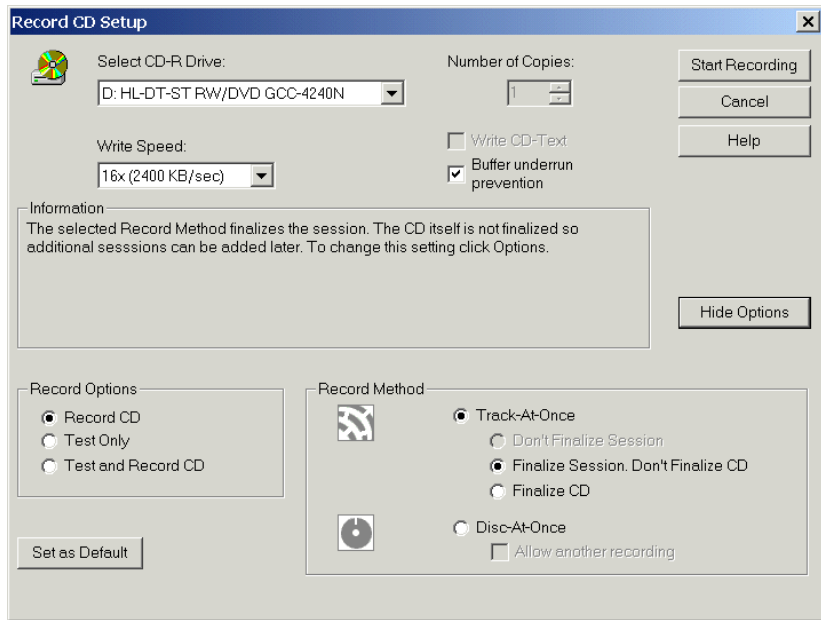
CD Layout Window

- Follow these guidelines to choose what to copy:

Guidelines for Item Selection

If you want to copy...	Do this...
All patient folders	Highlight the Patient directory
An individual patient folder	Highlight the folder with the patient's name
An Image directory	Highlight the dated folder in the Image directory
A single image or loop file	Highlight the file name

- Highlight the folders or files you want to write to the CD and click the **Add** button.
- Verify that the Estimated Free Space listed in the Status bar is at least 1 MB.
- Click the red **record** button. The Record CD Setup dialog box opens.



Creating a CD

11. If you see a **Show Options** button instead of the **Hide Options** button, click it.
12. In the Record Options section, select the option button for “Test and Record CD”. You can also choose Record CD, however, the test option double-checks that the copied files were written correctly.
13. In the Record Method section, select the option button for “Finalize Session. Don’t Finalize CD”. This choice lets you add more files to the CD in the future.
14. Click **Start Recording**. The status window shows the copying progress.
15. When the program finishes copying the files, click **OK**.
16. 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 need to re-write the CD.
17. Remove the CD and label it.
18. Close the CD creation program.

Using Nero to Write to a CD

To copy images to a CD, follow 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 (Create with Nero StartSmart).



Nero Desktop Shortcut

The startup menu window opens.



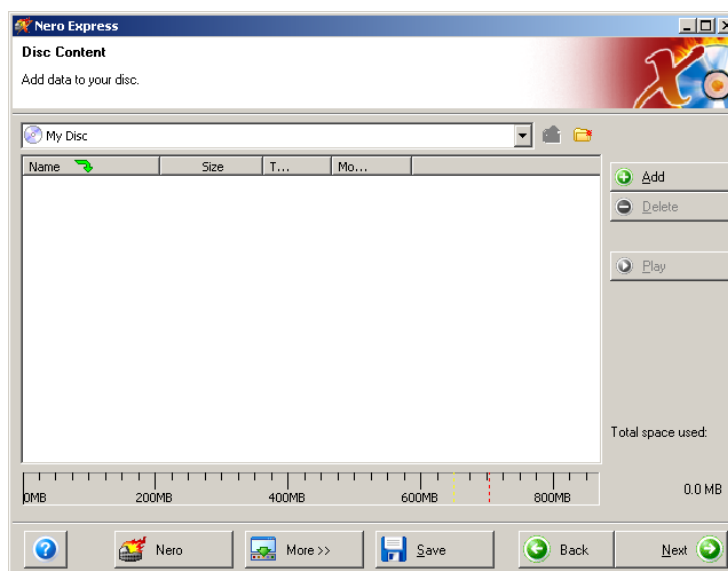
Nero Favorites Menu

4. Double-click the **Make Data Disc** icon.



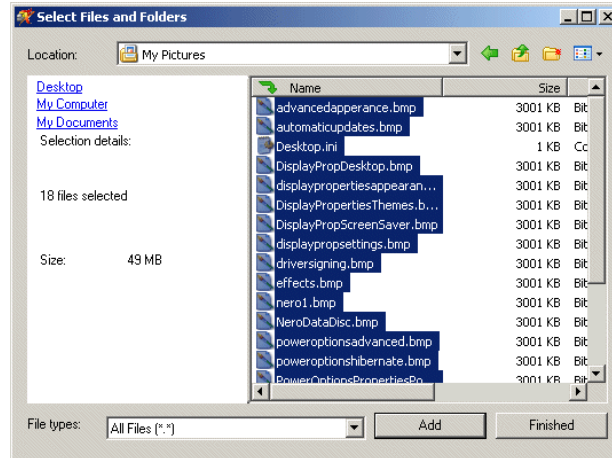
Nero Data Menu Window

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.



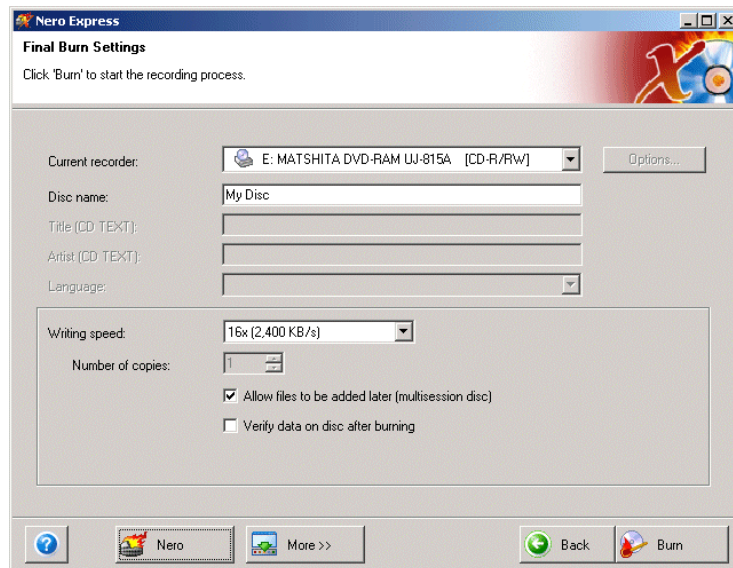
Nero Select Files and Folders Dialog Box

7. Open the Program Files folder, the Teratech folder, and the Terason 2000 folder.
8. Follow these guidelines to choose what to copy:

Guidelines for Item Selection

If you want 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 5-7 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 the **Next** button. The Final Burn Settings dialog box opens.

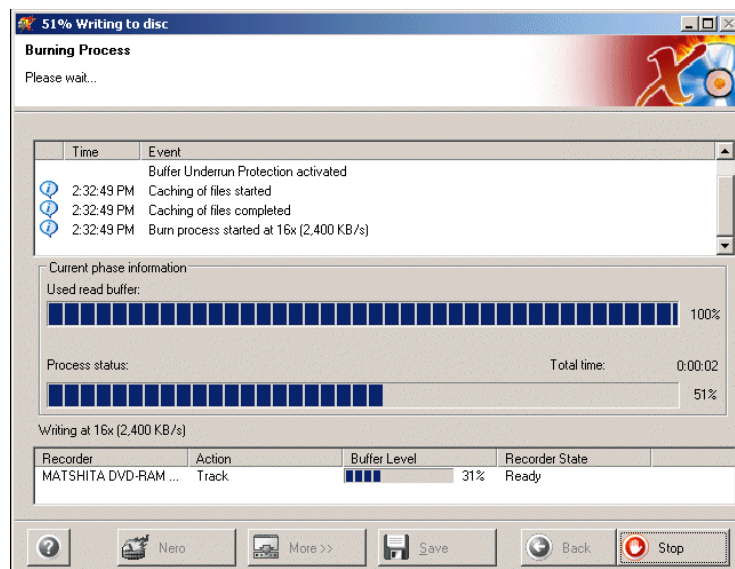


Nero Final Burn Settings

13. Select both check boxes:

- Allow files to be added later (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 prompting you 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 need to re-write the CD.

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. If you do, those files will not display in the Terason Explorer window and you may have difficulty locating them. Typically, you only move files when you are archiving older files that you do not need to keep on your computer any more.

To move a file, follow 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 is displayed.
3. In the right pane of the window, click the file or folder you want to move.
4. Select **Edit > Cut**.
5. In the left pane of the window, open the folder where you want to store the file or folder.
6. Select **Edit > Paste**.

Renaming Files

You can rename files using the Terason Explorer or the Windows Explorer.

Renaming Files in the Terason Explorer

You can edit the name of any image file; you cannot edit the name of a Patient Info file. To edit a file name, follow these steps:

1. Click the file name in the Terason Explorer window 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 the Windows Explorer

You can rename image and patient info files using the Windows Explorer. To rename files from Windows Explorer, follow 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: 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 the 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

To delete files from the Terason Explorer, follow these steps:

1. In the Terason Explorer, 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; click **No** if you do not want to delete the file.

Deleting Files Using the Windows Explorer

Files deleted from the Windows Explorer go into the Recycle Bin where you can retrieve them if necessary. When you empty the Recycle Bin, all files are permanently removed from the system and cannot be recovered. If you need to delete a Patient Info file, you can do so using the Windows Explorer.

To delete files from the Windows Explorer, follow 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 the 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, follow 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 before deletion.

Emptying the Recycle Bin

When you empty the Recycle Bin, all of the files are permanently deleted from your hard disk and cannot be retrieved.

To empty the Recycle Bin, follow 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, and 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. You can only edit Terason Image Format files and loops (*.ult). You can view images saved in other formats, but you cannot 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 palette
- 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 (dependent 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. If you want to replace the original file with the one you edited, select **File > Export**, locate the original file and select it, then click **Save**. You will see a message indicated that the file already exists and asking 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. If you want to print the entire image loop, you need to use the DICOM option. See “Printing Files to a DICOM Printer” on page 166 for instructions.


You can use any of these methods (described in more detail in the subsequent sections) to print images:

- Click 
- Select **File > Print**
- Select thumbnails in the **Image Sorter** window, then click 
- Select **File > Print Preview**, then click the Print button
- Select **File > Print DICOM Image** (see “Printing Files to a DICOM Printer” on page 166)

You can also use the **File > Print Setup** 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 in Split Screen mode, the Terason software prints both screens.

When you use the Print button, the Terason software immediately sends the image(s) to your system’s default printer; you cannot set up any custom options, such as number of copies or paper size.

For a live image, you must freeze the image before you can print it. For best results, follow these steps to print an image:

1. Make sure the Image Display window is frozen (both screens if using Split Screen mode) and you have added any measurements or annotations necessary.
2. Press the F11 key. The Terason software enlarges the Image Display window to cover the entire desktop window.

3. Click .

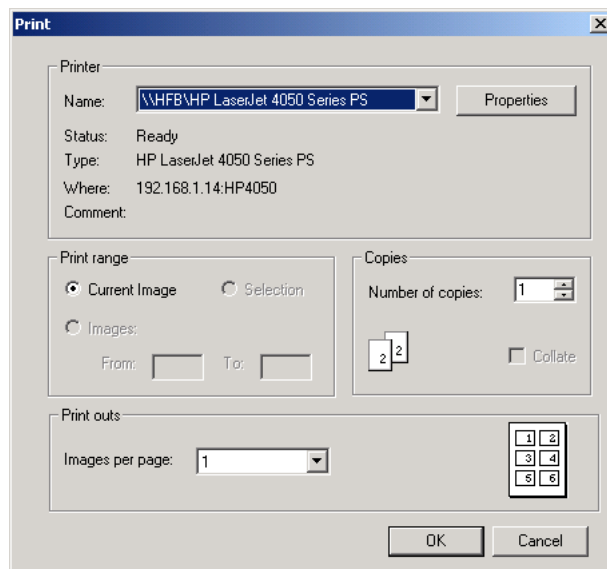
The Terason software prints the Image Display window, including both screens.

If you used the **Tools > Options** 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 212 if you want 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, you can use the **File** menu. To do so, follow these steps:

1. Use one of these methods to choose what you want 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 the needed printer, and change any 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 will be “Selection”.

If you want to print the image to see details, choose a smaller value for “Images per page”. If you want 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.

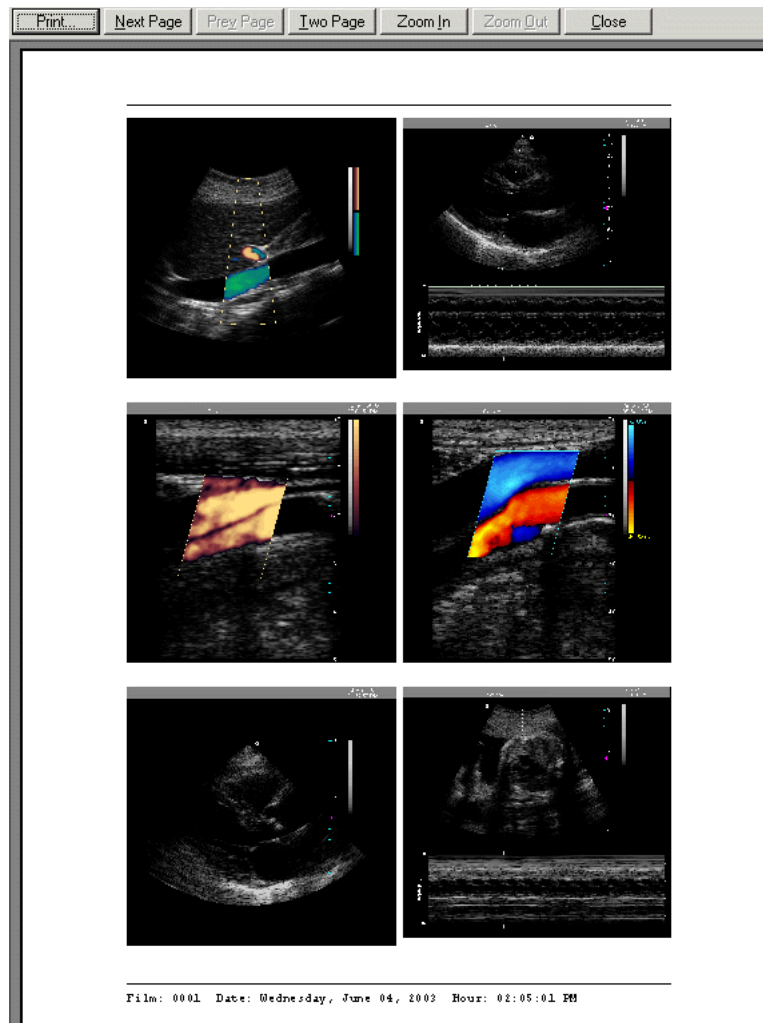
The Terason software scales the images to fit the selected number on the page. The smaller the number of images, the larger each image prints. To change the number of images per page, use the **File** menu as described in “Printing from the File Menu” on page 163.

If you only want to print some of the images, hold the control key down and click on 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 only prints the selected images.

Printing from the Print Preview Window

The **File > Print Preview** menu lets you see the expected print out 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 these functions:

Buttons on the Print Preview Window

Button	Description
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

Using Images with a DICOM Printer or Server

DICOM, Digital Imaging and Communications in Medicine, is a format created by the National Electrical Manufacturers Association (NEMA) to aid in the distribution and viewing of medical images such as ultrasound scans.

If you have the DICOM option installed on your Terason Ultrasound System, you can:

- 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

Before you can use the Terason DICOM utility, you need to install the software and dongle, and configure the utility. See “Installing the Terason DICOM Utility” on page 41 for installation and configuration instructions. If the DICOM utility is not installed, the DICOM menu items will not be accessible.



Do not remove the dongle after installing it. If you see the message “HASP not connected.” when you start up your computer, the dongle has been removed or is not securely seated in the port.

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.

If you want 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 buttons for Save Image, Save Image Loop, and Print to Send DICOM Image, Send DICOM Loop, and Print DICOM Image, respectively. See “Setting Image Save and Print Defaults” on page 212 for instructions.

Printing Files to a DICOM Printer

You can configure your Print button to automatically send an image file to the DICOM printer. If you need to change any configuration options, see “Installing the Terason DICOM Utility” on page 41 for instructions.

To send an image to a DICOM printer, follow 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 will remain in the temporary directory and it will not be sent to the printer.

Sending Files to a DICOM Server

To send an image or loop to a DICOM server, follow these steps:

1. Load the image (if it was previously saved) or obtain a new scan.
2. Select **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 41 for information on configuring the DICOM utility for your server.

If the dongle is not connected, the image or loop files will remain in the temporary directory and will not be sent to the DICOM server.

You can also send a saved DICOM file or loop to the server. To do so, follow these steps:

1. In the Terason Explorer, click on the folder (either in the Patient folder or in the Image folder) that contains the needed DICOM file(s).
2. Click the Image Sorter tab.
3. Select the file(s) to send.
4. Select **File > Send DICOM File(s)**.

The Terason application sends the files to the configured DICOM server.

8 Working with Measurements

Measurements accompanying ultrasound images are intended to supplement other clinical procedures available to the attending physician. The accuracy of 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, you will see a 2D Measure and an M Measure tab. Each tab provides tools specific to the measurements applicable to the scan mode.

When you save an image, all measurements in the 2D window are saved with the image. Measurements in the Time Series window are not saved in the ULT format. You can save Time Series measurements if you use a format other than ULT; however, if you open that saved file you cannot adjust the measurements or make additional measurements.

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 need to know how to:

- Measure the 2D image (including obstetrical measurements)
- Measure the M-Mode image
- Measure the PWD image
- Select measurements
- Delete measurements

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. Except for an obstetrical exam, measurements remain on the Image Display window until you:

- Select a different exam
- Select a different scan mode (except for the Obstetrical exam)
- Load a different patient

For the obstetrical exam, measurements remain on the 2D image if you select a different scan mode.

Measuring in the 2D Window

To measure the scan in the 2D window, the Terason software lets you:



- Measure a distance
- Measure volume
- Measure a circumference and area (ellipse tool)
- Trace to determine the circumference and area (trace tool)
- Measure in Split Screen mode
- Calculate the percent stenosis
- Calculate percent area compromised
- Make obstetrical measurements
- Make gynecological measurements

In general, select what you want to measure from the list 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 choice starts a measurement of the type currently selected in the 2D Measure tab.

Measuring Distances


To measure a distance in the 2D window, follow these general steps:

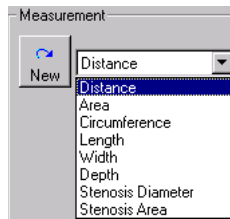
1. Click . If playing a loop, click . The measure tabs for the selected scan mode are added to the Image Control window.



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 “Zooming in on an Area of the Image” on page 60) to enlarge the needed area of the 2D scan.

4. Select the type of measurement you want to make from the drop-down list, or click . The software uses the Measurement selection to label the completed measurement.



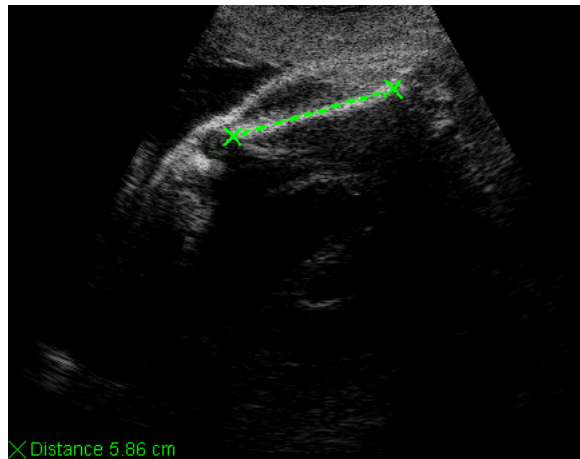
Measurements for the 2D Window

When using the Fetal Cardiac, Cardiac, Obstetrical or Gynecological exams, you will see additional measurements in the list. For the Cardiac and Fetal Cardiac exams, the Terason software provides additional calculations as described in “Measuring Cardiac Exams” on page 186.

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.


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 on 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**.

If you want to make more than one measurement of the same type on an image, click , then make the additional measurement.

Measuring Volume

When you measure length, width, and depth, the Terason software automatically calculates the volume in cubic centimeters. You need to make two scans to properly measure volume. You can optionally use Split Screen mode to see both scans at once.

To measure the volume of an area on a 2D image, follow these steps (you can make the length, width, and depth measurements in any order that make sense for the specific scans):

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.

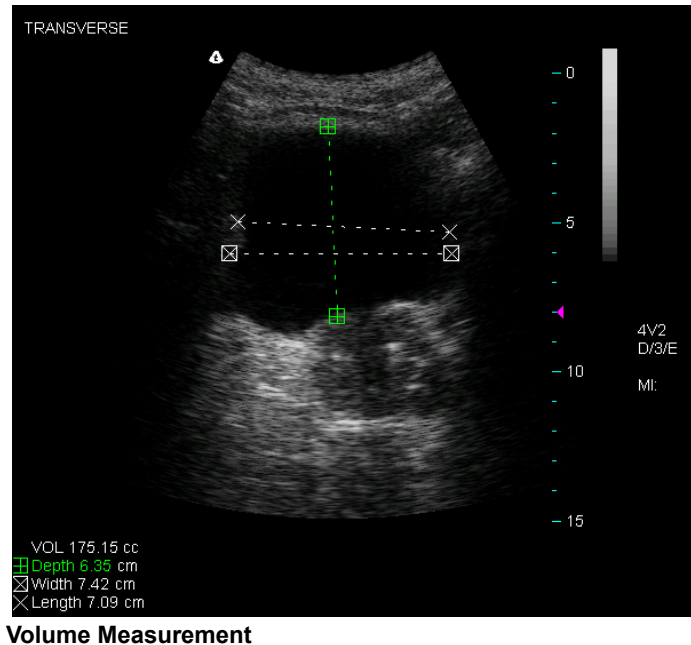
The Terason software displays the length measurement.

5. If necessary, click Live and acquire a view for the width measurement, then click Freeze.
6. Select Width from the Measurement list.
7. 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.



8. Select Depth from the Measurement list.
9. 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 and the volume calculation.







Volume Measurement

Measuring Elliptical Circumference and Area

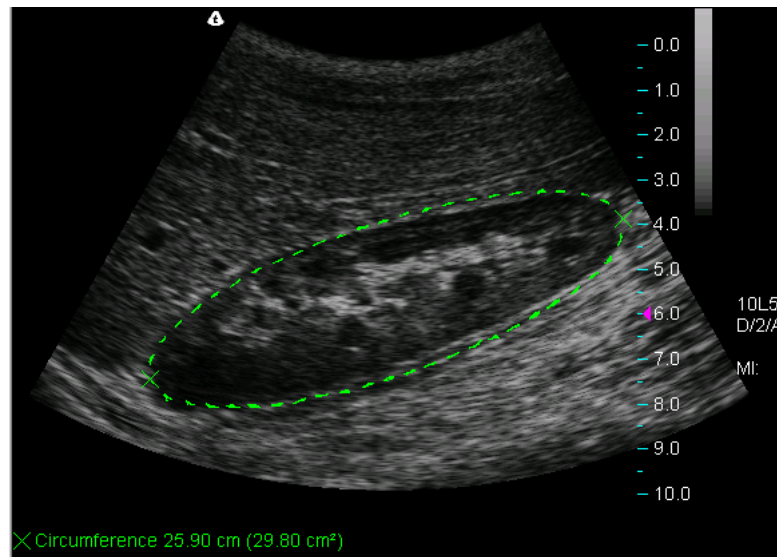
You can use either the  (ellipse) tool or the  (trace) tool to measure a circumference on the image. If you want to measure an oval area, use the Ellipse tool; if you want to measure the area of an irregular shape, use the Trace tool. See “Tracing Areas on the Image” on page 173 for instructions on using the trace tool.

If you want to measure a detailed area, use the Zoom function before you measure.

To use the ellipse tool to measure an elliptical area, follow these 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 these methods to activate the ellipse tool:
 - Click 
 - Select Circumference from the Measurement list
 - Select Area from the Measurement list, 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 end location and click. If you are using a touch pad, slide your finger along until the cursor is at the end location and click.

