3 Acquiring Images

To support image acquisition, you must understand:

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

Ultrasound Safety

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

> Use diagnostic ultrasound only when there is a good medical reason. Also, the Terason uSmart3200T Ultrasound System does not provide explicit control of acoustic output. Therefore, to minimize the exposure to ultrasound energy, limit the duration of ultrasound examinations.

Acoustic Output Indices

The Terason uSmart3200T Ultrasound System complies with the *Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment* (UD3-98). When the relevant output index is below 1.0, the index value is not displayed.

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

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

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

Infection Control

When performing intraoperative studies or scanning patients with open wounds, you must use a sterile sheath on the probe. See “Infection Control” in the Safety chapter of *Volume 2* of this guide for information on sterile sheaths.

The ultrasound probe should also be cleaned and disinfected between patients. See “Processing Terason Probes Between Uses” in the Maintenance chapter of *Volume 2* of this guide for information on disinfecting probes.

Powering the Ultrasound System On and Off

To power the uSmart3200T Ultrasound System on, press the power button on the top edge of the tablet until the blue power indicator appears at the bottom left corner of the screen. If a probe is connected to the system, the imaging window displays. If no probe is connected, the Patient Information window displays.

To power off the uSmart3200T Ultrasound System, press and hold the same power button on the top edge of the tablet.

Starting and Exiting the Software

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

- Double-tap the Terason shortcut  , on the Windows desktop.
- Select Start > Programs > Terason > Terason.