The Terason software displays 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 on the caliper and move it to a new location, which results in changing 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 172 for instructions.

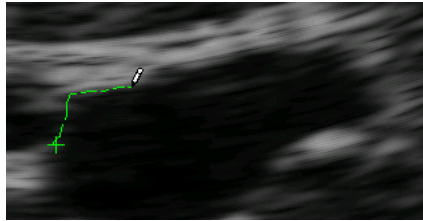
You can use the trace tool to:

- 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.

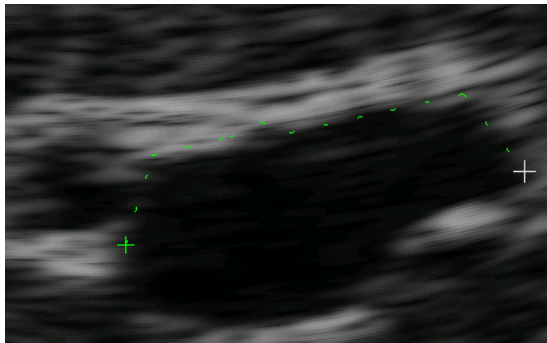
To trace an area on an image, follow these steps:

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 these methods to select the trace tool:
 - Click  on the 2D Measure tab
 - Select Area from the Measurement list
 - Select Circumference from the Measurement list 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

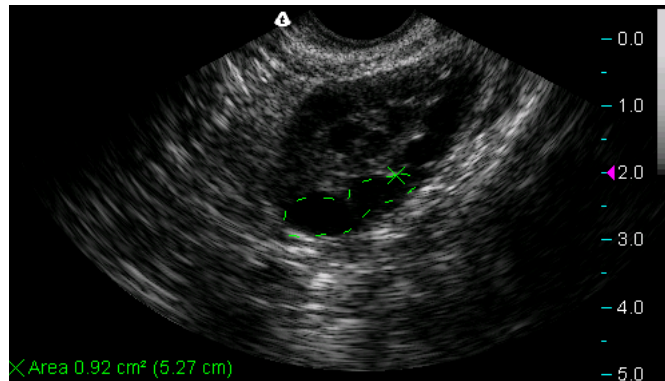
- c. To erase part of the tracing, release the mouse button and press the Backspace key to delete line segments, then press the left mouse button and continue tracing.
5. To draw a polygon:
 - a. Click where you want to start measuring.
 - b. Click on the next corner of the shape. The cursor looks like + 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 on 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.



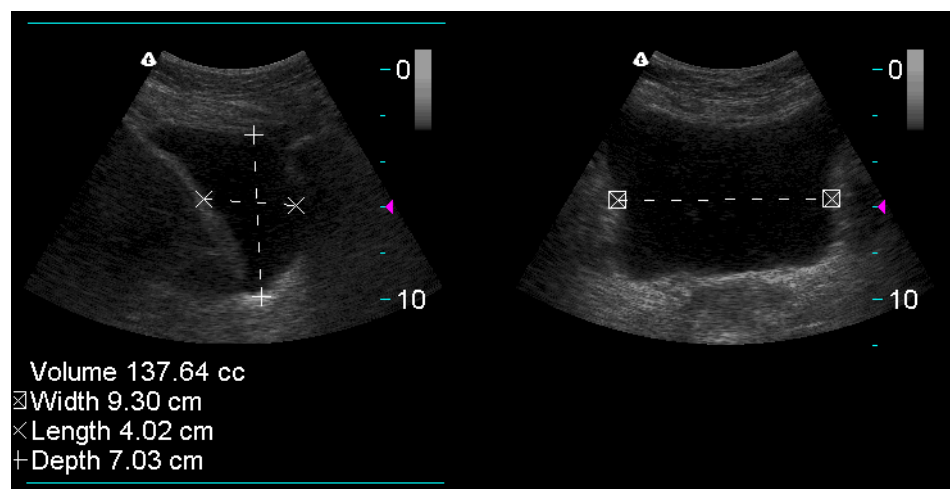
Trace Measurement on an Image

Measuring in Split Screen Mode

You make measurements in Split Screen mode the same way you normally make measurements. You need to make the specific screen (left or right) active by clicking in the screen or clicking the Toggle button before you can make a measurement.

When measuring in Split Screen mode, all of the measurements are displayed in a single list, regardless of which screen contains that measurement. In addition, you can make length, width, and depth measurements on either of the two screens and the Terason software will calculate the volume.

This figure shows a series of measurements made in two scans.



Split Screen Measurements



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.

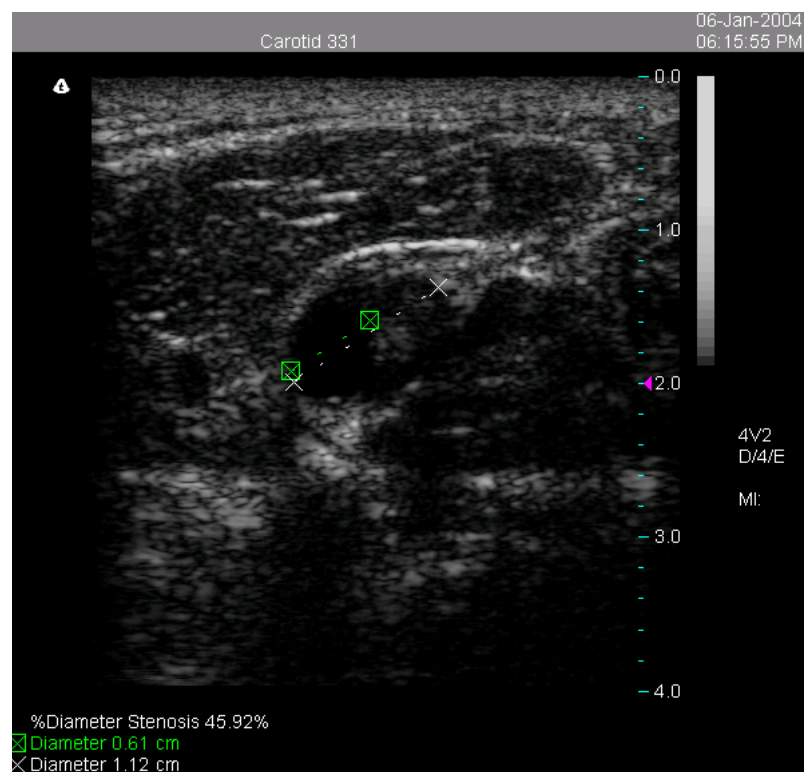
You can make these measurements in any order; the Terason software always uses the largest measurement as the diameter or area of the vessel.

This procedure shows you how to measure the percentage of stenosis based on the diameter:

1. Click . 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. Select Stenosis Diameter from the Measurement list.
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 list and use the Trace tool to measure the vessel and the residual lumen.

Calculating a Percent Compromised Area (Area Ratio)





For veterinary applications, the Trace and Ellipse tools can calculate the percentage of an area that has been compromised. For example, you can use this tool to determine the ratio of the size of lesions to the total surface area of a tendon.

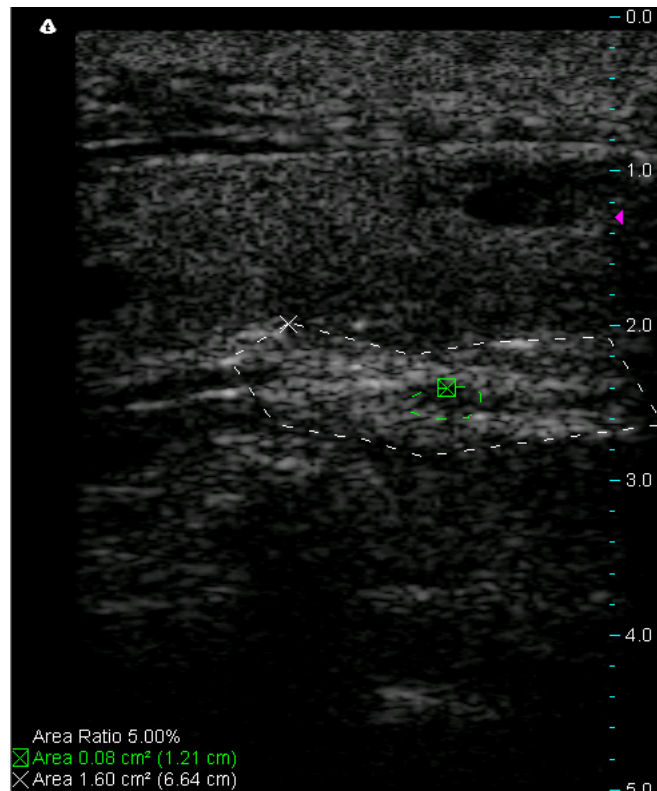
To use this function, you measure the total surface area to be evaluated (the entire tendon) and the compromised areas (lesions). As soon as you make the second area measurement, the Terason software calculates the percentage of the compromised area. You can measure as many areas within the total surface area as needed.

This function calculates a ratio between any number of areas measured on an image. The Terason software uses the largest area as the total surface area, and then sums the area of all other tracings and calculates the ratio of the combined tracings to the total surface area.

You can use any combination of the Trace and Ellipse tools to measure areas on the scan. If you use the Ellipse tool, you also need to select Area in the Measurement list instead of the default Ellipse measurement (Circumference). This example uses the Trace tool.

To calculate a percent compromised area or area ratio, follow these 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. Select the trace tool using one of these methods:
 - Click 
 - Select Area from the Measurement list
4. Trace the total surface area to be evaluated.
5. Click .
6. Trace the first compromised area. As soon as you close the smaller traced area, the software calculates the percentage.



Percent Area Compromised (Area Ratio)

In this example, the traced area marked with the X is the total surface area. The smaller area, marked with the boxed x, is 5.00% of the total surface area.

7. Trace additional areas within the total surface area as needed.

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, you can:

- Make measurements on the obstetrical exam
- Calculate the estimated fetal weight using AC, HC, and FL measurements
- Calculate the gestational sac size mean using GSDH, GSDW, and GSDL measurements
- Export obstetrical measurements for use by the R4 reporting application

The Obstetrical and Gynecological exams also allow you to use the **Measurement > Send Measurements to Serial Port** menu item. This menu item sends all measurements to another computer connected via a serial cable. The resulting text file can be imported into another

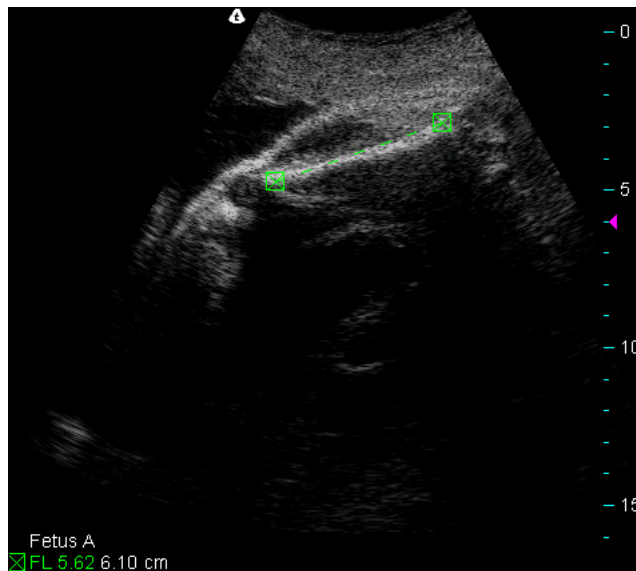
application, typically the R4 reporting application, for further analysis. See “Setting Measurement Defaults” on page 218 for instructions on setting with port on your computer is connected to the other computer.

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 Fetus B measurements when that Fetus is selected in the 2D Measure tab.

All measurements use the distance tool (see “Measuring Distances” on page 169), except AC (Abdominal Circumference) and HC (Head Circumference) use the Ellipse (see “Measuring Elliptical Circumference and Area” on page 172) or Trace (see “Tracing Areas on the Image” on page 173) tools.

You can make multiple measurements of one type, on multiple scans, to acquire all the needed measurements. For example, this scan shows two femur length (FL) measurements.



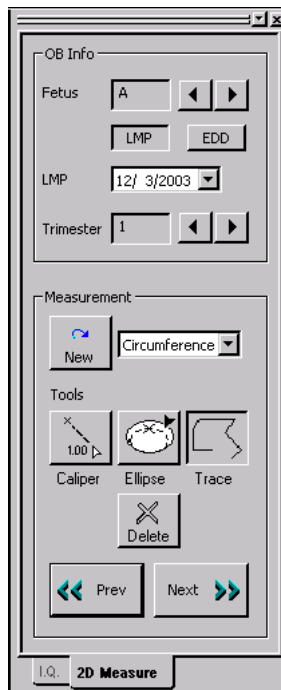
Two Measurements on an Image

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 183.)



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 on 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). These calculations are made when saved measurements are imported into the R4 application (see “Exporting Obstetrical Measurements to the R4 Reporting Package” on page 184).

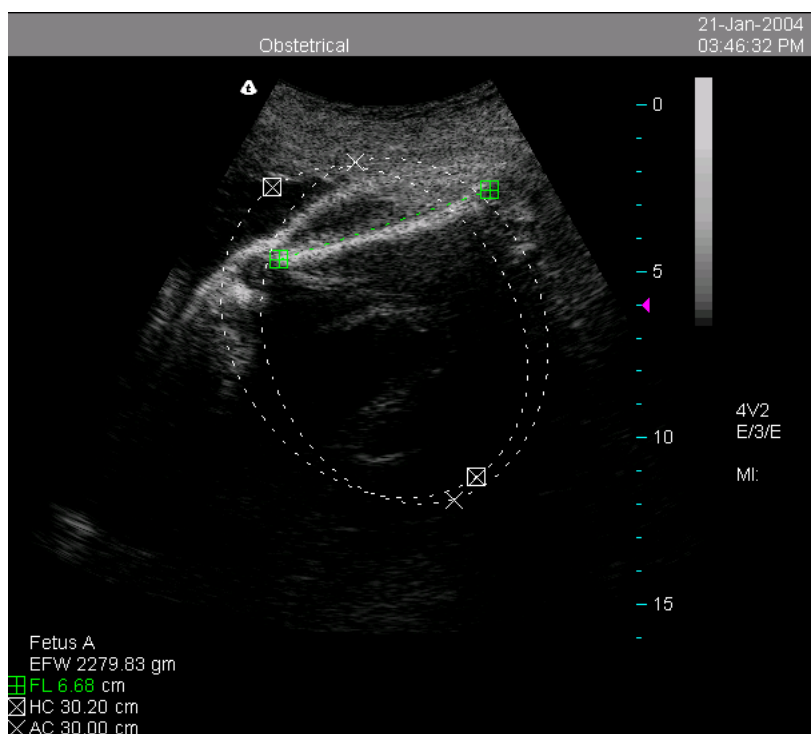
Calculating Estimated Fetal Weight

The Terason software can estimate the weight of a fetus. Terason uses the Hadlock formula (see Appendix D, “Gestational Tables,” on page 298) 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 218. If you choose a different setup, the selected setup may not support the EFW calculation.

To calculate the estimated fetal weight, follow these steps:

1. Perform an obstetrical exam.
2. Click  .
3. Select AC from the Measurement list 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 list 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 list and use the Distance tool to measure the femur length.

When the Terason software places all three AC, HC, and FL labels on an obstetrical exam, it automatically calculates the estimated fetal weight (EFW).






Estimated Fetal Weight Calculation

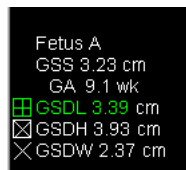
Calculating Gestational Sac Size and Age

For a first trimester obstetrical exam, the Terason software can calculate the mean gestational sac size, and based on that size, provide the estimated Gestational Age. Terason uses the Hadlock formula and tables (see Appendix D, “Gestational Tables,” on page 298). To use a measurement setup other than Hadlock, see “Setting Measurement Defaults” on page 218. If you choose a different setup, the selected setup may not support the GSS and GA calculation.

To measure the mean gestational sac size, follow these steps:

1. Perform an obstetrical exam.
2. Click .
3. Select GSDH from the Measurement list 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 list 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 list and measure the gestational sac diameter length.

Once 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 218 to select the system default measurement setup.

Exporting Obstetrical Measurements to the R4 Reporting Package

If you purchased the R4 obstetrical reporting package as an option, the Terason software can export a file containing all of the obstetrical measurements. You can then import that file into the R4 software.

When you save the scan, the Terason software automatically creates this file:

C:\Temp\usdata.txt

Use the R4 software to import this file for the report. Refer to the R4 documentation for instructions on importing files.

The next time you save an obstetrical scan (whether or not you made any measurements on it), this file will be overwritten. You should always import the file into R4 as soon as you create it.

If the R4 application runs on a different computer, you can connect the two computers with a serial cable and use the **Measurement > Send Measurements to Serial Port** menu item to transmit the text data to the second computer. See “Setting Measurement Defaults” on page 218 for instructions on setting the port used to connect to the other computer.

Making Gynecological Measurements

All gynecological measurements use the distance tool (see “Measuring Distances” on page 169). When you freeze a Gynecological exam, the Terason software lets you choose any of the default 2D measurements, plus the measurements in this 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, follow these steps:

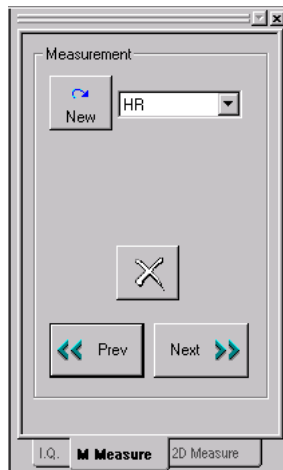
1. Perform an gynecological exam.

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)
- Cardiac and Fetal Cardiac exams:
 - Right ventricular diameter diastole, labelled RVDd
 - Interventricular septal thickness diastole, labelled IVSd
 - Left ventricular diameter diastole, labelled LVDd
 - Left Ventricular posterior wall thickness diastole, labelled LVPWd
 - Interventricular septal thickness systole, labelled IVSs
 - Left ventricular diameter systole, labelled LVDs
 - Left ventricular posterior wall thickness systole, labelled LVPWs
 - Right ventricular diameter systole, labelled RVDs



The LVDs and LVDd measurements provide additional calculations as described in “Measuring Cardiac Exams” on page 186.

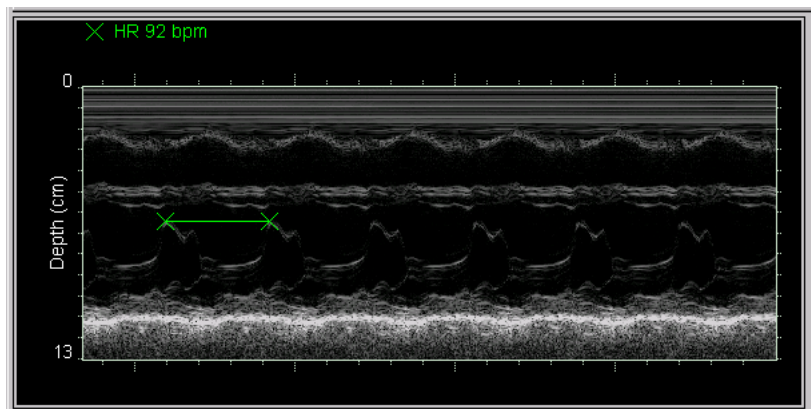


If you want to make more than one measurement of the same type on a scan, click the New button to make the second and any subsequent measurements. For most cardiac measurements, you can only make one measurement of each type.

When you save an image to the ULT format, measurements in the M-Mode window are not saved. You should print the image before you save it or acquire another scan. Measurements are saved as part of the image when you use alternate formats; however, you cannot edit those measurements when you view the file.

To measure in the M-Mode Time Series window, follow these 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 from the drop-down list in the M Measure tab.
3. Click the cursor where you want to start measuring.
4. Move the cursor to the desired end location and click. The measurement displays at the top, left of the Time Series window.



M-Mode Measurement

5. Print and save the image, if needed.

Measuring Cardiac Exams

The Terason application can calculate the End Diastolic Volume (EDV) and End Systolic Volume (ESV) based on the Left Ventricular Diameter diastolic and systolic measurements (LVDd and LVDs).

When you make an LVDd measurement, either in the M-Mode Time Series or 2D image display windows, the Terason application displays the EDV calculation using the Teichholz and Cubic calculation methods. For an LVDs measurement, the Terason application adds the ESV calculation.

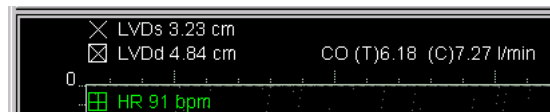
When both LVDd and LVDs measurements have been made, the Terason application calculates these items:

- End Diastolic Volume (EDV)
- End Systolic Volume (ESV)
- Stroke Volume (SV)
- Ejection Fraction (EF)
- Fractional Shortening (FS)

	Teichholz	Cubic
ESV	41.87 ml	33.67 ml
EDV	109.69 ml	113.48 ml
SV	67.82 ml	79.80 ml
EF	61.83 %	70.33 %
FS	33.30 %	

Left Ventricular Diameter Calculations

If you add a Heart Rate (HR) measurement to an M-mode scan that already has LVDd and LVDs measurements, the Terason application calculates the Cardiac Output (CO) and displays both the Teichholz and Cubic calculations.



Cardiac Output Calculation

For your information, Terason uses these formulas to make the cardiac calculations:

Teichholz formulas:

- End Diastolic Volume: $EDV = (LVDd^3 \times 7) / (2.4 + LVDd)$
- End Systolic Volume: $ESV = (LVDs^3 \times 7) / (2.4 + LVDs)$

Cubic formulas:

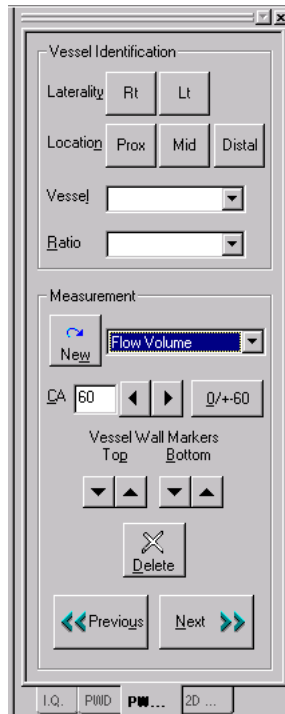
- End Diastolic Volume: $EDV = LVDd^3$
- End Systolic Volume: $ESV = LVDs^3$

The following formulas use the corresponding (Teichholz or Cubic) values for EDV and ESV:

- Stroke Volume: $SV = EDV - ESV$
- Ejection Fraction (%): $EF = [(SV) / (EDV \times 100)]$
- Fractional Shortening (%): $FS = [100 \times (LVDd - LVDs) / (LVDd)]$
- Cardiac Output (l/min): $CO = (SV \times HR) / 1000$

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 tab lets you:

- Measure arterial velocity
- Calculate arterial ratios
- Measure heart rate or rise time
- Measure flow volume



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 108.

The Vessel Wall Markers move the top and bottom marker along the scan line and are only used when making a Flow Volume measurement (see “Measuring Flow Volume” on page 195).

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 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 list and to label the vessel on the image. The Cardiac and Gynecological exams do not include any vessel selections.

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
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

Exam	Menu/Label	Vessel
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
Fetal Cardiac	Ao	Aorta
	LVOT	Left Ventricular Outflow Tract
	MV	Mitral Valve
	Peroneal A	Pulmonary Artery
	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

Exam	Menu/Label	Vessel
Pelvic	Arcuate A	Arcuate Artery
	Ext Iliac A	External Iliac Artery
	Int Iliac A	Internal Iliac Artery
	Ovarian A	Ovarian Artery
	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
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	ISpermatic 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

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 these measurements:

- Peak Systole
- End Diastole
- Peak Systole/End Diastole ratio (S/D)
- Resistance Index (RI)

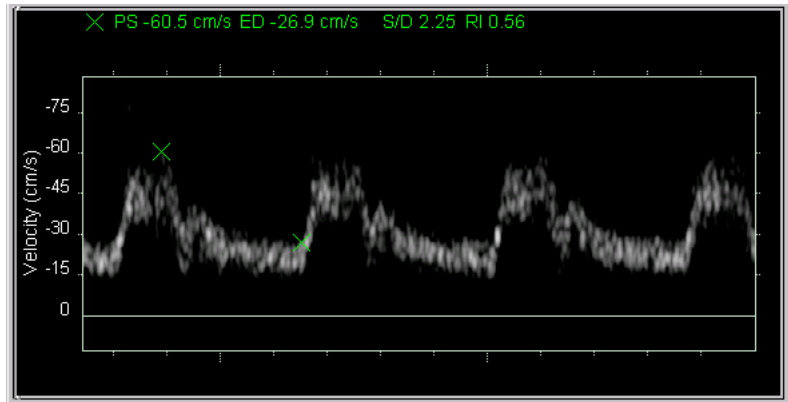
You can measure PS/ED for a scan that uses Frequency (kHz) or Velocity (cm/s) as the velocity display units (the Y-axis of the Time Series window).

Follow these 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 list.
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 ICA (Internal Carotid Artery) to CCA (Common Carotid Artery) ratios, or systolic renal artery to aorta ratio.



Before you make a PS/ED measurement, select Artery 1 (denominator) or Artery 2 (numerator). 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.

To measure velocities for two arteries and calculate ratios, follow these steps:

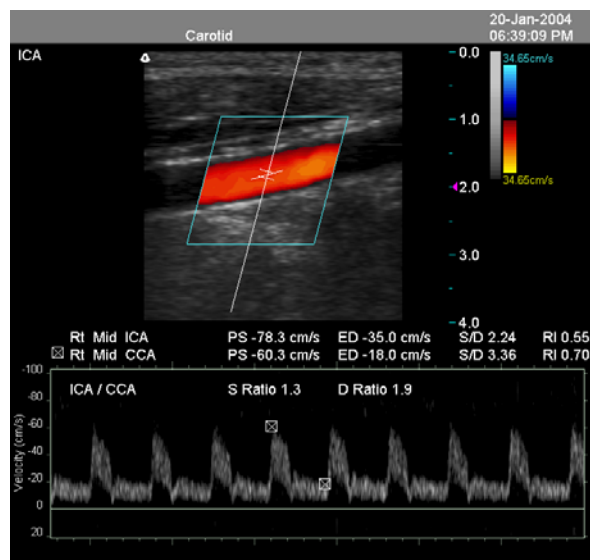
1. Click  and select the needed exam from the **Exam** menu of 2D tab (Carotid, Arterial, or Abdominal).
2. Scan an artery and click .
3. Follow steps 1-5 in “Measuring Vessel Blood Velocities” on page 192.

4. Select the artery to use as the denominator from the Ratio list.
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 from the Ratio list.

The Terason software shows the arterial PS and ED values for the second scan, plus the S and D ratios between the two arteries.



PS/ED Ratio for Two Arteries



If the ratio does not display, check the two PS/ED measurements for these items:

- Both measurements have a vessel name
- You selected opposite sides, but they used different vessels or different locations

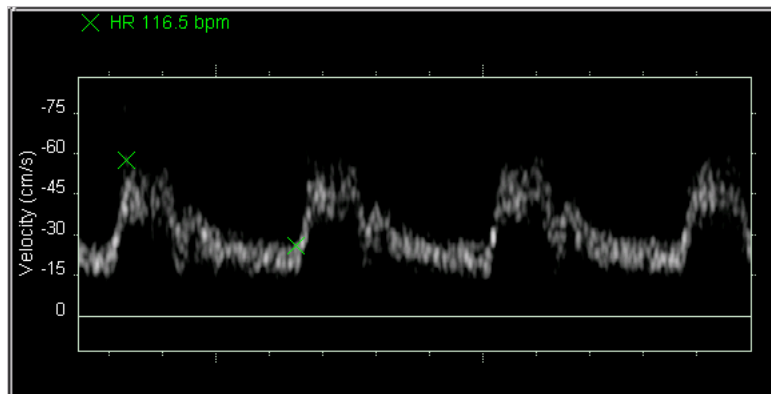
If you select opposite sides (right and left) for the two measurements, both measurements must have the same vessel name and the same location (Prox, Mid, or Distal).

Measuring Heart Rate and Rise Time

Follow these 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.
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 HR (for Heart Rate) or RT (for Rise Time) from the Measurement list.
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. These values are included in this calculation:

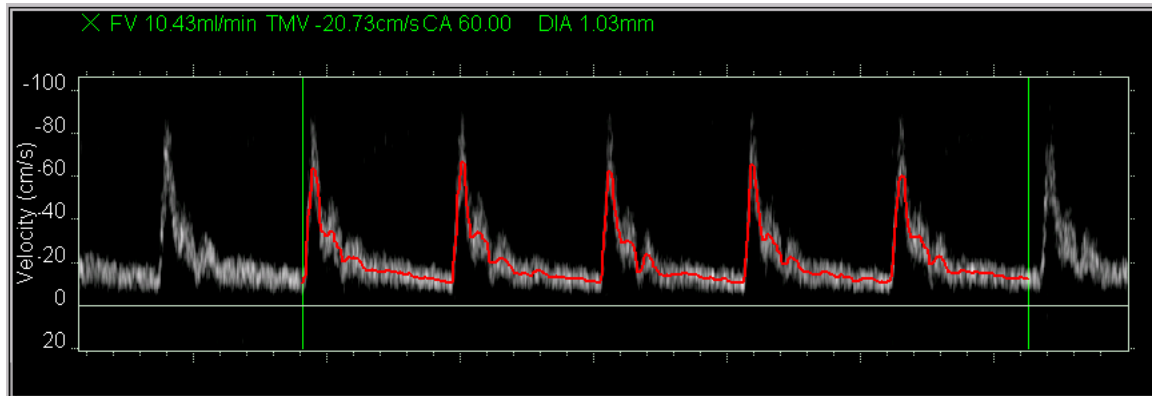
- FV: Flow Volume (milliliters/minute)
- TMV: Time Mean Velocity (centimeters/second)
- DIA: Diameter (millimeters)
- CA: Correction Angle (degrees)

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, follow these steps:


1. Set the sample volume size and location and acquire image data.
2. Click . The 2D and PWD measure tabs are added to the Image Control bar.
3. On the PWD Measure tab, select Flow Volume from the Measurement list.

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 on the green bar, move to another end diastolic location, and click.

Selecting Measurements


If you have multiple measurements in the 2D window, the Terason software provides tools to help you select a specific measurement. When you select a measurement, both the measurement and the value become highlighted.

To select a measurement, you can:

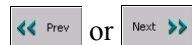
- Click  or  until the needed measurement is highlighted
- Click the measurement
- Click the value

Deleting Measurements

You can use any of these methods to delete a highlighted measurement:

- Click  on a Measure tab
- Press the Del key on the keyboard
- Right-click on a 2D measurement and select **Delete Measurement**

If you want to delete a measurement other than the highlighted one, click



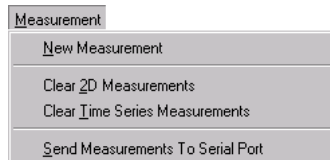
until the needed measurement is highlighted. These buttons cycle through the measurements in the same sequence in which they were created in the active window.

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

The **Edit > Clear All** 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

The **New Measurement** menu item initiates a new measurement of the type currently selected. The **Send Measurements To Serial Port** menu item works with Obstetrical and Gynecological exams as described in “Working with Measurements on an Obstetrical Exam” on page 178.

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 applicable for the exam. You can use these optimized preset exams as is, or you can make individual adjustments to 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 need to change each time you perform a specific ultrasound exam.

To work with exams, you need to know:

- What preset exams are available
- How to open an exam
- How to create a custom exam
- How to delete a custom exam

About Exams

The Terason Ultrasound System provides pre-defined exams for all transducer models. Although several transducers may support the same exam, the preset image control parameters are unique to the characteristics of each transducer.

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 the presets for that size. When you select a different size, you do not need to reload the exam or load a different exam; the Terason software automatically updates the preset values for the selected size.

This table lists the preset exams available for each transducer.

Terason Transducers and Preset Exams

Transducer	Exams		
4C2	Abdominal Fetal Cardiac Gynecological	Obstetrical Pelvic	Prostate Renal
4V2	Abdominal Cardiac Gynecological	Obstetrical Pelvic	Prostate Renal
7L3	Arterial Breast Carotid	Dialysis Access Musculoskeletal Testes	Thyroid Vascular Access Venous
8B4S	Prostate		
8IOL4	Intraoperative		
8MC4	Abdominal Cardiac Intraoperative	Gynecological Neonatal Head Obstetrical	Pelvic Renal Small Parts
10L5	Arterial Breast Carotid	Dialysis Access Musculoskeletal Testes	Thyroid Vascular Access Venous
10LAP4	Laparoscopic		
10V5	Cardiac	Pediatrics	

This 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	Depth Focus	Gain TGC Curve	
I.Q.	Left/Right invert Up/Down invert Palette	Smoothing Persistence Map	Brightness Contrast
M-Mode	Speed	Scan line position	
PWD	Speed Velocity display PRF Wall filter	Steering angle Invert Correction angle Sample volume size	Gain Baseline Sound volume
CD	Scan area PRF Wall filter Steering angle	Invert Color Gain Priority Persistence	Baseline Spatial Resolution and Frame Rate
DirPwr	Scan area PRF Wall filter Steering angle	Invert Gain Priority Persistence	Baseline Spatial Resolution and Frame Rate
Pwr	Scan area PRF Wall filter	Steering angle Gain Priority	Persistence Spatial Resolution and Frame Rate

When you use the Save or Save Loop buttons (see “Saving Images and Loops” on page 141), the Terason software uses a default file name based on the selected exam. This 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	Pelvic	PEL
Cardiac	CAR	Prostate	PRO
Carotid	CRD	Renal	REN
Dialysis Access	DIA	Testes	TES
Fetal Cardiac	FET	Thyroid	THY
Gynecological	GYN	Vascular Access	VAS
Laparoscopic	LAP	Venous	VEN

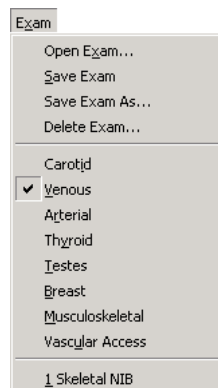
Opening an Exam

When you select an exam, the Terason software loads the preset values for that exam for your 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 to those for the selected exam.

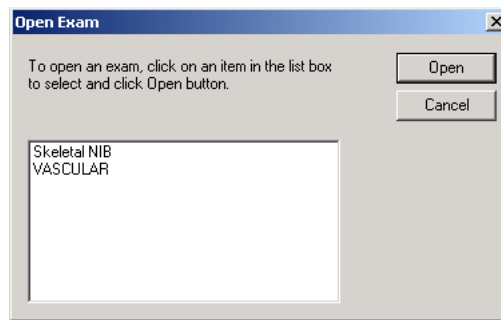
You cannot open an exam when viewing a frozen or saved image. If the Image Display window is frozen, you must click Live before you can change the exam.

You can open an exam using any of these methods:

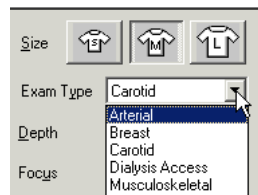
- Select the exam from the **Exam** menu (the checked exam indicates the open exam)



- Select **Exam > Open Exam**, click on an exam, and click **Open**



- Select an Exam from the pull-down list on the 2D Image Control tab



Creating Custom Exams

In addition to using the provided preset exams, you can create your own exams. Customized 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. Any exam can be customized to include your specific control settings.

You cannot change the settings for a system exam; you can edit the image control settings and save the exam 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 necessary, exit the Terason system, disconnect the current transducer, and connect the needed transducer. See “Switching Transducers” on page 75 for instructions.

To create an exam, follow these steps:

1. Select the system exam that has settings close to the one you want to create. See “Opening an Exam” on page 200.
2. Modify the Image Control settings as needed. See Chapter 5, “Working with Scan Modes,” on page 88 for instructions.
3. If you want 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.

If you want 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 and is only available when the current transducer is connected to the computer. If you connect a different transducer, this new exam will not be available.

Creating Size Specific Versions

When you create a custom exam for a specific size, a preset exam is created for the size selected when the exam is saved. If you want to use the parameters you defined in the preset for other sizes too, you will need to create customized exams for each size.

For each size you modify, save the exam with the same name. The Terason software saves the presets as part of the same exam. 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 for the same exam, you will need to remember to load the size-specific exam; in this case the Terason software can not update the preset values based on the size setting.

To create size-specific versions of an exam, follow 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.

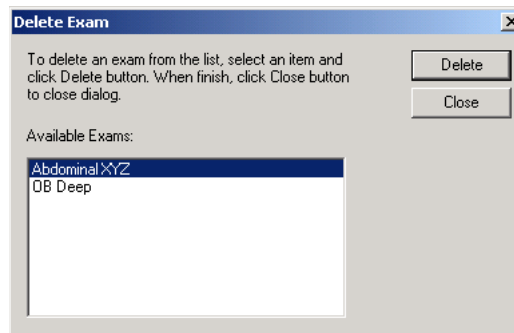
Deleting Exams

If you no longer want a particular exam, you can delete it at any time. You can only delete exams that you created; you cannot delete any of the system exams.

You cannot delete the exam if it is currently loaded. If so, select a different exam before you start this procedure.

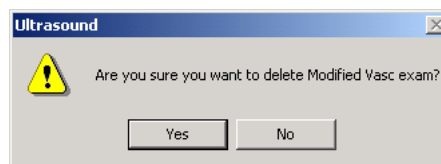
To delete an exam, follow these steps:

1. Select **Exam > Delete Exam**. The Terason software opens the Delete Exam dialog box.



Deleting an Exam

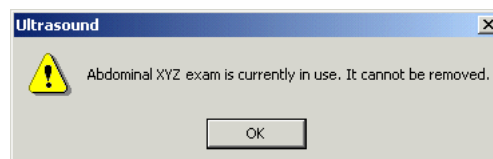
2. Click the exam that you want to delete from the list, and click **Delete**. The Terason software prompts you to confirm that you want to delete this exam.



Confirm Delete Dialog Box

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

If you select the active exam, you will see this message:

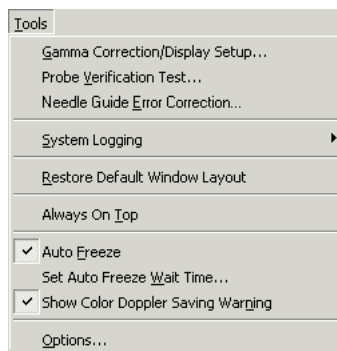


Error Message If Delete Active Exam

Click **OK**, then open a different exam. Now you can delete this exam.

10 Using System Tools

The **Tools** menu provides utilities that support various functions of the Terason software.



Tools Menu

The tools let you:

- Adjust the monitor
- Run a probe verification test
- Make minor adjustments to the needle guide position
- Create and purge a system log file
- Restore the layout of windows and toolbars to the default settings
- Keep the Terason software on top of your computer desktop
- Set a time-out value for powering the transducer
- Enable or disable the Color Doppler warning message
- Configure options

Adjusting the Monitor's Gamma Display

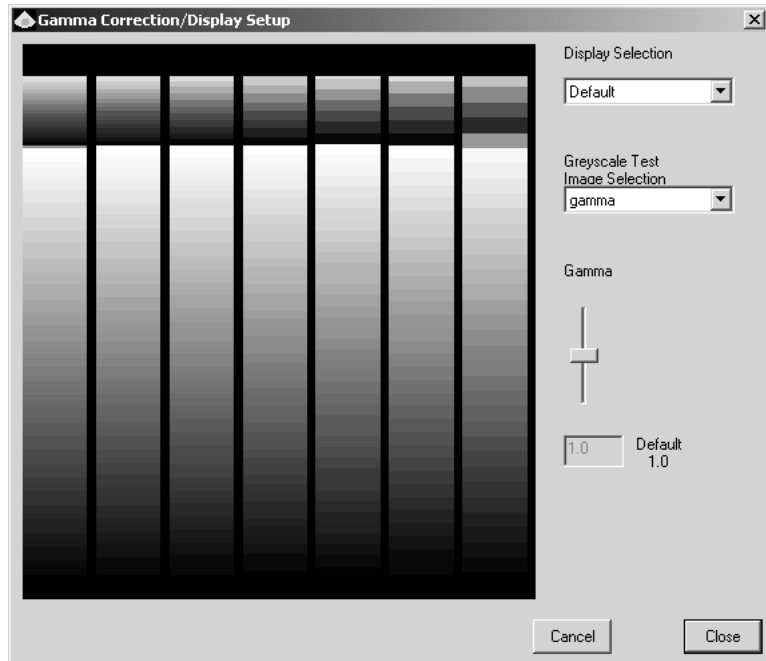
When you purchase a laptop from Terason as part of the Terason Ultrasound System, the monitor has already been adjusted for proper gamma control. You may never need to use the Gamma Correction tool unless instructed to by a Terason Support Representative.

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 follow the procedure in this section to adjust the gamma. The gamma correction

feature includes four industry-standard tests. You can use any combination of these tests to adjust your monitor's display. The procedure shows you how to use all of the tests; you can skip any of them.

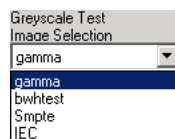
To adjust the gamma for your display, follow these steps:

1. In the **I.Q.** tab of the Image Control window, select Gray from the Palette pull-down list.
2. Select **Tools > Gamma Correction/Display Setup**. The setup dialog box opens.



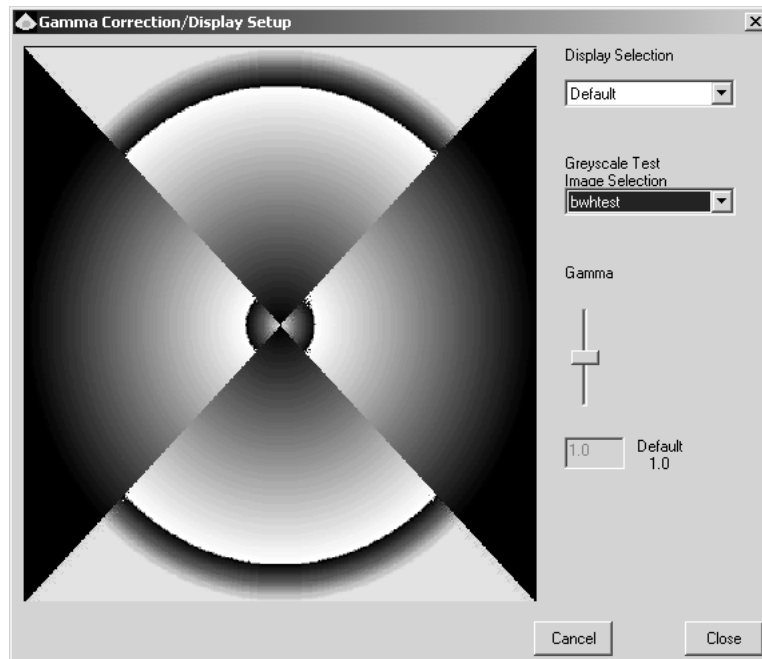
Gamma Correction Dialog Box - Gamma Test

3. From the Display Selection pull-down list, select your monitor. If you do not see any monitors listed, select Default.
 - a. Verify that the gray bars in each column are increasingly difficult to distinguish as you look from right to left.
 - b. If you need to adjust the gamma, drag the Gamma slider up or down to adjust the image. Any adjustment you make takes affect immediately; the Cancel button does not revert to the previous setting.
4. Select the next text, bwhtest, from the Greyscale Test Image Selection pull-down list.



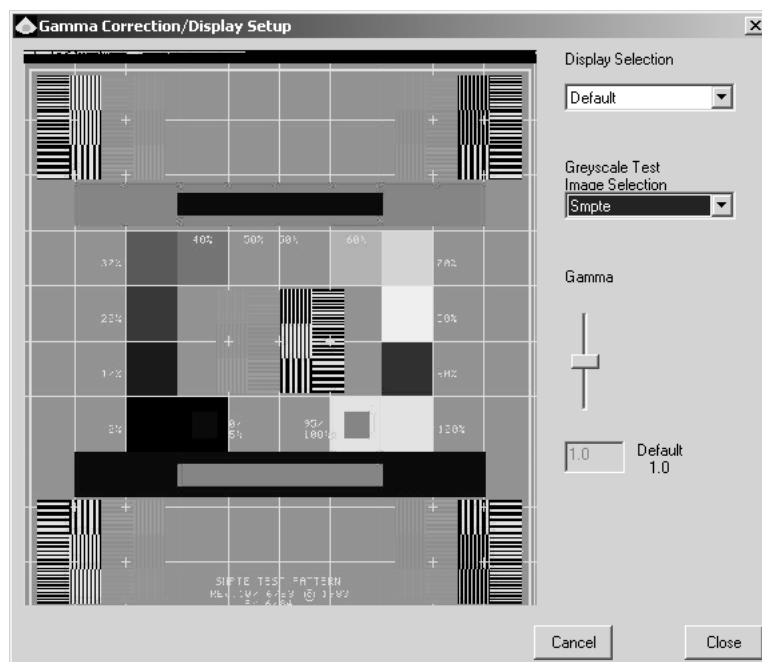
Greyscale Tests

This figure shows the BWHtest:



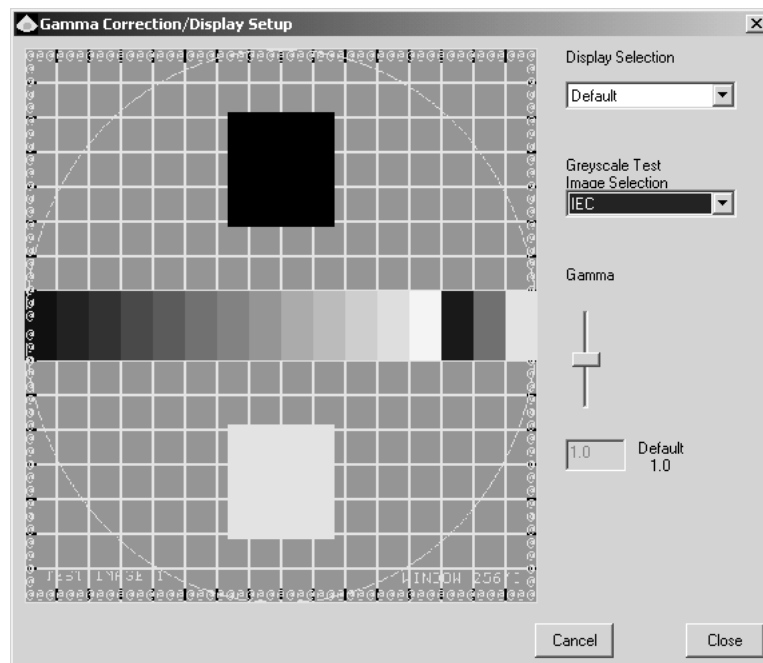
Gamma Correction Dialog Box - BWHTest (BWH: Brigham and Women's Hospital)

- a. 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.
 - b. If you need to adjust the gamma, drag the Gamma slider up or down to adjust the image.
5. Select the SMPTE test.



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% and 95%, respectively. You should be able to visually 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 as simple patterns of black and white pairs. 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.
 - c. If you need to adjust the gamma, drag the Gamma slider up or down to adjust the image.
6. Select the IEC test.



Gamma Correction Dialog Box - IEC Test

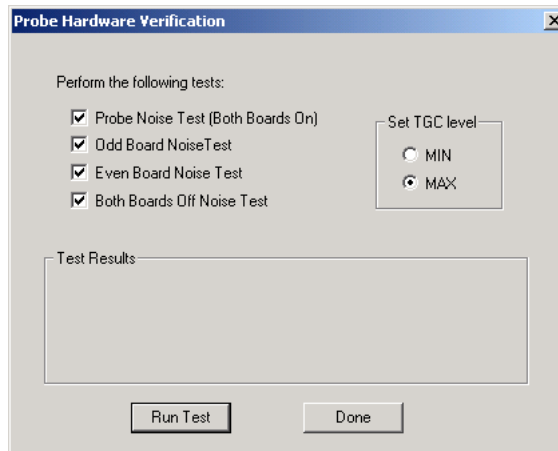
- a. You should be able to differentiate between the gray bars along the center of the image. The large black square (top) should appear black and the large white square (bottom) should appear white.
 - b. If you need to adjust the gamma, drag the Gamma slider up or down to adjust the image.
7. Click Close.

Running a Probe Verification Test

The Terason software automatically verifies the 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.

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, here is how you do it:

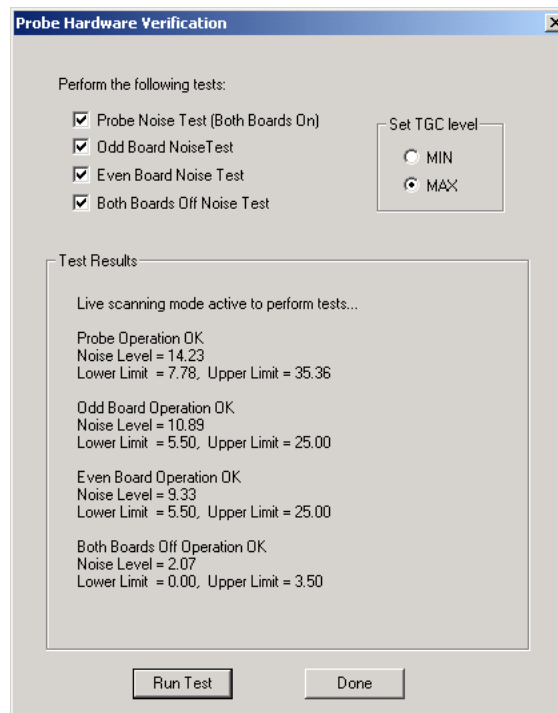
1. Select **Tools > Probe Verification Test**. The Probe Hardware Verification dialog box opens.



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 dialog box.



Verification Results

3. Report the results to the Terason Technical Representative.
4. Click **Done**.

Correcting the Position of the Needle Guides

The Needle Guide Error Correction item in the **Tools** menu is used exclusively with the biopsy/medical procedures options. See “Setting the Error Correction” on page 135 for instructions on using this menu item.

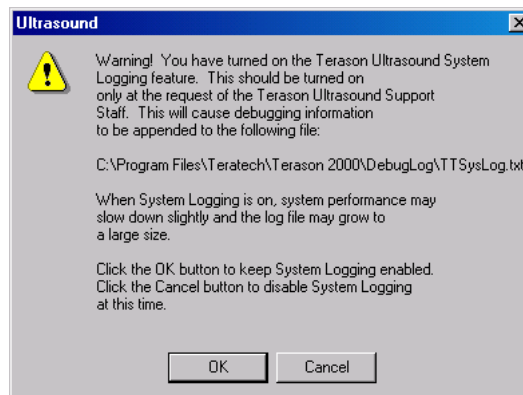
System Logging

Terason Technical Support may request that you create a system log file. This log file will help Terason analyze the problem. The log file will quickly become large, so you should not enable logging unless asked to by a Terason Technical Support representative.

Creating a Log File

To create a log file, follow these steps:

1. Start the Terason software.
2. Select **Tools > System Logging > Start Logging**. The software displays a warning message.



System Logging Warning Message

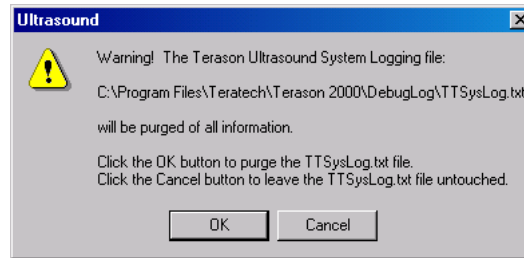
3. Click **OK**.
4. Continue using the Terason software until the error occurs.

Terason Technical Support will work with you to resolve the problem.

Deleting the Log File

Because the log file can get large, as soon as your issue is resolved, you should purge the log file and disable further logging. To do so, follow these steps:

1. Select **Tools > System Logging > Stop Logging**. The software stops logging system messages.
2. Select **Tools > System Logging > Purge Log File**. The software displays a warning message.



Purging Log File Warning Message

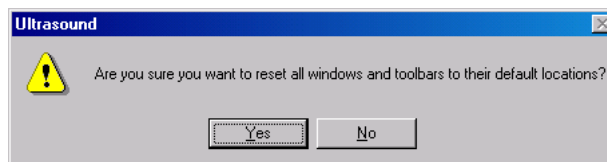
3. Click OK. The software deletes the file from your computer.

Restoring the Default Layout

You can easily reset the layout of the toolbars and windows to their default locations. To do so, follow these steps:

1. Select **Tools > Restore Default Window Layout**.

The Terason software prompts you to confirm this choice.



Confirmation Prior to Resetting the Layout

2. Click Yes.


The Terason software opens the Terason Explorer and Image Control windows (if they had been 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 do not use other applications while the Terason software is running. Although today's computer systems can simultaneously run several applications at a time, you will get the best performance if the Terason software does not need to share resources with other applications.

If you use more than one application on your computer, Windows automatically places the active application on top of 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 menu bar. This menu item shows a check mark when it is selected.

When selected, no other application will block your view of the Terason application. If you want to see a different application window, minimize the Terason window (click  at the top right of the Terason window).

Windows adds a  button on the taskbar at the bottom of the screen. You can then use other applications as needed. When you are ready to use the Terason software again, click the  button and Windows opens the Terason window.

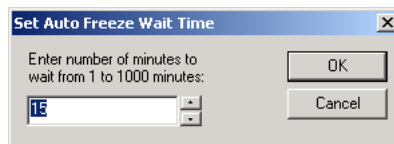
Setting a Time-Out Value

The Terason software lets you set a time-out value that shuts off power to the transducer if it has been inactive for a set length of time. 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, follow these steps:

1. Select **Tools > Set Auto Freeze Wait Time**. The Terason software opens the Set Auto Freeze Wait Time dialog box.



Setting the Time Out Value

2. 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.
3. Click **OK**.

When the specified number of minutes elapses, the computer shuts off power to the transducer and displays this message:

Terason has automatically suspended. Hit any key or move mouse to resume.

The Terason title bar is updated to "Terason - Suspended" to indicate that the transducer power has been 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 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 119 for information on the color persistence setting.

You can use the **Tools > Show Color Doppler Save Warning** menu 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

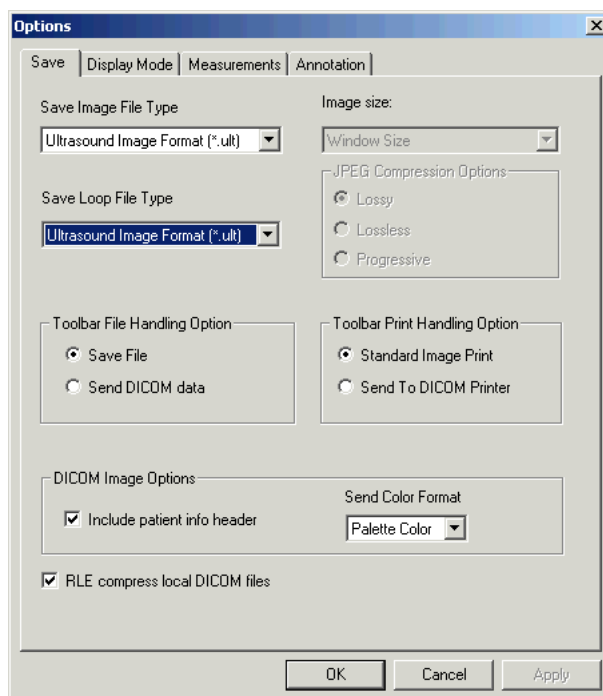
The Terason software lets you specify several optional settings. You can change defaults that affect:

- Image saving and printing
- Display options
- Measurements
- Annotation text

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 dialog box opens showing the Save tab.



Options Dialog Box

These options let you set defaults for:









- Save image and image loop file types
- File and Print toolbar options
- DICOM options

Save Image File Type

By default, the Terason software uses its own file format when saving image files and loops. If you want to choose a different format as the default for images or loops, you can do so.

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. This 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, or Bitmap with Spatial Info		Not Available
DICOM		
JPEG		Not Available
TIFF		Not Available

If you change the default file type, you can use the **File > Export** 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 pull-down menu.

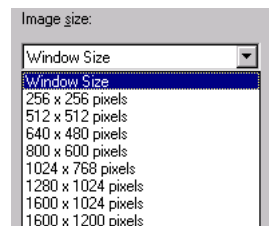


Image Sizes for non-ULT File Types

Your choice becomes the new default; you can change the image size when you save the file by using the **File > Export** menu item instead of the **Save** button.

If you select JPEG as the default and you want to customize the JPEG defaults further, choose a level of compression:

- **Lossy:** Compresses the image but may reduce image quality
- **Lossless:** Compresses the image without reducing image quality, but results in large file sizes
- **Progressive:** Compresses the image, and loads that image by progressively adding more detail until the entire image is loaded

See “Selecting File Types” on page 139 for a description of image artifacts that can be introduced when using the Lossy option.

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. If you select these options, use the **File** menu to save an image or loop to your computer or in a format other than DICOM, or if you want to print to a printer other than the DICOM printer. The Toolbar File and Print handling options will only be enabled if the DICOM utility has been 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 166 for information on using these buttons.

DICOM Image Format

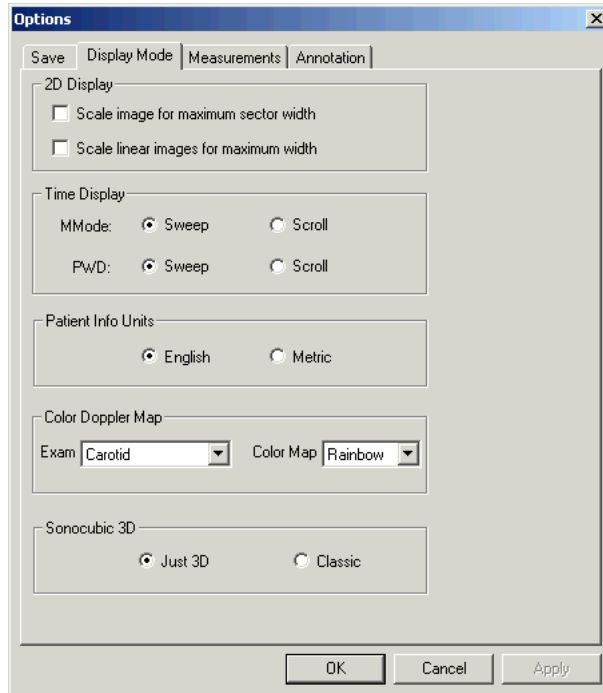
You can choose whether or not patient data is sent with the DICOM image, and the color format used for sending a DICOM image. You can choose Palette (8-bit color) or RGB (24-bit) color. This setting only affects files sent to a DICOM server; DICOM files saved on the laptop always use the Palette color format.

The “RLE compress local DICOM files” check box 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” check box. Changing the default will result in longer image save and load times and larger image files.

Changing the Display Mode Defaults

The Display Mode options are shown in this dialog box.



Options: Display Mode Options

The Display Mode options let you choose:

- Whether or not to scale curved transducers when changing the sector width
- Whether or not to scale linear transducers for maximum width
- The direction for the Time Series window scanning
- The units for height and weight of a patient
- The color map for specific exams

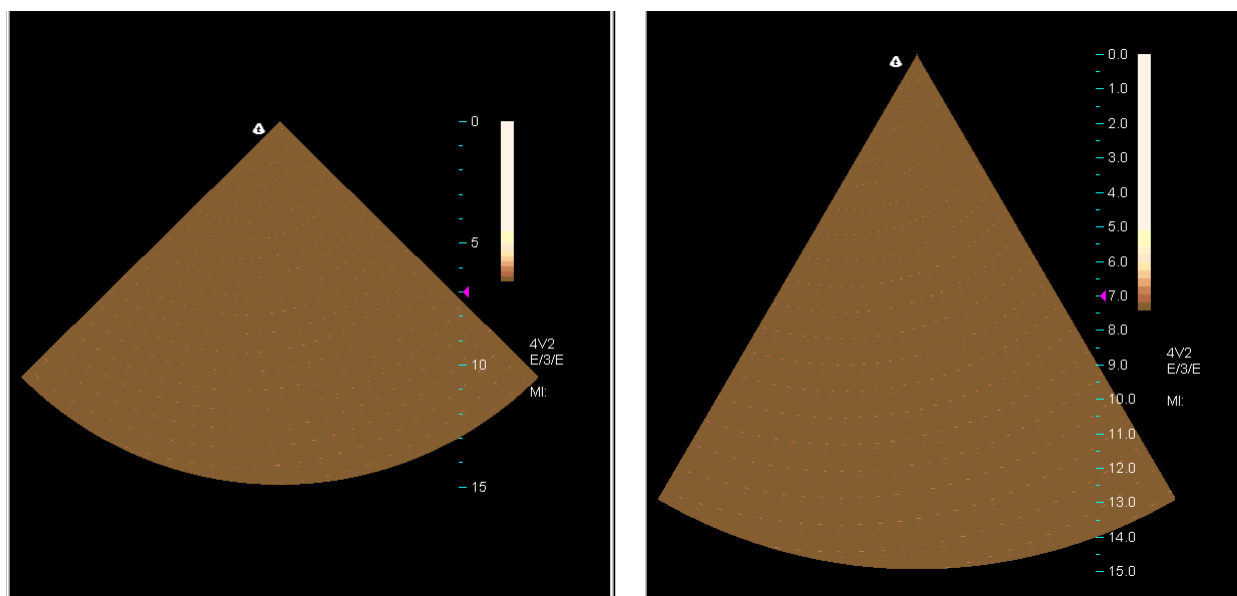
Choosing the Direction for the Time Series Scan

The Terason software can build the Time Series window from left-to-right (sweep) or from right-to-left (scroll). See Chapter 5, “Working with Scan Modes,” on page 88 for more information on the Time Series window used in M-Mode, PWD mode, and Triplex mode.

The Options dialog box selects the default direction. If you want to temporarily change the direction, you can right-click in the Time Series window and select the Display Mode.

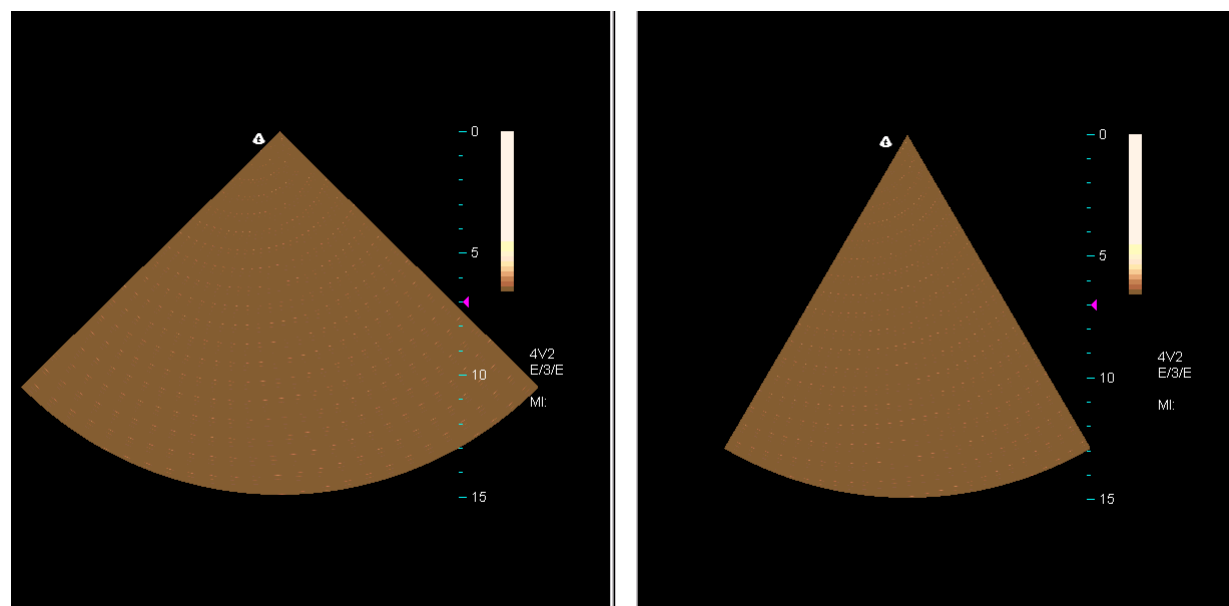
Scaling Curved Transducers

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 this 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.

If you want 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 this figure.

**Wide Sector vs. Scaled Narrow Sector**

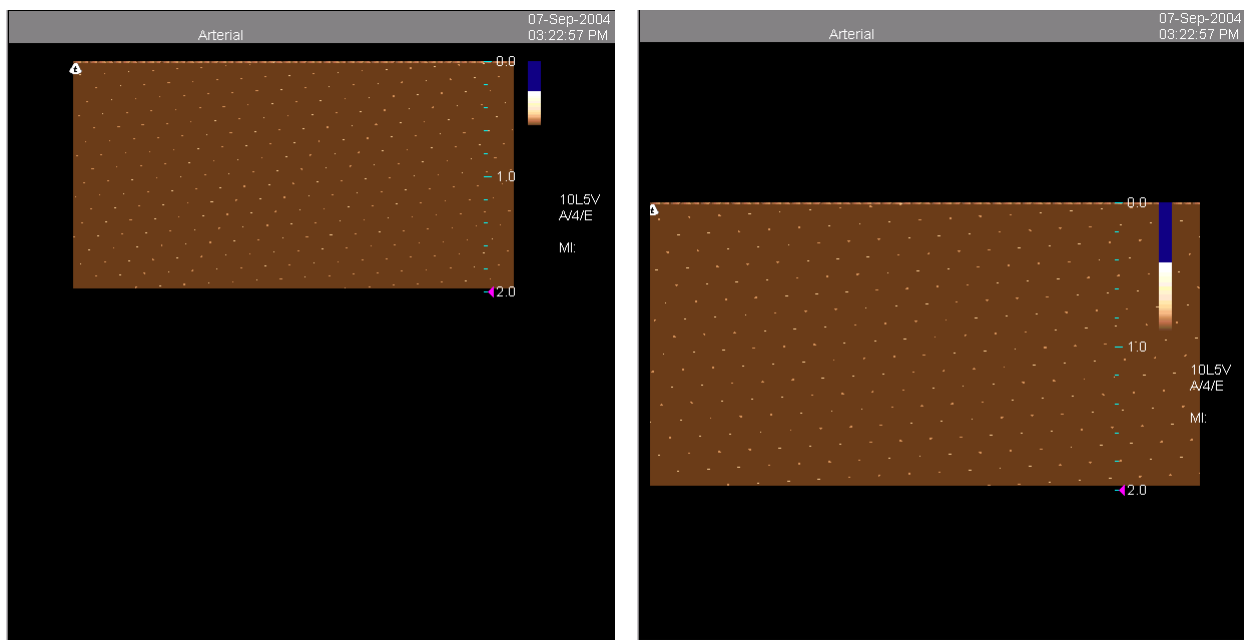
The scales are the same, and you can see that the narrow width really is narrower than the wide width. However, the window contains unused space that could be used to show image data.

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.

If you want 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” check box. When you do, the Terason software scales the image (while maintaining the same aspect ratio) to fill as much of the window as possible.

This figure shows the difference between not scaled and scaled linear arrays.



Not Scaled (Left) and Scaled (Right) Linear Scan Images

Setting the Units for Patient Measurements

When entering a patient's height and weight, you can choose to use English units (feet/inches and pounds), or metric units (meters and kilograms).

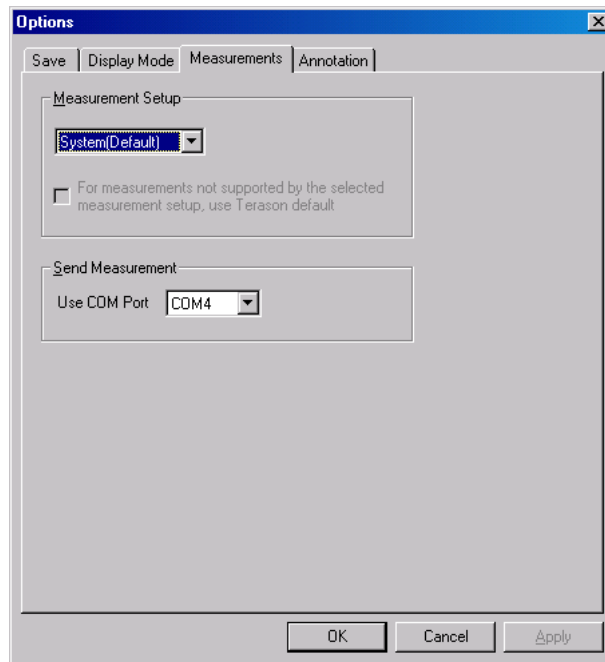
Choosing Color Maps for Exams

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 saves the color map for the previous 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.

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.

In addition, if you use the R4 reporting software with the Terason software, you can use the **Measurement > Send Measurements to Serial Port** menu item to transmit obstetrical/gynecological measurements to another computer (connected via serial cable). Use this option only if the R4 software is installed on a separate computer. The Measurement defaults let you choose which serial port (COM1 to COM4) to use for transmitting the measurements.

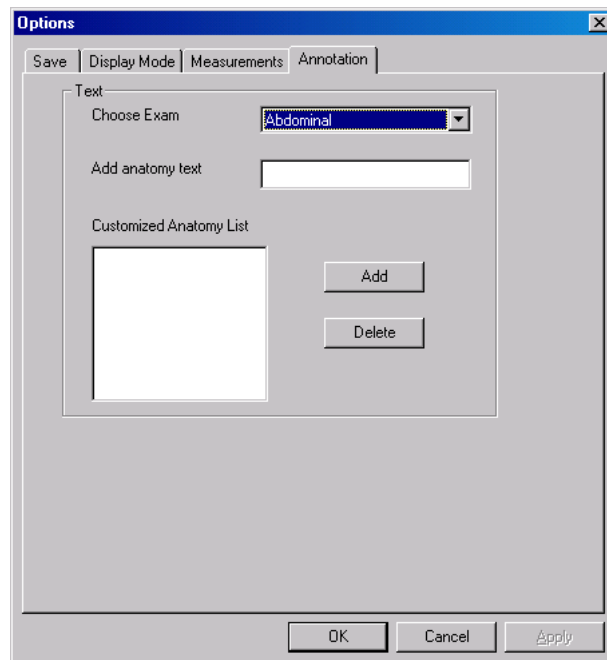
See “Working with Measurements on an Obstetrical Exam” on page 178 for more information.

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 that shows in the Annotation window depends on the selected exam; if you want to have a certain text phrase available for all exams, you will need to add it to all exams.

To add custom text, follow these steps:

1. Select **Tools > Options**.
2. In the Options dialog box, click the Annotation tab.



Options: Annotation Tab

3. From the Choose Exam pull-down list, choose the exam for which you want this text to be available.
4. Type the text into the text box.
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 67.

11 System Safety and Maintenance

To use the Terason Ultrasound System successfully and safely, Terason provides the following information:

- Safety standards
- Acoustic output indices
- Relationship of index to display accuracy
- Acoustic output tables
- Accuracy measures
- Transducer processing between uses
- Compliance and approvals
- System warranty
- Recommended maintenance
- Equipment list

Safety Standards

According to the American Institute of Ultrasound in Medicine (AIUM) in their Official Statement of the Clinical Safety of Diagnostic Ultrasound (approved 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 further minimize patient exposure in the presence of a system fault or a fault within 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 the electrical safety and emissions standards, the Terason Ultrasound System **MUST** be used only with the supplied Medical Grade Power Adaptors.

Surface Heating of Invasive Transducers

The average and peak radiated acoustic powers of all Terason 2000 transducers are limited using detection circuitry to insure that the surface heating of the transducer array is limited to 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. If the maximum allowable PRF is exceeded, an error message is sent to be displayed on the host computer and the transducer 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, a Zener diode is placed between the high-voltage lead and ground of each transducer element. This diode limits the maximum voltage that can be applied to each transducer element; thereby, limiting the maximum transducer-array case temperature.

Indications For Use

This section provides the 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 individual transducers, and include the following transducers:

- 4C2
- 4V2
- 7L3V
- 8EC4 and 8B4S
- 8IOL4
- 8MC4
- 10L5
- 10LAP4
- 10V5

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 ^a	Comb. Modes ^b	Other ^c
Ophthalmic	Ophthalmic							
Fetal Imaging and Other	Fetal	X ^h	X ^h	X ^h		X ^h	X ^h	X ^h
	Abdominal	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative ^e	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative (Neuro)	X	X	X		X	X	X
	Laparoscopic	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Pediatric	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Small Organ (Thyroid, Breast, Testes, etc.)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Neonatal Cephalic	X	X	X		X	X	X
	Adult Cephalic	X	X	X		X	X	X
	Trans-rectal	X ^f	X ^f	X ^f		X ^f	X ^f	X ^f
	Trans-vaginal	X ^g	X ^g	X ^g		X ^g	X ^g	X ^g
	Trans-urethral							
	Trans-esoph. (non-Cardiac)							
	Musculo-skel. (Conventional)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Musculo-skel. (Superficial)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-luminal							
	Other (Specify)							
Cardiac	Cardiac Adult	X	X	X		X	X	X
	Cardiac Pediatric	X	X	X		X	X	X
	Trans-esoph. (Cardiac)							
	Other (Specify)							
Peripheral Vessel	Peripheral vessel	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Other (Specify)							

^aIncludes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

^bB+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

^cTissue Harmonic Imaging (THI).

^dIncludes ultrasound guidance for placement of needles, catheters.

^eAbdominal organs and peripheral vessels.

^fIncludes ultrasound guidance for placement of needles, catheters, cryosurgery, and brachytherapy.

^gIncludes ultrasound guidance of transvaginal biopsy.

^hIncludes ultrasound guidance of amniocentesis, infertility monitoring of follicle development.

^jIncludes ultrasound guidance for placement of needles.

Includes uses in military field settings in addition to hospital/clinic settings.

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM								
System: Terason Ultrasound System								
Transducer: 4C2								
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 ^a	Comb. Modes ^b	Other ^c
Ophthalmic	Ophthalmic							
Fetal Imaging and Other	Fetal	X ^h	X ^h	X ^h		X ^h	X ^h	X ^h
	Abdominal	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative (Specify)							
	Intra-operative (Neuro)							
	Laparoscopic							
	Pediatric	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	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							
	Other (Specify)							

^aIncludes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

^bB+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

^cTissue Harmonic Imaging (THI).

^dIncludes ultrasound guidance for placement of needles, catheters.

^eAbdominal organs and peripheral vessels.

^fIncludes ultrasound guidance for placement of needles, catheters, cryosurgery, and brachytherapy.

^gIncludes ultrasound guidance of transvaginal biopsy.

^hIncludes ultrasound guidance of amniocentesis, infertility monitoring of follicle development.

Includes uses in military field settings in addition to hospital/clinic settings.

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 ^a	Comb. Modes ^b	Other ^c
Ophthalmic	Ophthalmic							
Fetal Imaging and Other	Fetal	X ^h	X ^h	X ^h		X ^h	X ^h	X ^h
	Abdominal	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative (Specify)							
	Intra-operative (Neuro)							
	Laparoscopic							
	Pediatric	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	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)							
	Cardiac	Cardiac Adult	X	X	X		X	X
Cardiac Pediatric		X	X	X		X	X	X
Trans-esoph. (Cardiac)								
Other (Specify)								
Peripheral Vessel	Peripheral vessel							
	Other (Specify)							

^aIncludes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

^bB+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

^cTissue Harmonic Imaging (THI).

^dIncludes ultrasound guidance for placement of needles, catheters.

^eAbdominal organs and peripheral vessels.

^fIncludes ultrasound guidance for placement of needles, catheters, cryosurgery, and brachytherapy.

^gIncludes ultrasound guidance of transvaginal biopsy.

^hIncludes ultrasound guidance of amniocentesis, infertility monitoring of follicle development.

Includes uses in military field settings in addition to hospital/clinic settings.

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	CWD	Color Dopp ^a	Comb. Modes ^b	Other ^c
Ophthalmic	Ophthalmic							
Fetal Imaging and Other	Fetal							
	Abdominal	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative ^e	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative (Neuro)							
	Laparoscopic							
	Pediatric	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Small Organ (Thyroid, Breast, Testes, etc.)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	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 ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Musculo-skel. (Superficial)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-luminal							
	Other (Specify)							
Cardiac	Cardiac Adult							
	Cardiac Pediatric							
	Trans-esoph. (Cardiac)							
	Other (Specify)							
Peripheral Vessel	Peripheral vessel	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Other (Specify)							

^aIncludes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

^bB+M; B+PWD; B+CD; B+DPD; B+PDV

^cTissue Harmonic Imaging (THI).

^dIncludes ultrasound guidance for placement of needles, catheters.

^eAbdominal organs and peripheral vessels.

Includes uses in military field settings in addition to hospital/clinic settings.

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM								
System: Terason Ultrasound System								
Transducer: 8EC4 and 8B4S								
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 ^a	Comb. Modes ^b	Other ^c
Ophthalmic	Ophthalmic							
Fetal Imaging and Other	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 ^f	X ^f	X ^f		X ^f	X ^f	X ^f
	Trans-vaginal	X ^g	X ^g	X ^g		X ^g	X ^g	X ^g
	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							
	Other (Specify)							

^aIncludes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

^bB+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

^cTissue Harmonic Imaging (THI).

^fIncludes ultrasound guidance for placement of needles, catheters, cryosurgery, and brachytherapy.

^gIncludes ultrasound guidance of transvaginal biopsy.

Includes uses in military field settings in addition to hospital/clinic settings.

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM								
System: Terason Ultrasound System								
Transducer: 8IOL4								
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 ^a	Comb. Modes ^b	Other ^c
Ophthalmic	Ophthalmic							
Fetal Imaging and Other	Fetal							
	Abdominal							
	Intra-operative (Specify)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative (Neuro)							
	Laparoscopic							
	Pediatric							
	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							
	Other (Specify)							

^aIncludes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

^bB+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD

^cTissue Harmonic Imaging (THI).

^dIncludes ultrasound guidance for placement of needles, catheters.

Includes uses in military field settings in addition to hospital/clinic settings.

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM								
System: Terason Ultrasound System								
Transducer: 8MC4								
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 ^a	Comb. Modes ^b	Other ^c
Ophthalmic	Ophthalmic							
Fetal Imaging and Other	Fetal							
	Abdominal							
	Intra-operative (Specify)							
	Intra-operative (Neuro)							
	Laparoscopic							
	Pediatric	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Small Organ (Thyroid, Breast, Testes, etc.)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	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)							
	Cardiac	Cardiac Adult						
Cardiac Pediatric								
Trans-esoph. (Cardiac)								
Other (Specify)								
Peripheral Vessel	Peripheral vessel							
	Other (Specify)							

^aIncludes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

^bB+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

^cTissue Harmonic Imaging (THI).

^dIncludes ultrasound guidance for placement of needles, catheters.

Includes uses in military field settings in addition to hospital/clinic settings.

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM								
System: Terason Ultrasound System								
Transducer: 10L5								
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 ^a	Comb. Modes ^b	Other ^c
Ophthalmic	Ophthalmic							
Fetal Imaging and Other	Fetal							
	Abdominal	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative ^e	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative (Neuro)							
	Laparoscopic							
	Pediatric	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Small Organ (Thyroid, Breast, Testes, etc.)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	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 ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Musculo-skel. (Superficial)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-luminal							
	Other (Specify)							
Cardiac	Cardiac Adult							
	Cardiac Pediatric							
	Trans-esoph. (Cardiac)							
	Other (Specify)							
Peripheral Vessel	Peripheral vessel	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Other (Specify)							

^aIncludes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

^bB+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

^cTissue Harmonic Imaging (THI).

^dIncludes ultrasound guidance for placement of needles, catheters.

^eAbdominal organs and peripheral vessels.

Includes uses in military field settings in addition to hospital/clinic settings.

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM								
System: Terason Ultrasound System								
Transducer: 10LAP4								
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 ^a	Comb. Modes ^b	Other ^c
Ophthalmic	Ophthalmic							
Fetal Imaging and Other	Fetal							
	Abdominal							
	Intra-operative (Specify)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative (Neuro)							
	Laparoscopic	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Pediatric							
	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							
	Other (Specify)							

^aIncludes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

^bB+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD

^cTissue Harmonic Imaging (THI).

^dIncludes ultrasound guidance for placement of needles, catheters.

Includes uses in military field settings in addition to hospital/clinic settings.

DIAGNOSTIC ULTRASOUND INDICATIONS FOR USE FORM								
System: Terason Ultrasound System								
Transducer: 10V5								
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 ^a	Comb. Modes ^b	Other ^c
Ophthalmic	Ophthalmic							
Fetal Imaging and Other	Fetal							
	Abdominal							
	Intra-operative ^e (spec)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Intra-operative (Neuro)	X ^j	X ^j	X ^j		X ^j	X ^j	X ^j
	Laparoscopic							
	Pediatric	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	Small Organ (Thyroid, Breast, Testes, etc.)	X ^d	X ^d	X ^d		X ^d	X ^d	X ^d
	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)							
	Cardiac	Cardiac Adult	X	X	X		X	X
Cardiac Pediatric		X	X	X		X	X	X
Trans-esoph. (Cardiac)								
Other (Specify)								
Peripheral Vessel	Peripheral vessel							
	Other (Specify)							

^aIncludes Color Doppler (CD), Directional Power Doppler (DPD), and (non-directional) Power Doppler (PD).

^bB+M; B+PWD; B+CD; B+DPD; B+PD; B+CD+PWD.

^cTissue Harmonic Imaging (THI).

^dIncludes ultrasound guidance for placement of needles, catheters.

^eAbdominal organs and peripheral vessels.

^jIncludes ultrasound guidance for placement of needles.

Includes uses in military field settings in addition to hospital/clinic settings.

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 transducer and operating mode currently active.

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, each index is 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 of less than 1.0 indicates relatively low risk for harm to the patient when the index is applied properly.
- **Type of operating mode:** Mechanical effects are generally of greater concern during B-Mode only operation, while thermal effects are generally of greater concern during operation of any non-B-Mode operation; thermal effects are calculated separately for non-scanned modes (M-Mode and Pulsed Wave Doppler modes), and 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; in all calculations an attenuation (or “derating”) rate of 0.3 dB/cm/MHz is assumed.

MI: The Mechanical Index

MI is of possible clinical interest if the surface of lung tissue occurs close to the beam focus. This parameter does not exceed a value of 1.0 with the Terason Ultrasound System, and no real-time value of MI is displayed 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 B-Mode 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-B-Mode 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 each scanned mode, the associated intensity at the surface is usually related to surface tissue heating; for each unscanned mode, the maximum derated power through a 1 cm² area anywhere along the beam axis is the basis for estimating tissue heating: unscanned beams less than 1 cm² 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 cm² 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 Neo-natal 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-B-Mode 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 a value of 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 the cranial bone (with indirect heating of adjacent brain tissue) due to absorption of ultrasound in 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-B-Mode 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: the 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
B-Mode only	Any	MI
Any mode, other than B-Mode only	Include <i>neither</i> Adult Cephalic <i>nor</i> Neonatal Cephalic	TIS, TIB
Any mode, other than B-Mode 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 B-Mode

In B-Mode 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 value of MI will be less than 1.0. As is the case for all conditions with the Terason Ultrasound System in which the maximum value of a relevant acoustic for a particular transducer is less than 1.0, the B-Mode image display will always show the label for the Mechanical Index in standard video, with no value displayed to indicate the current MI value.

MI:

Since B-Mode operation under such conditions is considered to be without significant risk due to non-linear acoustic effects, the Terason Ultrasound System may therefore be used in B-Mode with all available transducers for all intended applications without concern for monitoring and minimizing a displayed value of MI. However, in consideration of the general principle of ALARA, the depth control should generally be operated in the deepest setting (thereby minimizing the time-average ultrasound energy) that yields the desired image quality.

Display Format for Modes Other Than B-Mode

When any mode other than B-Mode 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). If no value is to be displayed, then TIS and TIB is shown without any value. For such transducers, the most common Thermal Index display is as follows.

TIB:
TIS:

When this format is displayed, no control settings for the active transducer will allow either TIS or TIB to exceed a value of 1.0. For these transducers, operation in the intended clinical applications is considered without significant risk due to heating of tissues by ultrasound energy. No real-time TI values need be monitored and the transducer may be used without concern for minimizing the displayed value of any TI.

Certain other transducers with the Terason Ultrasound System will display a Thermal Index format of the following type.

TIB: 0.8
TIS:

Since the label for TIS is still shown in standard video format and no value displayed, no real-time TIS values need be monitored. The display of the TIB label, however, indicates that the transducer in use may in some cases be set to a control state where the Bone Thermal Index may exceed 1.0. (In the example shown, the current real-time value of TIB is approximately 0.8).

For another group of transducers in the Terason Ultrasound System, the Thermal Index display will show a format of the following type.

TIB: 0.8
TIS: 0.6

The display of both Thermal Index labels indicates that the transducer in use may in some cases be set to control settings where either or both the TIS and TIB 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 value of TIC is less than 1.0; if the maximum values of TIS and TIB for a given transducer/mode combination exceed 1.0, then the Thermal Index display will show 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, an index value may exceed a value of 1.0 for some control settings with this transducer. For these indices, the real-time values are displayed to allow monitoring and control. The displayed values (shown along with the corresponding labels) may take on the following values (where x indicates the actual calculated index value).

Display of TI Values		Display of MI Values	
Range of calculated value $x_{\text{Calc.}}$	Displayed value x_{Display}	Range of calculated value $x_{\text{Calc.}}$	Displayed value x_{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,” on page 88 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 (as 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 M. C. Ziskin, “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 $\epsilon_{\text{SPPA.3}}$
- 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 cm² in area
- Soft-Tissue Thermal Index for unscanned modes, when the beam-entrance dimension is greater than 1 cm² 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 ϵ_k , is approximately:

$$\epsilon_k = (\epsilon_{\text{Cal}}^2 + \epsilon_A^2 + \epsilon_{V^2}^2)^{\frac{1}{2}} = 10.2\%$$

where the following are defined:

- ϵ_{Cal} Calibration error, as supplied by the National Physical Laboratory; 8% at the frequency range of the transducers tested.
- ϵ_A Relative error in the reproducibility of positioning the hydrophone at the point of the spatial peak of the pulse intensity integral, estimated to be 5%
- ϵ_{V^2} Relative error resulting from errors in reading peak squared voltage in the recorded waveform, estimated to be 4%

The **relative error in the spatial-peak derated pulse-intensity integral, defined as $\epsilon_{\text{SPPA.3}}$** , is approximately:

$$\epsilon_{\text{SPPA.3}} = (\epsilon_k^2 + \epsilon_{\text{TI}}^2 + \epsilon_{\text{stab}}^2 + \epsilon_{.3}^2 + \epsilon_{\text{lin}}^2 + \epsilon_v^2 + \epsilon_{\text{PD}}^2)^{1/2} = 12.8\%$$

where the following is defined:

- ϵ_{TI} Relative error due to hydrophone positioning and temporal integration of the waveform, estimated to be 4%

ϵ_{stab}	Relative error due to temporal instability of the hydrophone, estimated to be 1%
$\epsilon_{.3}$	Relative error in estimating derating factor, due to uncertainties in estimating frequency and reproducibility in determining derating location, estimated to be 4%
ϵ_{lin}	Relative error due to the effects of non-linearities in the pressure waveform upon the hydrophone and integral amplifier, estimated to be 0% for this transducer set
ϵ_{PD}	Relative error in estimate of pulse duration, estimated to be 5%

The **relative error in the spatial-peak derated temporal average intensity for unscanned modes**, defined as $\epsilon_{\text{SPTA.3-unc.}}$, is approximately:

$$\epsilon_{\text{SPTA.3-unc.}} = (\epsilon_{\text{SPPII.3}}^2 + \epsilon_{\text{prf}}^2)^{1/2} = 11.3\%$$

where the following is defined:

ϵ_{prf}	Relative error in prf estimation for operating condition giving actual peak ISPTA.3-unc., estimated to be 1%
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The **relative error in estimating spatial-peak derated temporal average intensity for scanned modes**, defined as $\epsilon_{\text{SPTA.3-scan.}}$, is approximately:

$$\epsilon_{\text{SPTA.3-scan.}} = (\epsilon_{\text{SPPII.3}}^2 + \epsilon_{\text{srf}}^2 + \epsilon_{\text{BOF}}^2)^{1/2} = 12.8\%$$

where the following are defined:

ϵ_{srf}	Relative error in estimating srf (scan repetition frequency) for operating condition giving actual peak ISPTA.3-scan., estimated to be 1%
ϵ_{BOF}	Relative error in estimating BOF (beam-overlap factor) for operating conditions giving actual peak ISPTA.3-scan., estimated to be 5%

The **relative error in the peak derated rarefactional pressure**, defined as $\epsilon_{\text{pr.3}}$, is approximately:

$$\epsilon_{\text{pr.3}} = \left(\frac{1}{2}\right) \epsilon_{\text{SPPII.3}} = 5.9\%$$



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 ε_{MI} , is approximately:

$$\varepsilon_{MI} = \left(\varepsilon_{pr.3}^2 + \left(\frac{\varepsilon_{fc}}{2} \right)^2 \right)^{1/2} = 6.4\%$$

where the following is defined:

ε_{fc} Relative error in estimating center frequency, estimated to be 5%.



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 $\varepsilon_{TISscan}$, is approximately:

$$\varepsilon_{TISscan} = (\varepsilon_{W01}^2 + \varepsilon_{fc}^2)^{1/2} = 11.2\%$$

where the following is defined:

ε_{W01} Relative error in estimating the peak acoustic power from a 1 cm width of the active scanned aperture, estimated to be 10%



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 ε_{W0} , is approximately:

$$\varepsilon_{W0} = \varepsilon_{FB} = 10\%$$



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 cm² in area**, defined as $\varepsilon_{TISunsc-A<1}$, is approximately:

$$\varepsilon_{\text{TISunsc-A} \leq 1} = (\varepsilon_{W0}^2 + \varepsilon_{fc}^2)^{1/2} = 11.2\%$$

The relative error in the Soft-Tissue Thermal Index for unscanned modes, when the beam-entrance dimension is greater than 1 cm² in area, defined as $\varepsilon_{\text{TISunsc-A} > 1}$, is approximately:

$$\varepsilon_{\text{TISunsc-A} > 1} = (\varepsilon_{W0}^2 + \varepsilon_{fc}^2 + \varepsilon_{\text{ITA.6}}^2)^{1/2} = 16.2\%$$

where the following is defined:

$\varepsilon_{\text{ITA.6}}$ Relative error in estimating the spatial peak intensity, when derated at 0.6 dB/cm/MHz, estimated to be:

$$\varepsilon_{\text{ITA.6}} = \varepsilon_{\text{SPTA.3-unsc.}} = 11.8\%$$

The relative error in the Bone Thermal Index for unscanned modes, defined as $\varepsilon_{\text{TIBunsc.}}$, is approximately:

$$\varepsilon_{\text{TIBunsc.}} = (1/2)(\varepsilon_{W0}^2 + \varepsilon_{\text{ITA.6}}^2)^{1/2} = 7.7\%$$

The relative error in estimating the Cranial Thermal Index, defined as ε_{TIC} , is approximately:

$$\varepsilon_{\text{TIC}} = (\varepsilon_{W0}^2 + \varepsilon_{\text{Deq}}^2)^{1/2} = 10.2\%$$

where the following is defined:

ε_{Deq} Relative error in estimating the equivalent diameter of the active aperture, estimated to be 2%

The **estimated relative errors of the calculated indices** are as follows.

$$\varepsilon_{\text{MI}} = 6.4\%$$

$$\varepsilon_{\text{TISscan}} = 11.2\%$$

$$\varepsilon_{\text{TISunsc-A} < 1} = 11.2\%$$

$$\varepsilon_{\text{TISunsc-A} > 1} = 16.2\%$$

$$\varepsilon_{\text{TIBunsc}} = 7.7\%$$

$$\varepsilon_{\text{TIC}} = 10.2\%$$

Relationship of Index to Display Accuracy

The above discussion is concerned with the relationship between the calculated index value ($x_{\text{Calc.}}$), 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 ($x_{\text{Calc.}}$). 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 ($x_{\text{Calc.}}$))

Display Precision of TI Values

The following table indicates the precision of the display for TI values.

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

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 below 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 in the following table, 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.

Display Value	MI	TIS _{scan}	TIS _{unsc-A<1}	TIS _{unscA>1}	TIB _{unsc}	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%
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%

The table indicates values of Display Accuracy, resulting from combined effects of calculation accuracy and display precision. Only unshaded values correspond to index values actually displayed by the Terason Ultrasound System.

Notes:

- Display Accuracy is not defined for actual index values (x_{Actual}) of zero.
- $x_{\text{Display}} - x_{\text{Actual}}$ is always greater than zero.
- Mechanical Index (MI) values greater than 1.9 are in excess of FDA Guideline levels.

Acoustic Output Tables

The Track 3 Transducer/Mode Combination Summary table in this section lists those transducer/mode combinations (indicated by “X”) for the Terason Ultrasound System for which a relevant index parameter is

capable of exceeding a value of 1.0. For an accompanying acoustic-output page for each transducer, refer to Appendix E, “Acoustic Output Reporting for Track 3”.

The default settings for the PWD (and B+PWD) mode using the 4V2 and 4C2 Transducers have been set to limit the Bone Thermal Index (TIB) to 40% of the peak value (i.e., a global index value of 0.92). Increasing any parameter (pulse-repetition frequency [PRF] and/or sample-volume size), which in turn increases the TIB, should be chosen to be consistent with ALARA exposure.

Track 3 Transducer/Mode Combination Summary

Transducer Model	B	M	PWD	CWD	Color Doppler (a)	Combined (b)	Other
4V2			X			X	
4C2			X			X	
7L3			X			X	
8B4S (Linear)			X				
8B4S (Curvilinear)			X				
8EC4							
8IOL4			X			X	
8MC4			X			X	
10L5			X			X	
10LAP4			X			X	
10V5			X			X	

Notes:

- 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 E, “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

The accuracy measures for distance are as follows:

Formula:

$$D = \sqrt{(x_1 + x_2)^2 + (y_1 + y_2)^2}$$

where (x_1, y_1) and (x_2, y_2) 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

The accuracy measures for area are as follows:

Assumptions: Circular cross section, length of axes: 2a, 2b

Formula: $K = \pi ab$

Range: 0-300 cm²

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 cm², accuracy=4%

Circumference

The accuracy measures for circumference 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

The accuracy measures for volume 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.

Terason Transducer Processing Between Use

Each transducer must be processed between uses according to the type of tissue it will contact during use:

- For non-critical applications, in which the device contacts only intact skin, clean and low-level disinfect the transducer.
- For 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.
- For critical uses, in which the device contacts blood, compromised tissue, or is used in a sterile field, the transducer must be cleaned and at least high-level disinfected. Use of a sheath is required.

General Cleaning

After use involving 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 250.

Between patient exams, perform the following steps to clean the transducer:

1. Wipe 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 chosen from the list on the next page.
4. To prevent the solution from air-drying on the transducer and cable, immediately wipe them with a soft cloth moistened in sterile water.



Avoid the following cleaning techniques, which may damage the transducers:

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.

Do not sterilize a transducer with autoclave, ultraviolet, gamma radiation, gas, or dry-heat sterilization techniques.



Do Not Submerge Transducers Above Line (10LAP4 not to scale)



The cable and connector are not waterproof. Do not immerse the cable or allow liquid to contact the connector.

Precleaners and Low-Level Disinfectants for Vernon Transducers

The precleaners and disinfectants listed below have been tested and found to be compatible with transducers from Vernon. The Vernon transducers include these models (as indicated by the name of the Image Display tab):

- 4C2V
- 7L3V
- 8B4S (Image Control tabs show as VBMC and VBML)
- 8EC4V
- 10LAP4
- 10L5V

These precleaners are compatible with Vernon transducers:

- Alkazyme
- Klenzyme

This low-level disinfectant is compatible with Vernon transducers:

- Salvantos ph10

Precleaners and Low-Level Disinfectants for Other Transducers

The following precleaners and low-level disinfectants have been tested and found to be compatible with the Terason transducers from manufacturers other than Vernon (Thales and Sound, transducers not listed above), except for the 8EC4 transducer.

For the 8EC4 transducer, the following precleaners, except for Asphene 381 Spray, are compatible. The use of low-level disinfectants is not applicable to the 8EC4 transducer.

A list of recommended low-level disinfectants follows.

Recommended Low-Level Disinfectants

Ascend	Hi-Tor Plus	Rivascope
Asphene 381	Medallion	Salvantos ph10
Engarde	PH7Q Ultra	SaniZide Plus
Exidene 4	Quat-Stat	Sekusept

A list of recommended precleaners follows.

Recommended Precleaners

Alkazyme	Incidine	RBS-50
Alydiol Spray 40	Instruzyne	Sani-Cloth

Ampholysine Plus	Kleen-Aseptic	SaniZide
Asepti-Wipe	Klenzyme	Savogerm
Asphene 381 Spray*	M-Ytidesinfektion	Sekulyse
Cidalkan	Manu-Klenz	Sekupoudre
Endozime	Medi-Prep	T-Spray
Enzol	Metrispray	T-SprayII
Erinox	Metrizyme	TheraCide
Esculase	Neodiol+	Transeptic
Firstsinald	Orthozime	WEX-CIDE
Hexanious G+R	Preven's D51	

* Not for use with the 8EC4 endocavity transducer.

High-Level Disinfectants

The following high-level disinfectants have been tested, found to be compatible with the Terason transducers from Vernon (Image Display tab name ends in a V), and are cleared for use by the United States Food and Drug Administration (FDA):

- Cidex 2%
- Cidex OPA
- Steranios 2%

The following high-level disinfectants have been tested, found to be compatible with the Terason transducers from other manufacturers (Thales and Sound, Image Display tab name does not end in V), and are cleared for use by the United States Food and Drug Administration (FDA).

Recommended High-Level Disinfectants

Cidex	Cidex 7	Cidex OPA
Metricide	Metricide 28	Procide 14 N.S.
Sporicidin	Wavicide-01	

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>

Cleaning and High-Level Disinfection of the 8EC4 and 8B4S Transducers

The 8EC4 transducer and 8B4S biplanar transducer are not delivered sterilized or disinfected, and must be high-level disinfected before initial use and after each subsequent use following the directions given below and working in accordance with standard hospital practice. (For reference, consult “Good Hospital Practice: Handling and Biological Decontamination of Reusable Medical Devices: ANSI/AAMI ST35-1991”, published by the Association for the Advancement of Medical Instrumentation.)



The 8EC4 transducer is not delivered sterilized. High-level disinfection before use is required.



The 8B4S transducer is not delivered sterilized. High-level disinfection before use is required.

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.



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 8EC4 and 8B4S Transducers Above Line



The cable and connector are not waterproof. Do not immerse the cable or allow liquid to contact the connector.

Rinsing and Drying

After pre-cleaning, and prior to high-level disinfection, the transducer must be thoroughly rinsed with high-quality tap water to remove all residue of detergent solution.

After all residue of detergent solution has been removed, “rough dry” the transducer with a soft cloth or towel. Do not use an abrasive sponge.

Use of Liquid Chemical Disinfectant

For disinfection of the 8EC4 or 8B4S transducer using liquid chemicals, follow the procedures as described below. (For reference, consult “Chemical Sterilants and Sterilization Methods—A Guide to Selection and Use: AAMI TIR7-113”, published by the Association for the Advancement of Medical Instrumentation.)

Disinfection of the 8EC4 and 8B4S Transducers

Using one of the high-level disinfecting agents previously listed, follow the manufacturer’s directions for activation and dilution (if any). Immerse the transducer in the activated solution for a period of time as recommended by the agent manufacturer to achieve the level of high-level disinfection as required.

Compatibility of the 8EC4 and 8B4S Transducers with Liquid-Chemical Disinfectants

Terason has confirmed the materials compatibility of the 8EC4 transducer and 8B4S biplanar transducer with all of the disinfectant agents previously listed.



The effectiveness of any disinfectant agent, other than those listed in this guide, must be validated prior to clinical use.

Rinse After Disinfection

Use sterile techniques when removing the transducer from disinfectant solution, and rinse thoroughly with sterile water.

The transducer must be thoroughly rinsed with sterile water to remove all residue of the disinfectant solution.

8EC4 and 8B4S Endocavity Transducer Sheaths

Only sheaths cleared by the US FDA should be used with the Terason 8EC4 and 8B4S transducer. The Civco Medical, Sterile CIV-Flex Non-Latex, Transducer Covers (Model 610-006) are recommended for use with the 8EC4 and 8B4S endocavity transducer.

To obtain additional information on proper handling of any Terason transducer, call 1-866-TERASON (837-2766) or 1-781-270-4143, or check the Web site at <http://www.terason.com>.

Biocompatibility

The materials used for the Terason transducers that come into patient contact have been subjected to biocompatibility testing (per ISO 10993-1) and are acceptable for contact with intact skin.

Cleaning and High-Level Disinfection of the 8IOL4 Transducer

The 8IOL4 transducer is not delivered sterilized or disinfected, and must be high-level disinfected before initial use and after each subsequent use following the directions given below and working in accordance with standard hospital practice. (For reference, consult “Good Hospital Practice: Handling and Biological Decontamination of Reusable Medical Devices: ANSI/AAMI ST35-1991”, published by the Association for the Advancement of Medical Instrumentation.)



The 8IOL4 transducer is not delivered sterilized. High-level disinfection before use is required.

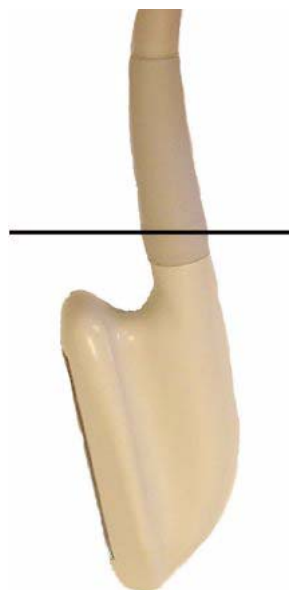
Pre-Cleaning

Immerse the transducer in an enzymatic antiseptic detergent solution, using one of the precleaners previously listed (Alkazyme or Klenzyme).

Soak the transducer in the enzymatic detergent for at least 30 minutes to remove all visible soil and dried protein.



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 8IOL4 Transducers Above Line**

The cable and connector are not waterproof. Do not immerse the cable or allow liquid to contact the connector.

Rinsing and Drying

After pre-cleaning, and prior to high-level disinfection, the transducer must be thoroughly rinsed with high-quality tap water to remove all residue of detergent solution.

After all residue of detergent solution has been removed, “rough dry” the transducer with a soft cloth or towel. Do not use an abrasive sponge.

Use of Liquid Chemical Disinfectant

For disinfection of the 8IOL4 transducer using liquid chemicals, follow the procedures as described below. (For reference, consult “Chemical Sterilants and Sterilization Methods—A Guide to Selection and Use: AAMI TIR7-113”, published by the Association for the Advancement of Medical Instrumentation.)

Disinfection of the 8IOL4 Transducer

Using one of the high-level disinfecting agents previously listed (Cidex 2%, Cidex OPA, or Steranios 2%), follow the manufacturer’s directions for activation and dilution (if any). Immerse the transducer in the activated solution for a period of time as recommended by the agent manufacturer to achieve the level of high-level disinfection as required.

Compatibility of the 8IOL4 Transducer with Liquid-Chemical Disinfectants

Terason has confirmed the materials compatibility of the 8IOL4 transducer with all of the disinfectant agents previously listed.



The effectiveness of any disinfectant agent, other than those listed in this guide, must be validated prior to clinical use.

Rinse After Disinfection

Use sterile techniques when removing the transducer from disinfectant solution, and rinse thoroughly with sterile water.

The transducer must be thoroughly rinsed with sterile water to remove all residue of the disinfectant solution.

8IOL4 Transducer Sheaths

Only sheaths cleared by the US FDA should be used with the Terason 8IOL4 transducer. The Civco Medical, Niggard Surgi-Tip Intraoperative Covers (Model 610-833) are recommended for use with the 8IOL4 transducer.

To obtain additional information on proper handling of any Terason transducer, call 1-866-TERASON (837-2766) or 1-781-270-4143, or check the Web site at <http://www.terason.com>.

Biocompatibility

The materials used for the Terason transducers that come into patient contact have been subjected to biocompatibility testing (per ISO 10993-1) and are acceptable for contact with intact skin.

Cleaning and High-Level Disinfection the 10LAP4 Transducer

The 10LAP4 transducer is not delivered sterilized or disinfected, and must be high-level disinfected before initial use and after each subsequent use following the directions given below and working in accordance with standard hospital practice. (For reference, consult “Good Hospital Practice: Handling and Biological Decontamination of Reusable Medical Devices: ANSI/AAMI ST35-1991”, published by the Association for the Advancement of Medical Instrumentation.)



The 10LAP4 transducer is not delivered sterilized. High-level disinfection before use is required.

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.



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 10LAP4 Transducers Above Line



The cable and connector are not waterproof. Do not immerse the cable or allow liquid to contact the connector.

Rinsing and Drying

After pre-cleaning, and prior to high-level disinfection, the transducer must be thoroughly rinsed with high-quality tap water to remove all residue of detergent solution.

After all residue of detergent solution has been removed, “rough dry” the transducer with a soft cloth or towel. Do not use an abrasive sponge.

Use of Liquid Chemical Disinfectant

For disinfection of the 10LAP4 transducers using liquid chemicals, follow the procedures as described below. (For reference, consult “Chemical Sterilants and Sterilization Methods—A Guide to Selection and Use: AAMI TIR7-113”, published by the Association for the Advancement of Medical Instrumentation.)

Disinfection of the 10LAP4 Transducers

Using one of the high-level disinfecting agents previously listed (Cidex 2%, Cidex OPA, or Steranios 2%), follow the manufacturer's directions for activation and dilution (if any). Immerse the transducer in the activated solution for a period of time as recommended by the agent manufacturer to achieve the level of high-level disinfection as required.

Compatibility of the 10LAP4 Transducer with Liquid-Chemical Disinfectants

Terason has confirmed the materials compatibility of the 10LAP4 biplanar transducer with all of the disinfectant agents previously listed.



The effectiveness of any disinfectant agent, other than those listed in this guide, must be validated prior to clinical use.

10LAP Laparoscopic Covers

Only covers cleared by the US FDA should be used with the Terason 10LAP4 transducer. The Civco laparoscopic cover (Model 610-658) is recommended for use with the 10LAP4 transducer.

To obtain additional information on proper handling of any Terason transducer, call 1-866-TERASON (837-2766) or 1-781-270-4143, or check the Web site at <http://www.terason.com>.

Rinse After Disinfection

Use sterile techniques when removing the transducer from disinfectant solution, and rinse thoroughly with sterile water.

The transducer must be thoroughly rinsed with sterile water to remove all residue of the disinfectant solution.

Biocompatibility

The materials used for the Terason transducers that come into patient contact have been subjected to biocompatibility testing (per ISO 10993-1) and are acceptable for contact with intact skin.

Cleaning and High-Level Disinfection of the 10V5 Transducer

The 10V5 transducer is not delivered sterilized or disinfected, but must be high-level disinfected before initial use, and after each subsequent use in a sterile environment, following the directions given below and working in accordance with standard hospital practice. (For reference, consult "Good Hospital Practice: Handling and Biological Decontamination of Reusable Medical Devices: ANSI/AAMI ST35-1991", published by the Association for the Advancement of Medical Instrumentation.)

Use of the 10V5 transducer in a surgical application is considered a critical use, and a sterile, pyrogen-free sheath is required over the transducer. When using the 10V5 probe in a neurosurgical application on patients with Creutzfeld-Jacob disease, additional care must be taken to ensure the transducer is not contaminated. If the sheath breaks when in use on patients with Creutzfeld-Jacob disease, then the 10V5 transducer must be destroyed.



The 10V5 transducer is not delivered sterilized. High-level disinfect before use as required. The precleaners listed in “Precleaners and Low-Level Disinfectants for Vernon Transducers” on page 249 are compatible with the 10V5 transducer. Currently, the 10V5 transducer has not been qualified for use with automatic washers or under conditions achieving sterilization.



Use of the 10V5 transducer in a critical application (i.e., in an environment where the device contacts blood, compromised tissue, or is used in a sterile field) requires the use of a sterile, pyrogen-free sheath over the transducer. These intraoperative probe drapes can be obtained from Microtek Medical Co. (www.microtekmed.com). The PC3787 intraoperative probe drape is recommended for use with the 10V5 transducer.



If the pyrogen-free sheath breaks when using the 10V5 transducer in a neurosurgical application on patients with Creutzfeld-Jacobs disease, then the transducer must be destroyed.

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.



The 10V5 transducer 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 10V5 Transducer Above Line



The cable and connector are not waterproof. Do not immerse the cable or allow liquid to contact the connector.

Rinsing and Drying

After pre-cleaning, and prior to high-level disinfection, the transducer must be thoroughly rinsed with high-quality tap water to remove all residue of detergent solution.

After all residue of detergent solution has been removed, “rough dry” the transducer with a soft cloth or towel. Do not use an abrasive sponge.

Use of Liquid Chemical Disinfection

For disinfection of the 10V5 transducer using liquid chemicals, follow the procedures as described below. (For reference, consult “Chemical Sterilants and Sterilization Methods—A Guide to Selection and Use: AAMI TIR7-113”, published by the Association for the Advancement of Medical Instrumentation.)



When the 10V5 transducer is used in a neurological application, note that the residue of liquid chemical disinfectants left on the transducer is neurotoxic. Therefore, in such an application, the 10V5 transducer should be used with a pyrogen-free sheath to avoid contact of the probe with brain tissue.

Disinfection of the 10V5 Transducer

Using one of the high-level disinfecting agents previously listed, follow the manufacturer’s directions for activation and dilution (if any). Immerse the transducer in the activated solution for a period of time as recommended by the agent manufacturer to achieve the level of high-level disinfection as required.

Compatibility of the 10V5 Transducer with Liquid-Chemical Disinfectants

Terason has confirmed the materials compatibility of the 10V5 transducer with all of the disinfectant agents previously listed.



The effectiveness of any disinfectant agent, other than those listed in this guide, must be validated prior to clinical use.



When the 10V5 transducer is used in a neurological application, note that the residue of liquid chemical disinfectants left on the transducer is neurotoxic. Therefore, in such an application, the 10V5 transducer should be used with a pyrogen-free sheath to avoid contact of the probe with brain tissue.

Rinse After Disinfecting

Use sterile techniques when removing the transducer from the disinfectant solution, and rinse thoroughly with sterile water.

The transducer must be thoroughly rinsed with sterile water to remove all residue of the disinfectant solution.

10V5 Sheaths for Critical Applications

Only sheaths cleared by the US FDA should be used with the Terason 10V5 transducer. These sheaths must be pyrogen-free. These intraoperative probe drapes can be obtained from Microtek Medical Co. (www.microtekmed.com). The PC3787 Intraoperative Probe Drape is recommended for use with the 10V5 transducer.

To obtain additional information on proper handling of any Terason transducer, call 1-866-TERASON (837-2766) or 1-781-270-4143, or check the Web site at <http://www.terason.com>.

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 for signs of damage:

- 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 this action may cause crystal aging and loss of sensitivity.

In environments between -25° and 60°C, the Terason Ultrasound System must be stored in the original shipping container.

Equipment List

The Terason Ultrasound System is shipped with the following hardware:

- Terason 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
- One or more Transducers:
 - 4C2 Convex-Linear Transducer
 - 4V2 Phased Array Transducer
 - 7L3 Linear Array Transducer
 - 8B4S Biplanar Endocavity Transducer
 - 8EC4 Convex-Linear Endocavity Transducer
 - 8IOL4 Linear Array Transducer
 - 8MC4Tightly-Curved Array Transducer
 - 10L5 Linear Array Transducer
 - 10LAP4 Linear Array Transducer
 - 10V5 Phased Array Transducer

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 need to be familiar with:

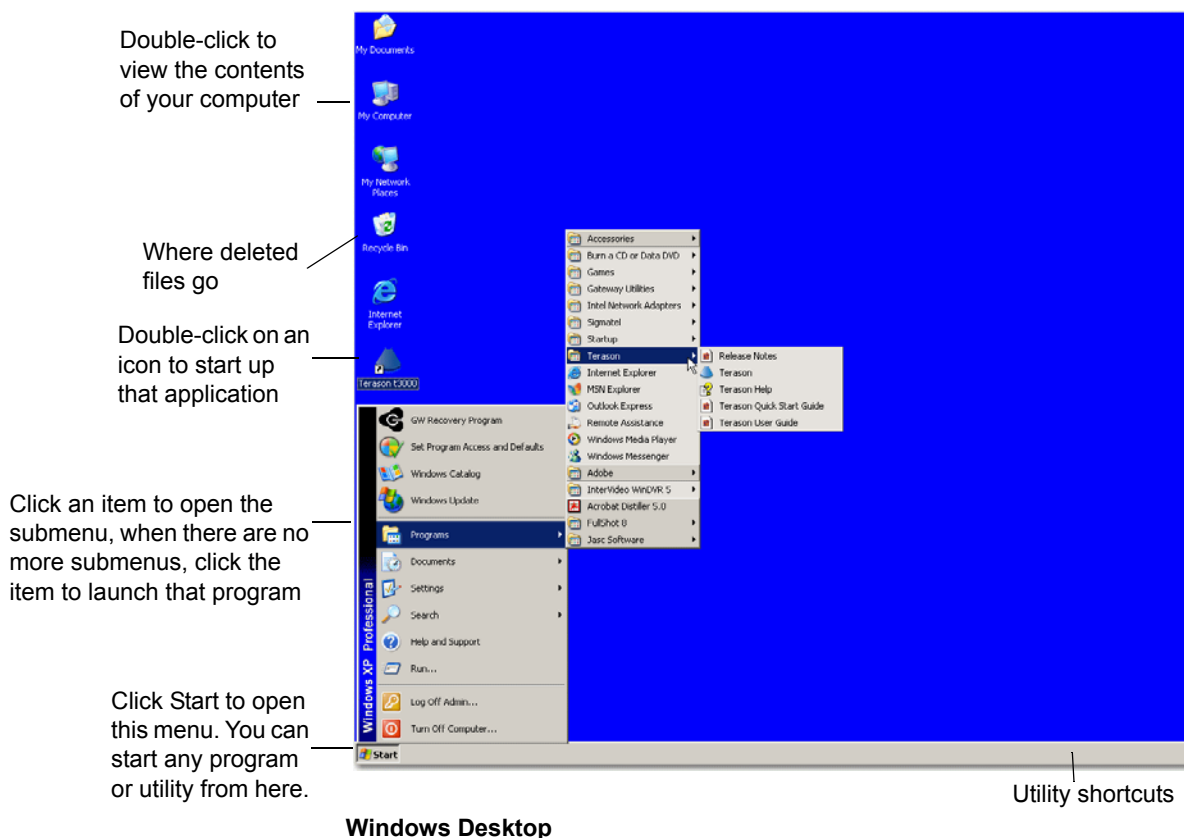
- Windows desktop
- Application window
- Windows terminology
- Touchpad or 2-button mouse
- Starting and exiting programs
- Resizing windows
- Moving windows
- Floating windows and toolbars

The examples use the Terason software, but the concepts apply to all programs that run on the 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.

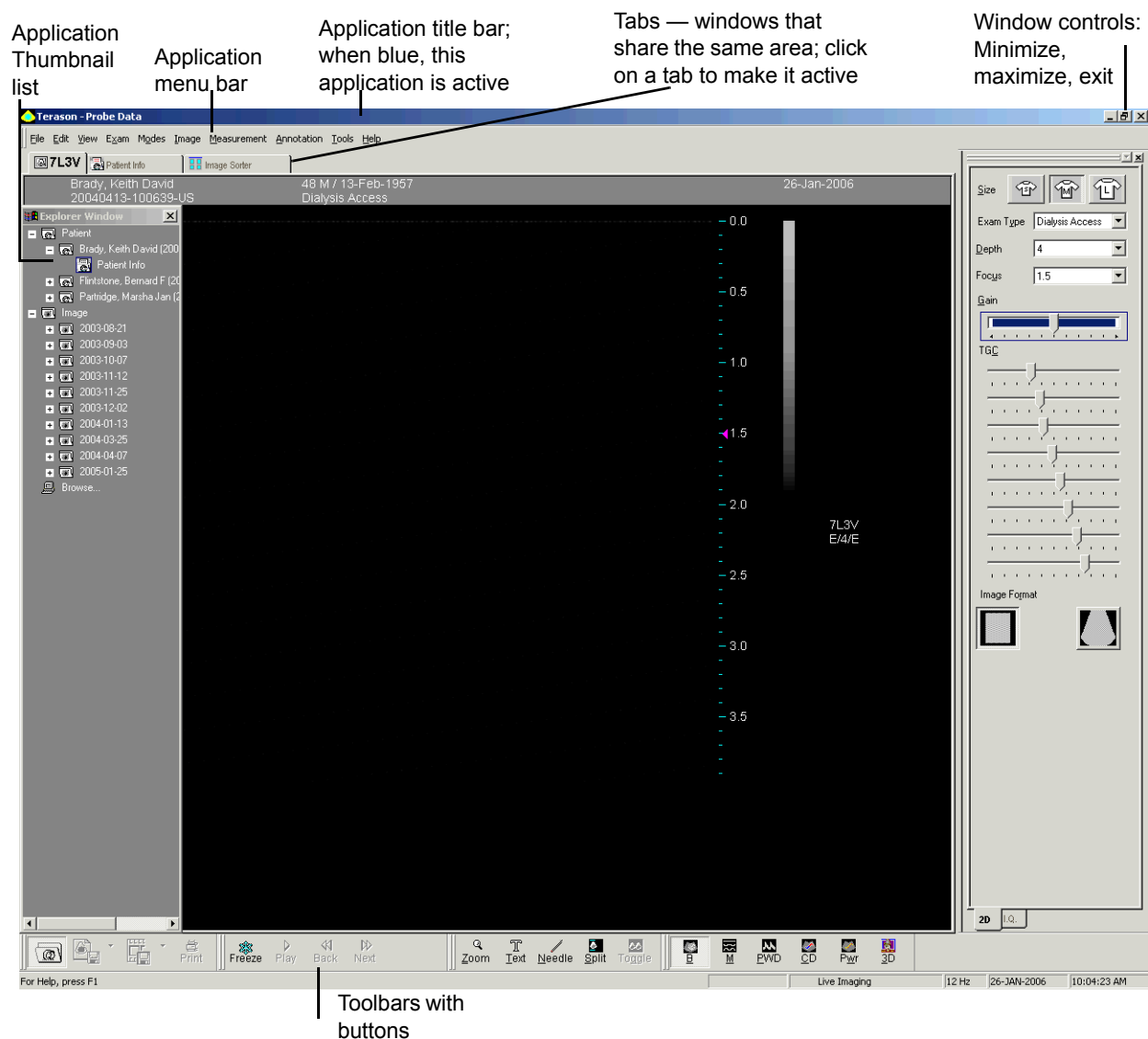
The Windows Desktop

This figure 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. This figure shows the Terason application window:



Application Window - Terason Ultrasound System

Windows Terms

This table provides the definitions of several terms used to describe objects within Windows:

Windows Terminology

Term	Definition
Button	An item that you can click to execute a function. For example, the Print button will print a file; the PWD button starts Pulsed Wave Doppler scan mode.
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 screen in Windows where you put things you want to use. The desktop can hold files, shortcuts to programs, 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: and that's the function of the directory. Just like the file folders in your desk drawer, a folder contains any number of files. Files could be data documents or applications.
Drop-down list	It looks like a text box followed by a down arrow. When you click the down arrow, a list of choices shows beneath the text box. Click on any of the items, and the software puts your choice in the text box. Drop-down lists provide a quick method for entering text, and make sure you only enter text appropriate at that location.
Hot Key	Shortcuts that let you use the keyboard instead of the mouse to select a menu or button. For example, if you type Alt-F, Windows opens the File menu. In a menu or button name, the hot key is underlined. Sometimes, you only see the hot key after pressing the Alt key.
Icon	A small picture that represents a file, program, network connection, or anything else. 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 take up all the space on the desktop.
Menu	A list of functions from which you select what you want to do or use. For example, you can select to 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 shows the individual menu categories. Most applications have a File menu (to open, save, print files), and 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.

Term	Definition
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 on the button.
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 has an 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 on a tab, Windows brings 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 look at 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	Also called fields, text boxes let you type information that the program will use.
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 pictorial 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 beneath it. The laptop, or if the Terason software is installed on a desktop computer, may also be set up to use 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 list 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 on the **View** menu in the menu bar, slide down the list to **Image Display Properties**, then slide to the right and click on **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 these terms in procedures:

Click	Gently tap the touchpad or press and release the left button on the mouse or touchpad
Double-click	Gently tap the touchpad twice or press the left button twice in quick succession
Right-click	Press and release the right button on the mouse or touchpad
Drag	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 any of these methods to start an application:

- Start button
- Desktop shortcut

You can use any 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 from the Start button:

1. Click (left mouse button) on the Start button at the bottom, left of the window. A list of options opens.
2. Slide up the list to Programs. A list of software programs installed on the computer pops out to the right.
3. Slide to the right, then up or down the list until you find the one you need. Windows highlights that item, and if it has more choices for that application, pops out another list of items.
4. Click on the application. Windows starts up that application.

Starting from the Desktop:

When installed, most applications place a shortcut on the computer desktop. To start the application, all you have to do is double-click its icon on the desktop.


Exiting Using the File menu:

When finished using an application, you can exit from it. You need to exit from applications before you can turn off the computer. To exit an application, follow these steps:

1. Click the **File** menu.
2. Highlight the **Exit** item.
3. Click.

The application closes, or, if you have not saved what you were working on, the application displays a message prompting you to save your work. You can choose whether or not you want to save it.

Exiting Using the Close Button

Every application window in Windows has  in the upper right corner. Clicking this button is the same as selecting the Exit item from 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).



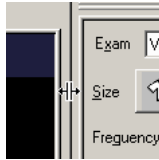
Returns the window to the size that it was before you maximized it.



Exits the Terason program. Be sure to save any images that you want to keep before you click this button.

When an application contains more than one window, you can usually resize the windows to enlarge or reduce the area used for adjacent windows. Enlarging the size of one window usually reduces the size of

another window. For example, to make the Terason Explorer window more narrow, place your cursor between the two windows and watch for the cursor to change shape as shown in the figure below, click, and drag the window border to a new position.



Resizing Parts of the Window

Moving Windows and Toolbars

You can rearrange where windows and toolbars appear within the Terason window. For example, if you want to move the Terason Explorer window to the far right, you can do that. Or maybe you want the Tools toolbar to be underneath the Playback toolbar.

Notice that each window and toolbar has a set of double lines along one edge. If you click on 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
- Menus on the menu bar
- Shortcut menus when right-click in different areas of the Terason window
- Toolbar functions

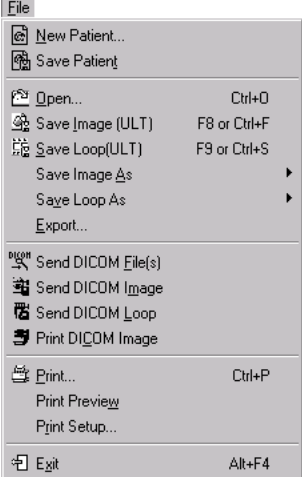
Shortcut Keys

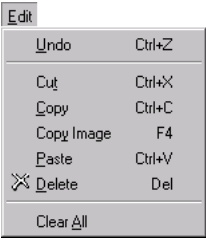
The Terason software has mapped the keyboard function keys (F1 to F12) and several other keys to specific functions, as listed in this table.

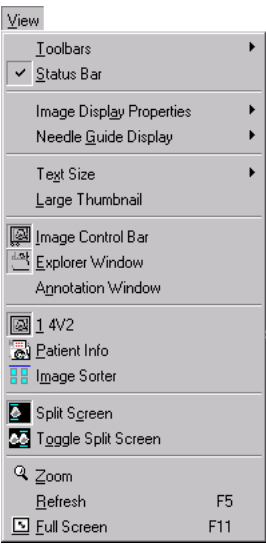
Key	Description	Key	Description
Space	Freeze/Live image (toggles)	B	Start scanning in B-Mode
F1	Open Terason online help	M	Start scanning in M-Mode
F2	Freeze imaging	P	Start scanning in Pulsed Wave Doppler mode
F3	Live imaging	C	Start scanning in Color Doppler mode
F4	Copy Image	D	Start scanning in Directional Power Doppler mode
F5	Refresh	W	Start scanning in Power Doppler mode
F8	Save Image	G	Toggle split screen
F9	Save Loop	S	Enter Split screen mode
F11	Full Screen/Exit Full Screen	T	Text
Alt + F4	Exit	Z	Enter or exit Zoom mode
PrtScrn	Print Screen	N	Show Needle Guides
.	(Period) Select region of interest to move; select scan line in M-Mode	/	(Slash) Select steering angle
..	(Two periods) Select region of interest to resize	//	(Two slashes) Select PWD correction angle
Esc	Exit Full Screen Mode; Delete unfinished measurement		

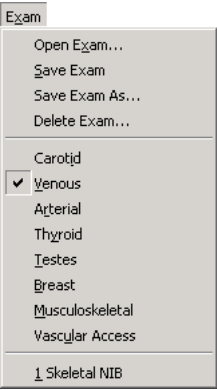

Menu Reference


For each menu item, the table provides a brief description, and the location where more information about that menu item can be found.

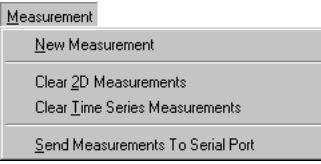
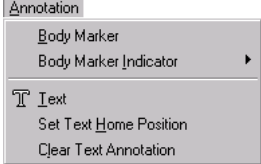
Menu	Menu Item	Description	Where Described in Guide
	New Patient	Clears the current patient info in the Patient Info tab	"Adding a New Human Patient" on page 80
	Save Patient	Saves any changes made to the patient info in the Patient Info tab	"Adding a New Human Patient" on page 80
	Open	Opens the Windows File Browser window and you can locate a needed saved image or loop	"Finding Stored Images and Loops" on page 143
	Save Image (ULT)	Saves the displayed frame as a Terason format (ULT) image file	"Saving Images and Loops" on page 141
	Save Loop (ULT)	Saves an image loop as a Terason format loop file	"Saving Images and Loops" on page 141
	Save Image As	Saves an image in a specific file format (select from pop-out menu)	"Saving Images and Loops" on page 141
	Save Loop As	Saves an image loop in a specific file format (select from pop-out menu)	"Saving Images and Loops" on page 141
	Export	Specify a filename, location, and image format when saving an image or loop	"Exporting a File" on page 142
	Send DICOM File(s)	Sends a saved DICOM file to the server	"Sending Files to a DICOM Server" on page 167
	Send DICOM Image	Exports an image to a DICOM server	"Sending Files to a DICOM Server" on page 167
	Send DICOM Loop	Exports an image loop to a DICOM server	"Sending Files to a DICOM Server" on page 167
	Print DICOM Image	Prints to a DICOM printer	"Printing Files to a DICOM Printer" on page 166
	Print	Prints the image(s) in the Image Display window, Image Preview window, or the Image Sorter window	"Printing Images" on page 162
	Print Preview	Views a picture of what the print out will look like when it is printed	"Printing from the Print Preview Window" on page 164
	Print Setup	Configures the default printer options	"Printing Images" on page 162
	Exit	Closes the Terason Ultrasound System application	"Starting/Exiting the Software" on page 53


Menu	Menu Item	Description	Where Described in Guide
	Undo	Undoes the most recent text edit (cut, paste, or delete) or entry in the Patient Info window	"Using the Patient Info Window" on page 80
	Cut	Removes the selected text from its current location and puts it in the clipboard	"Using the Patient Info Window" on page 80
	Copy	Copies the selected text to a clipboard	"Using the Patient Info Window" on page 80
	Copy Image	Copies the image in the Image Display window to the computer's clipboard for pasting it into a different application	"Storing Images and Loops" on page 138
	Paste	At the location of the cursor, inserts the last text cut or copied	"Using the Patient Info Window" on page 80
	Delete	Deletes the selected text in a text box or text on the Image Display window,	"Deleting Text from an Image" on page 71
	Clear All	Deletes text entries and measurements on the Image Display window	"Deleting Text from an Image" on page 71

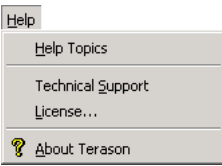
Menu	Menu Item	Description	Where Described in Guide
	Toolbars	Shows or hides any of the Terason toolbars (see “Toolbar Reference” on page 286)	“Hiding Windows and Toolbars” on page 62
	Status Bar	Shows or hides the Status bar	
	Image Display Properties	Shows or hides guides on the Image Display window	“Displaying Additional Guides on the Image Display” on page 63
	Needle Guide Display	Shows or hides needle guide lines (used for biopsies only)	“Selecting the Needle Guide” on page 100
	Text Size	Shows a list of text sizes for Image Display window	“Changing the Text Size” on page 64
	Large Thumbnail	When checked, specifies large thumbnails in the Image Sorter window; when clear, small thumbnails	“Finding Files in the Image Sorter Window” on page 147
	Image Control Bar	Shows or hides the Image Control window (that contains the scan mode tabs)	“Hiding Windows and Toolbars” on page 62
	Terason Explorer	Shows or hides the Terason Explorer window	“Finding Stored Images and Loops” on page 143
	Annotation Window	Shows or hides the Annotation window	“Working with Annotations” on page 66
	Image Display (4V2)	Shows the Image Display window or a loaded file; title is the connected Transducer model; for biplanar or multiple transducers, there will be an item for each transducer	“Hiding Windows and Toolbars” on page 62;
	Patient Info	Shows the Patient Info window	“Hiding Windows and Toolbars” on page 62
	Image Sorter	Shows the Image Sorter window	
	Split Screen	Splits the Image Display window into two screens	“Using Split Screen Mode” on page 65
	Toggle Split Screens	Makes the opposite screen the active screen	“Using Split Screen Mode” on page 65
	Zoom	Enlarges a selected area of the image in the Image Display window	“Zooming in on an Area of the Image” on page 60
	Refresh	Reloads data into the Terason Explorer and Image Sorter windows	“Finding Files in the Image Sorter Window” on page 147
	Full Screen	Enlarges the Image Display window to cover the entire computer’s screen, hiding all other windows and toolbars	

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	"Opening an Exam" on page 200
	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	"Creating Custom Exams" on page 201
	Save Exam As	Saves the current set of Image Control settings to a new Exam type	"Creating Custom Exams" on page 201
	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	"Deleting Exams" on page 202
	Exam Type	Opens the selected exam; lists the Terason-provided exams	"Opening an Exam" on page 200
	# Exam Name	Opens the selected custom exam; lists the custom exams for the connected transducer	
	B-Mode	Activates B-Mode scanning and starts a live image	"B-Mode" on page 22
	M-Mode	Activates M-Mode scanning and starts a live image	"M-Mode (Motion Mode)" on page 23
	Pulsed Wave Doppler	Activates Pulsed Wave Doppler scanning and starts a live image	"Pulsed Wave Doppler" on page 26
	Color Doppler	Activates Color Doppler scanning and starts a live image	"Color Doppler" on page 24
	Directional Power Doppler	Activates Directional Power Doppler scanning and starts a live image	"Directional Power Doppler" on page 25
	Power Doppler	Activates Power Doppler scanning and starts a live image	"Power Doppler" on page 23
	3D	Launches the Sonocubic application; only active if Sonocubic is installed	"Launching Sonocubic 3-D Imaging Software" on page 76

Menu	Menu Item	Description	Where Described in Guide
	Freeze/Live	Live if the Image Display window is frozen; Freeze if the Image Display window is live: menu chooses the opposite imaging state	"Freezing Images" on page 57
	Play	Play runs through the frames in a loop	"Working with Image Loops" on page 58
	Pause	Halts a playing loop at the current frame	"Working with Image Loops" on page 58
	Back	Moves to the previous frame in a loop	"Working with Image Loops" on page 58
	Next	Moves to the next frame in a loop	"Working with Image Loops" on page 58
	Size	Opens a submenu used for B-Mode to select Small, Medium, or Large	"Adjusting the Size (T-Shirt Buttons)" on page 89
	Depth	Opens a submenu used for B-Mode to set the depth for the scan	"Adjusting the Depth" on page 91
	Focus	Opens a submenu used for B-Mode to set the focus depth for the scan	"Adjusting the Focus" on page 92
	Gain	Opens a submenu used to increase (Up) or decrease (Down) the gain setting by one unit	"Adjusting the Gain" on page 93
	Invert	Opens a submenu used for B-Mode to choose Left/Right or Up/Down inverts	"Inverting Images" on page 96
	Palette	Opens a submenu used for B-Mode to choose a color palette	"Adjusting the Palette" on page 96
	Smoothing	Opens a submenu used for B-Mode to choose a Smoothing algorithm	"Adjusting Smoothing" on page 97
	Persistence	Opens a submenu used for B-Mode to choose a Persistence level	"Adjusting the Persistence" on page 98
	Map	Opens a submenu used for B-Mode to choose an image map	"Adjusting the Image Map" on page 99
	M-Mode Speed	Opens a submenu used to set the speed for the Time Series scan	"Adjusting the Time Line Speed" on page 102
	PWD Speed	Opens a submenu used to set the speed for the Time Series scan	"Adjusting the Time Series Speed" on page 104

Menu	Menu Item	Description	Where Described in Guide
	New Measurement	Initiates a new measurement of the type currently selected in the Measure tab	"Deleting Measurements" on page 197
	Clear 2D Measurements	Deletes all measurements in the 2D image display window	"Deleting Measurements" on page 197
	Clear Time Series Measurements	Deletes all measurements in the Time Series window	"Deleting Measurements" on page 197
	Send Measurements To Serial Port	Transmits OB and GYN measurements to another computer	"Exporting Obstetrical Measurements to the R4 Reporting Package" on page 184
	Body Marker	Opens Annotation window showing the Body Marker tab where you can select a body marker icon	"Adding a Body Marker" on page 73
	Body Marker Indicator	Opens a submenu that lets you choose to display the body marker indicator horizontally or vertically	"Changing the Indicator's Direction" on page 75
	Text	Activates the Text tool and opens the Annotation window showing the Text tab	"Adding Text to an Image" on page 67
	Set Text Home Position	Sets the home position for text at the location where you click after selecting this menu item	"Setting the Text Home Position" on page 69
	Clear Text Annotation	Deletes all text on the Image Display window	"Deleting Text from an Image" on page 71

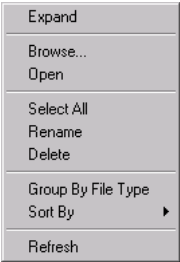
Menu	Menu Item	Description	Where Described in Guide
	Gamma Correction/Display Setup	Should not be needed; provides tool to adjust the display characteristics of the monitor	"Adjusting the Monitor's Gamma Display" on page 204
	Probe Verification Test	Runs several tests on the transducer; only use if instructed to do so by a Terason Technical Service Representative	"Running a Probe Verification Test" on page 207
	Needle Gauge Error Correction	Adjusts the guides for biopsy applications	"Setting the Error Correction" on page 135
	System Logging	Opens a submenu: starts or stops logging system messages to a file; only use when trying to analyze a problem and if instructed by Terason Technical Support	"Creating a Log File" on page 209 "Deleting the Log File" on page 209
	Restore Default Window Layout	Changes the location and visibility (hidden or shown) for all windows and toolbars to the default	"Restoring the Default Layout" on page 210
	Always on Top	Prohibits other Windows applications from obscuring the Terason window	"Keeping the Terason Software on Top" on page 210
	Auto Freeze	Stops sending power to the transducer after the transducer is not in use and the wait time expires	"Setting a Time-Out Value" on page 211
	Set Auto Freeze Wait Time	Sets the wait time for auto freeze	"Setting a Time-Out Value" on page 211
	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	"Adjusting the Color Persistence" on page 119
	Options	Changes the default file format for saving images or image loops; lets you set the display mode of the Time Series Display window for M-Mode and PWD mode	"Setting Image Save and Print Defaults" on page 212 "Changing the Display Mode" on page 103 "Setting the Display Mode" on page 113


Menu	Menu Item	Description	Where Described in Guide
	Help Topics	Opens the Terason Online Help window	"Terason Online Help" on page 19
	Terason Support	Opens a message box with contact information	"Contacting Terason" on page 20
	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)	"Contacting Terason Technical Support" on page 296
	About Terason	Opens a message box that displays the Terason copyright information, and the current version of the software	"Contacting Terason Technical Support" on page 296

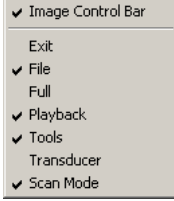
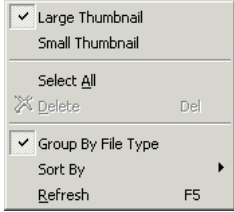
Shortcut Menu Reference

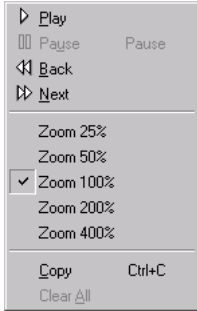
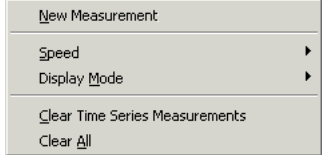
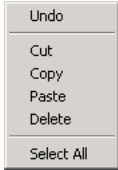
When you right-click on an area in the Terason window, a shortcut menu pops up with items specific to the location or item where you clicked. This table lists the shortcut menus you might see, with a brief description of the available menu items.

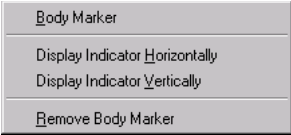

Shortcut Menus

Where Active/Menu	Menu Item	Description	Where Described in Guide
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	"About the Terason Main Window" on page 30
	Browse	Opens the Windows File dialog box. You can use that dialog box to locate a Patient info file or an image file	"Browsing to Find Files" on page 148
	Open	Opens the selected item, either a Patient info file or an image file	"Preparing Patient Info for an Exam" on page 85 "Finding Stored Images and Loops" on page 143
	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	"Renaming Files" on page 159
	Delete	Permanently deletes the selected image file (does not work with Patient Info files)	"Deleting Files Using the Terason Explorer" on page 160
	Group By File Type	Sort images in folders based on file type	
	Sort by	Sort images in folder based on file name or creation date	
	Refresh	Updates the file listing	"Finding Files in the Terason Explorer" on page 144
	Send DICOM	Available if DICOM is installed. Sends the selected DICOM file to the DICOM server	"Sending Files to a DICOM Server" on page 167

Where Active/Menu	Menu Item	Description	Where Described in Guide
2D Image Display Window: 	New Measurement	Start a measurement of the type currently selected in the 2D Measure tab	"Measuring in the 2D Window" on page 169
	Clear All	Deletes measurement and text entries on the Image Display window	"Deleting Text from an Image" on page 71
	Clear 2D Measurements	Deletes all measurements in the 2D Image Display window	"Deleting Measurements" on page 197
	Clear All Text Annotations	Deletes all text added to the Image Display window	"Deleting Text from an Image" on page 71
	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	"Freezing Images" on page 57
	Play	If the Image Display window contains a frozen loop or a saved loop, runs through the frames in the loop	"Working with Image Loops" on page 58
	Set PWD Gate	Locks the cursor position and switches to the PWD scan mode	"Adjusting the Sample Volume (SV) Size and Depth" on page 109
	Text	Activates the Text tool; you can click in the Image Display window and type any needed text	"Typing Text on an Image" on page 70
	Save Image (ULT)	Saves the displayed frame as an image file in the Terason file format	"Saving Images and Loops" on page 141
	Save Loop (ULT)	Saves an image loop in the Terason file format	"Saving Images and Loops" on page 141
	Export	Specifies a filename, location, and image format when saving an image or loop	"Exporting a File" on page 142

Where Active/Menu	Menu Item	Description	Where Described in Guide
Image Control window, toolbars, or menu bar: 	Terason Explorer	Shows or hides the Terason Explorer window	“Hiding Windows and Toolbars” on page 62
	Image Control Bar	Shows or hides the Image Control window	
	Exit	Shows or hides the Exit button	
	File	Shows or hides the File toolbar	
	Freeze	Shows or hides the Live/Freeze 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	
Image Sorter window: 	Large Thumbnail	Specifies large thumbnails in the Image Sorter window	“Finding Files in the Image Sorter Window” on page 147
	Small Thumbnail	Specifies small thumbnails in the Image Sorter window	
	Select All	Selects all images shown in the Image Sorter window	
	Delete	Deletes the selected thumbnail from the Image Sorter window; does not delete the actual file	
	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	












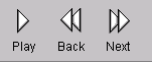




Where Active/Menu	Menu Item	Description	Where Described in Guide
Image Display window when viewing a saved non-ULT file: 	Play	Plays the AVI or DICOM loop	“Working with Image Loops” on page 58
	Pause	Halts the AVI or DICOM loop	
	Previous	Moves to the previous frame in the AVI or DICOM loop	
	Next	Moves to the next frame in the AVI or DICOM loop	“Finding Files in the Terason Explorer” on page 144
	Zoom values	Enlarges or reduces the image based on the selected zoom percentage value	
	Copy	Copies the image to the system clipboard (makes it available to paste into another application file)	
	Clear All	Not Used	
Time Series window 	New Measurement	Starts a new measurement of the type currently selected in the Measure tab	“Deleting Measurements” on page 197
	Speed	Opens a submenu where you can select the sweep speed for an M-Mode or PWD scan	“Adjusting the Time Line Speed” on page 102
	Display Mode	Opens a submenu where you can select the type of Time Series Display scan for M-Mode or PWD mode	“Changing the Display Mode” on page 103
	Clear Time Series Measurements	Deletes all measurements in the B-Mode and Time Series windows	“Deleting Measurements” on page 197
	Clear All	Deletes all text and measurements from the B-mode and Time Series windows	“Deleting Measurements” on page 197
Patient Info fields: 	Undo	Undoes the most recent text edit (cut, paste, or delete) or entry in the Patient Info window	“Using the Patient Info Window” on page 80
	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	“Deleting Text from an Image” on page 71
	Select All	Highlights all text in the field where you placed the cursor	N/A

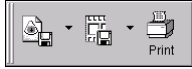






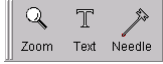









Where Active/Menu	Menu Item	Description	Where Described in Guide
Body Marker: 	Body Marker	Show Annotation window with Body Marker tab visible	"Adding a Body Marker" on page 73
	Display Indicator Horizontally	Show the pink indicator horizontally	"Changing the Indicator's Direction" on page 75
	Display Indicator Vertically	Show the pink indicator vertically	
	Remove Body Marker	Removes the body marker icon	"Removing the Body Marker" on page 75
Text in 2D window: 	New Text	Add a new line for typing text beneath the current line	"Editing Text" on page 71
	Delete Text	Delete the highlighted text	"Deleting Text from an Image" on page 71
	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)	"Placing Arrows on the Image" on page 69

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
		Brightness: provides a standard two-dimensional display in real time.
		Motion: displays motion along a line depicted in the B-Mode image as a function of time.
		Pulsed Wave Doppler: displays a line in the B-Mode 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.
		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.
		Directional 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. The different colors indicate the direction of blood flow. The <u>D</u> irectional Power button is on the Pwr image control window.
		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)
 (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
		Play button (visible when 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 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

Toolbar	Button	Mode Description
		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
		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
		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
		Shut down the Terason software application
		Switch: Start scanning with the next connected transducer, or the other plane of a biplanar transducer
		Enlarge the Image Display window to the full size of the monitor; press F11 to revert

Appendix C Solving Problems

You can resolve many problems with the Terason Ultrasound System yourself. These guidelines will help you determine what the problem is, and how to fix it. Refer to the section for your specific problem:

- Installation problems
- No scan image
- Interference with the scan image
- Printing problems
- Display problems
- VCR/TV problems
- CD problems
- Network problems

If you follow the procedures and the problem persists, contact Terason as described in “Contacting Terason Technical Support” on page 296.

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 used to install the Terason software) with the Microsoft Outlook application. Make sure you exit from all applications before you start installing the Terason software.

Problems with Scanning

If the software does not show a scan image, the problem could be:

- The transducer is not plugged in or was plugged in after the Terason software was started
- The connector for the media bay, 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 59. Use this table to determine how to resolve the problem:

Terason Transducer States

If the Image Status is...	Then...
Simulated Live Imaging	The computer does not sense that the transducer is connected, or the transducer driver has not been installed. Same issue if the status message shows "Simulated" combined with any status
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. All you need to do is click any key on the keyboard or move the mouse and the laptop will send 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 has already been installed so it is likely to be a connection problem.

If the blue bar at the top of the Terason window shows "Terason - Simulated Mode", you need to plug in the transducer when the Terason software is not running. To do so, follow these steps:

1. Quit the Terason software.
2. Plug in the transducer.
3. Restart the Terason software.

Reconnecting the Components


If the problem still exists, usually the cause is that one of the component connections has become loose. You need to unplug all of the components and plug them in again, following these steps:

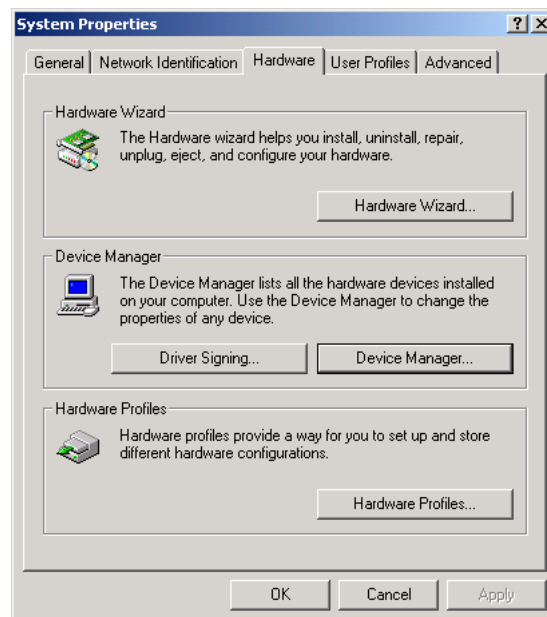
1. Quit the Terason software.
2. Shut down the computer.
3. Unplug the transducer.
4. Unplug the media bay and FireWire cable.
5. Plug in the media bay, make sure it latches.
6. Plug in the FireWire cable.
7. Start the computer.
8. When the hourglass icon is gone, plug in the transducer.
9. Wait 15 seconds.

10. If you see a “Digital Signature not Found” or a “Found New Hardware” message, follow the instructions in “Installing the Terason Transducer (FireWire) Driver” on page 38.
11. If no Digital Signature message displays, start the Terason software.

Determining if the Driver Is Installed

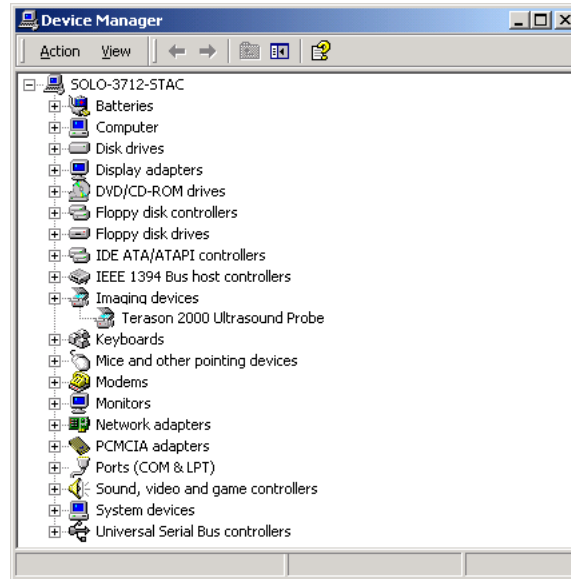
If you still cannot see an image, follow these steps:


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 dialog box 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**

6. Look for an entry named “Imaging devices”, and click the .
7. If you do not see “Terason 2000 Ultrasound Probe”, follow the instructions in “Installing the Terason Transducer (FireWire) Driver” on page 38.
8. If you do 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 or other device that uses electrical power, you may see interference patterns in the scan image.

To resolve this problem, move the transducer/electronics envelope away from all power sources, including the laptop. If the cable from the laptop to the electronics envelope is coiled or looped, the laptop can interfere with the scan. Make sure the electronics envelope 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

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 can not produce good quality output

If the printer is low or out of ink, you may need to change the printer cartridge. If you use the Epson C82 printer, follow the instructions in “Replacing an Ink Cartridge.” If you use a different printer, the user manual should have a similar section that shows you how to change the cartridge.

If you think you need to 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 Using the Full Screen” on page 62 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 will need to connect to the printer using the USB or parallel port on your computer.

If you need to 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/TV to the computer but the VCR/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.

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 the CD 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 still let you start the copying process, however, it 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 150 for guidelines.

Usually, 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 only use 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 do, the Create CD software will let 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 will let you know immediately if there is a problem with the CD.

Network Problems

Terason cannot provide network assistance. You need the assistance of a system administrator at your site to resolve any network issues. The laptop comes with a network card and internal modem, however, the needed network settings (such as IP address) will be 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

Before you call, make sure you have this information on hand:

- Serial number on the transducer/electronics envelope
- Operating system (Windows 2000 or Windows XP)
- Terason software version number
- If available, Sales Order Number
- Name of the organization that purchased the Terason Ultrasound System

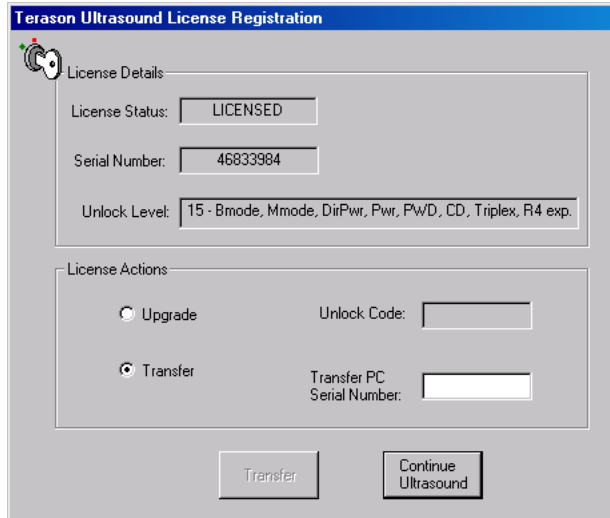
You can find the Terason software version by selecting **Help > About Terason** to open the About Ultrasound message box.



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.

The image shows a Windows-style dialog box titled "Terason Ultrasound License Registration". It has a blue title bar and a gray background. In the top-left corner, there is a small icon of a mouse cursor pointing at a speech bubble. The dialog is divided into two main sections. The first section, "License Details", contains three text boxes: "License Status:" with the value "LICENSED", "Serial Number:" with the value "46833984", and "Unlock Level:" with the value "15 - Bmode, Mmode, DirPwr, Pwr, PwD, CD, Triplex, R4 exp.". The second section, "License Actions", contains two radio buttons: "Upgrade" (which is unselected) and "Transfer" (which is selected). To the right of the "Upgrade" radio button is a text box labeled "Unlock Code:". To the right of the "Transfer" radio button is a text box labeled "Transfer PC Serial Number:". At the bottom of the dialog, there are two buttons: "Transfer" and "Continue Ultrasound".**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)
- 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 182 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
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		

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)
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
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
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

CRL (mm)	Menstrual Age	CRL (mm)	Menstrual Age	CRL (mm)	Menstrual Age
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
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
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
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 Acoustic Output Reporting for Track 3

This appendix contains tables that display the Acoustic Output Reporting for Track 3. Tables are shown for the Pulsed Wave Doppler mode for the following transducers:

- 4C2
- 4C2V
- 4V2
- 7L3
- 8B4S Linear
- 8B4S Curvilinear
- 8IOL4
- 8EC4
- 8MC4
- 10L5S
- 10L5V
- 10LAP4
- 10V5

Acoustic Output Reporting Table for Track 3 for the 4C2 Transducer

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 4C2 Operating Mode: Pulsed Wave Doppler								
Index Label			M I	TIS			TIB	TIC
				scan	non-scan		non-scan	
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	-	-	<1	3.10	(b)
Assoc Acoustic Parameter	p _{r,3}	(MPa)	#					
	W _o	(mW)		-	-		137.4	#
	min of [W _{.3} (Z ₁), I _{TA.3} (Z ₁)]	(mW)				#		
	Z ₁	(cm)				#		
	Z _{bp}	(cm)				#		
	Z _{sp}	(cm)	#				7.42	
	d _{eq} (Z _{sp})	(cm)					0.27	
	f _c	(MHz)	#	-	-	#	2.52	#
	Dim of A _{aprt}	X (cm)		-	-	#	2.65	#
		Y (cm)		-	-	#	1.50	#
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	deq@PII _{max}	(cm)					0.26	
	Focal Length	(cm)		-	-	#		#
	I _{PA.3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1							
	Control 2							
	Control 3							
	Control n							

Notes:

- 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 4C2V Transducer for Pulsed Wave Doppler

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 4C2V Operating Mode: Pulsed Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	-	1.27	(c)	3.15	(b)
Assoc Acoustic Parameter	p _{r,3} (MPa)	#						
	W _o (mW)		-	107.03		106.60	#	
	min of [W _{.3} (Z ₁), I _{TA,3} (Z ₁)] (mW)				#			
	Z ₁ (cm)				#			
	Z _{bp} (cm)				#			
	Z _{sp} (cm)	#				1.60		
	d _{eq} (Z _{sp}) (cm)					0.59		
	f _c (MHz)	#	-	2.50	#	2.50	#	
	Dim of A _{aprt} X (cm)		-	2.86	#	0.70	#	
	Y (cm)		-	1.20	#	1.20	#	
Other Information	PD (μsec)	#						
	PRF (Hz)	#						
	pr@PII _{max} (MPa)	#						
	deq@PII _{max} (cm)					0.47		
	Focal Length (cm)		-	2.5	#		#	
	I _{PA,3} @ MI _{max} (W/cm ²)	#						
Operating Control Conditions	Control 1				X		X	
	Control 2							
	Control 3							
	Control n							

Notes:

- 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 4C2V Transducer for Color Flow

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 4C2V Operating Mode: Color Flow								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	1.33	-	-	(a)	(b)
Assoc Acoustic Parameter	p _{r,3}	(MPa)	#					
	W _o	(mW)		111.22	-		#	#
	min of [W _{.3} (Z ₁), I _{TA.3} (Z ₁)]	(mW)				-		
	Z ₁	(cm)				-		
	Z _{bp}	(cm)				-		
	Z _{sp}	(cm)	#				#	
	d _{eq} (Z _{sp})	(cm)					#	
	f _c	(MHz)	#	2.50	-	-	#	#
	Dim of A _{aprt}	X (cm)		0.70	-	-	#	#
		Y (cm)		1.20	-	-	#	#
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	deq@PII _{max}	(cm)					#	
	Focal Length	(cm)		2.5	-	-		#
	I _{PA.3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1		X					
	Control 2							
	Control 3							
	Control n							

Notes:

- 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 for Pulsed Wave Doppler

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 4V2S Operating Mode: Pulsed Wave Doppler									
Index Label			M I	TIS		TIB	TIC		
				scan	non-scan			non-scan	
					A _{aprt} ≤1	A _{aprt} >1			
Global Maximum Index Value			(a)	-	-	<1.0	3.19	1.88	
Assoc Acoustic Parameter	p _{r.3}	(MPa)	#						
	W _o	(mW)		-	-		137.19	138.93	
	min of [W _{.3} (Z ₁), I _{TA.3} (Z ₁)]		(mW)				#		
	Z ₁		(cm)				#		
	Z _{bp}		(cm)				#		
	Z _{sp}		(cm)	#				5.83	
	d _{eq} (Z _{sp})		(cm)					0.35	
	f _c		(MHz)	#	-	-	#	2.51	2.51
	Dim of A _{aprt}		X (cm)		-	-	#	1.92	1.92
			Y (cm)		-	-	#	1.40	1.40
Other Information	PD	(μsec)	#						
	PRF	(Hz)	#						
	pr@PII _{max}	(MPa)	#						
	deq@PII _{max}	(cm)					0.33		
	Focal Length	(cm)		-	-	#		7.0	
	I _{PA.3} @ MI _{max}	(W/cm ²)	#						
Operating Control Conditions	Control 1						X	X	
	Control 2								
	Control 3								
	Control n								

Notes:

- This index is not required for this operating mode.
- This probe is not intended for transcranial or neonatal cephalic uses.
- 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 for Color Flow

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 4V2S Operating Mode: Color Flow								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	1.22	-	-	(a)	1.92
Assoc Acoustic Parameter	p _{r,3}	(MPa)	#					
	W _o	(mW)		101.80	-		#	142.00
	min of [W _{.3} (Z ₁), I _{TA,3} (Z ₁)]	(mW)				#		
	Z ₁	(cm)				#		
	Z _{bp}	(cm)				#		
	Z _{sp}	(cm)	#				#	
	d _{eq} (Z _{sp})	(cm)					#	
	f _c	(MHz)	#	2.51	-	#	#	2.51
	Dim of A _{aprt}	X (cm)		0.90	-	#	#	1.92
		Y (cm)		1.40	-	#	#	1.40
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	deq@PII _{max}	(cm)					#	
	Focal Length	(cm)		30	-	#		7.0
	I _{PA,3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1							
	Control 2							X
	Control 3							
	Control n							

Notes:

- 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

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 _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	-	2.41	-	3.92	(b)
Assoc Acoustic Parameter	p _{r.3}	(MPa)	#					
	W _o	(mW)		-	155		170	#
	min of [W _{.3} (Z ₁), I _{TA.3} (Z ₁)]	(mW)				-		
	Z ₁	(cm)				-		
	Z _{bp}	(cm)				-		
	Z _{sp}	(cm)	#				3.78	
	d _{eq} (Z _{sp})	(cm)					0.48	
	f _c	(MHz)	#	-	4.00	-	3.99	#
	Dim of A _{aprt}	X (cm)		-	1.29	-	1.50	#
		Y (cm)		-	0.70	-	0.70	#
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	deq@PII _{max}	(cm)					0.29	
	Focal Length	(cm)		-	7.0	-		#
	I _{PA.3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1							
	Control 2							
	Control 3							
	Control n							

Notes:

- 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 8B4S Linear Transducer

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 8B4S Linear Operating Mode: Pulsed Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	-	1.70	-	3.40	(b)
Assoc Acoustic Parameter	p _{r.3}	(MPa)	#					
	W _o	(mW)		-	89.25		89.25	#
	min of [W _{.3} (Z ₁), I _{TA.3} (Z ₁)]	(mW)				-		
	Z ₁	(cm)				-		
	Z _{bp}	(cm)				-		
	Z _{sp}	(cm)	#				1.60	
	d _{eq} (Z _{sp})	(cm)					0.38	
	f _c	(MHz)	#	-	4.00	-	4.00	#
	Dim of A _{aprt}	X (cm)		-	1.81	-	1.81	#
		Y (cm)		-	0.50	-	0.50	#
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@P _{II} max	(MPa)	#					
	deq@P _{II} max	(cm)					0.33	
	Focal Length	(cm)		-	6.5	-		#
	I _{PA.3} @ M _I max	(W/cm ²)	#					
Operating Control Conditions	Control 1							
	Control 2							
	Control 3							
	Control n							

Notes:

- This index is not required for this operating mode.
- This probe is not intended for transcranial or neonatal cephalic uses.
- 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 8B4S Curvilinear Transducer

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 8B4S Curvilinear Operating Mode: Pulsed Wave Doppler									
Index Label			M I	TIS		TIB	TIC		
				scan	non-scan			non-scan	
					A _{aprt} ≤1	A _{aprt} >1			
Global Maximum Index Value			(a)	-	<1	-	2.28	(b)	
Assoc Acoustic Parameter	P _{r.3}	(MPa)	#						
	W _o	(mW)		-	#		46.83	#	
	min of [W _{.3} (Z ₁), I _{TA.3} (Z ₁)]		(mW)				-		
	Z ₁		(cm)				-		
	Z _{bp}		(cm)				-		
	Z _{sp}		(cm)	#				2.02	
	d _{eq} (Z _{sp})		(cm)					0.26	
	f _c		(MHz)	#	-	#	-	4.03	#
	Dim of A _{aprt}		X (cm)		-	#	-	1.22	#
		Y (cm)		-	#	-	0.50	#	
Other Information	PD	(μsec)	#						
	PRF	(Hz)	#						
	pr@PII _{max}	(MPa)	#						
	deq@PII _{max}	(cm)					0.24		
	Focal Length	(cm)		-	-	#		#	
	I _{PA.3} @ MI _{max}	(W/cm ²)	#						
Operating Control Conditions	Control 1								
	Control 2								
	Control 3								
	Control n								

Notes:

- 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 8EC4V Transducer

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 8EC4V Operating Mode: Pulsed Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	-	1.46	-	3.29	(b)
Assoc Acoustic Parameter	p _{r,3}	(MPa)	#					
	W _o	(mW)		-	84.4		86.7	#
	min of [W _{.3} (Z ₁), I _{TA,3} (Z ₁)]		(mW)			-		
	Z ₁	(cm)				-		
	Z _{bp}	(cm)				-		
	Z _{sp}	(cm)	#				2.17	
	d _{eq} (Z _{sp})	(cm)					0.33	
	f _c	(MHz)	#	-	4.03	-	4.02	#
	Dim of A _{aprt}		X (cm)		-	1.30	-	1.50
		Y (cm)		-	0.70	-	0.70	#
Other Information	PD	(µsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	d _{eq} @PII _{max}	(cm)					0.29	
	Focal Length	(cm)		-	6.5	-		#
	I _{PA,3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1							
	Control 2							
	Control 3							
	Control n							

Notes:

- 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 8IOL4 Transducer

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 8IOL4 Operating Mode: Pulsed Wave Doppler								
Index Label			M I	TIS			TIB	TIC
				scan	non-scan		non-scan	
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum IndexValue			(a)	-	1.93	-	2.90	(b)
Assoc Acoustic Parameter	P _{r.3}	(MPa)	#					
	W _o	(mW)		-	100.8		95.9	#
	min of [W _{.3} (Z ₁), I _{TA.3} (Z ₁)]	(mW)				-		
	Z ₁	(cm)				-		
	Z _{bp}	(cm)				-		
	Z _{sp}	(cm)	#				1.58	
	d _{eq} (Z _{sp})	(cm)					0.49	
	f _c	(MHz)	#	-	4.01	-	4.01	#
	Dim of A _{aprt}	X (cm)		-	1.29	-	1.11	#
	Y (cm)		-	0.50	-	0.50	#	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	deq@PII _{max}	(cm)					0.37	
	Focal Length	(cm)		-	6.5	-		#
	I _{PA.3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1							
	Control 2							
	Control 3							
	Control n							

Notes:

- 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 8MC4 Transducer

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 8MC4 Operating Mode: Pulsed Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	-	<1	-	3.06	1.56
Assoc Acoustic Parameter	P _{r,3}	(MPa)	#					
	W _o	(mW)		-	#		93.3	93.3
	min of [W _{.3} (Z ₁), I _{TA,3} (Z ₁)]		(mW)				-	
	Z ₁	(cm)					-	
	Z _{bp}	(cm)					-	
	Z _{sp}	(cm)	#					2.38
	d _{eq} (Z _{sp})	(cm)						0.36
	f _c	(MHz)	#	-	#	-		4.03
	Dim of A _{aprt}		X (cm)		-	#	-	
		Y (cm)		-	#	-		0.70
Other Information	PD	(µsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	d _{eq} @PII _{max}	(cm)						0.30
	Focal Length	(cm)		-	#	-		7.5
	I _{PA,3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1							
	Control 2							
	Control 3							
	Control n							

Notes:

- This index is not required for this operating mode.
- This probe is not intended for transcranial or neonatal cephalic uses.
- 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 10L5S Transducer

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 10L5S Operating Mode: Pulsed Wave Doppler								
Index Label			M I	TIS			TIB	TIC
				scan	non-scan		non-scan	
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum IndexValue			(a)	-	1.05	-	2.28	1.62
Assoc Acoustic Parameter	P _{r,3}	(MPa)	#					
	W _o	(mW)		-	43.7		43.7	43.7
	min of [W _{.3} (Z ₁), I _{TA,3} (Z ₁)]	(mW)				-		
	Z ₁	(cm)				-		
	Z _{bp}	(cm)				-		
	Z _{sp}	(cm)	#				1.20	
	d _{eq} (Z _{sp})	(cm)					0.29	
	f _c	(MHz)	#	-	5.02	-	5.02	5.02
	Dim of A _{aprt}	X (cm)		-	0.90	-	0.90	0.90
	Y (cm)		-	0.40	-	0.40	0.40	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	deq@PII _{max}	(cm)					0.22	
	Focal Length	(cm)		-	4.5	-		4.5
	I _{PA,3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1							
	Control 2							
	Control 3							
	Control n							

Notes:

- 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 10L5V Transducer for Pulsed Wave Doppler

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 10L5V Operating Mode: Pulsed Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	-	1.62	-	2.58	2.01
Assoc Acoustic Parameter	P _{r,3}	(MPa)	#					
	W _o	(mW)		-	67.62		67.31	67.62
	min of [W _{.3(Z1)} , I _{TA,3(Z1)}]	(mW)				-		
	Z ₁	(cm)				-		
	Z _{bp}	(cm)				-		
	Z _{sp}	(cm)	#				1.47	
	d _{eq} (Z _{sp})	(cm)					0.36	
	f _c	(MHz)	#	-	5.01	-	5.01	5.01
	Dim of A _{aprt}	X (cm)		-	1.10	-	1.10	1.10
	Y (cm)		-	0.50	-	0.50	0.50	
Other Information	PD	(µsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	deq@PII _{max}	(cm)					0.24	
	Focal Length	(cm)		-	5.50	-		5.5
	I _{PA,3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1				X		X	X
	Control 2							
	Control 3							
	Control n							

Notes:

- This index is not required for this operating mode.
- This probe is not intended for transcranial or neonatal cephalic uses.
- 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 10L5V Transducer for Color Flow

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 10L5V Operating Mode: Color Flow								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	1.23	-	-	(1)	1.66
Assoc Acoustic Parameter	P _{r,3}	(MPa)	#					
	W _o	(mW)		58.55	0		#	58.55
	min of [W _{.3} (Z ₁), I _{TA,3} (Z ₁)]	(mW)				-		
	Z ₁	(cm)				-		
	Z _{bp}	(cm)				-		
	Z _{sp}	(cm)	#				#	
	d _{eq} (Z _{sp})	(cm)					#	
	f _c	(MHz)	#	-	5.02	-	#	5.02
	Dim of A _{aprt}	X (cm)		-	1.23	-	#	1.23
	Y (cm)		-	0.50	-	#	0.50	
Other Information	PD	(µsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	d _{eq} @PII _{max}	(cm)					#	
	Focal Length	(cm)		2.00	-	-		2.00
	I _{PA,3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1		X					X
	Control 2							
	Control 3							
	Control n							

Notes:

- This index is not required for this operating mode.
- This probe is not intended for transcranial or neonatal cephalic uses.
- 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 10LAP4 Transducer

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model:10LAP4 Operating Mode: Pulsed Wave Doppler								
Index Label			M I	TIS			TIB	TIC
				scan	non-scan		non-scan	
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum IndexValue			(a)	-	<1.0	-	1.52	(b)
Assoc Acoustic Parameter	P _{r.3}	(MPa)	#					
	W _o	(mW)		-	#		21.45	#
	min of [W _{.3} (Z ₁), I _{TA.3} (Z ₁)]	(mW)				-		
	Z ₁	(cm)				-		
	Z _{bp}	(cm)				-		
	Z _{sp}	(cm)	#				1.00	
	d _{eq} (Z _{sp})	(cm)					0.22	
	f _c	(MHz)	#	-	#	-	5.00	#
	Dim of A _{aprt}	X (cm)		-	#	-	0.69	#
	Y (cm)		-	#	-	0.50	#	
Other Information	PD	(μsec)	#					
	PRF	(Hz)	#					
	pr@PII _{max}	(MPa)	#					
	deq@PII _{max}	(cm)					0.19	
	Focal Length	(cm)		-	#	-		#
	I _{PA.3} @ MI _{max}	(W/cm ²)	#					
Operating Control Conditions	Control 1							
	Control 2							
	Control 3							
	Control n							

Notes:

- 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 10V5 Transducer

Acoustic Output Reporting Table for Track 3 (provide data where global maximum displayed index exceeds 1.0) Transducer Model: 10V5 Operating Mode: Pulsed Wave Doppler								
Index Label			M I	TIS		TIB	TIC	
				scan	non-scan			non-scan
					A _{aprt} ≤1	A _{aprt} >1		
Global Maximum Index Value			(a)	-	3.23	-	3.21	3.25
Assoc Acoustic Parameter	P _{r,3}	(MPa)	#					
	W _o	(mW)		-	134.7		134.7	134.7
	min of [W _{.3} (Z ₁), I _{TA,3} (Z ₁)]		(mW)			-		
	Z ₁	(cm)				-		
	Z _{bp}	(cm)				-		
	Z _{sp}	(cm)	#				2.30	
	d _{eq} (Z _{sp})	(cm)					0.84	
	f _c	(MHz)	#	-	5.03	-	5.03	5.03
	Dim of A _{aprt}		X (cm)		-	1.41	-	1.41
		Y (cm)		-	0.60	-	0.60	0.60
Other Information	PD	(µsec)	#					
	PRF	(Hz)	#					
	pr@P _{II} max	(MPa)	#					
	d _{eq} @P _{II} max	(cm)					0.59	
	Focal Length	(cm)		-	8.5	-		8.5
	I _{PA,3} @ M _I max	(W/cm ²)	#					
Operating Control Conditions	Control 1							
	Control 2							
	Control 3							
	Control n							

Notes:

- This index is not required for this operating mode.
- This probe is not intended for transcranial or neonatal cephalic uses.
- 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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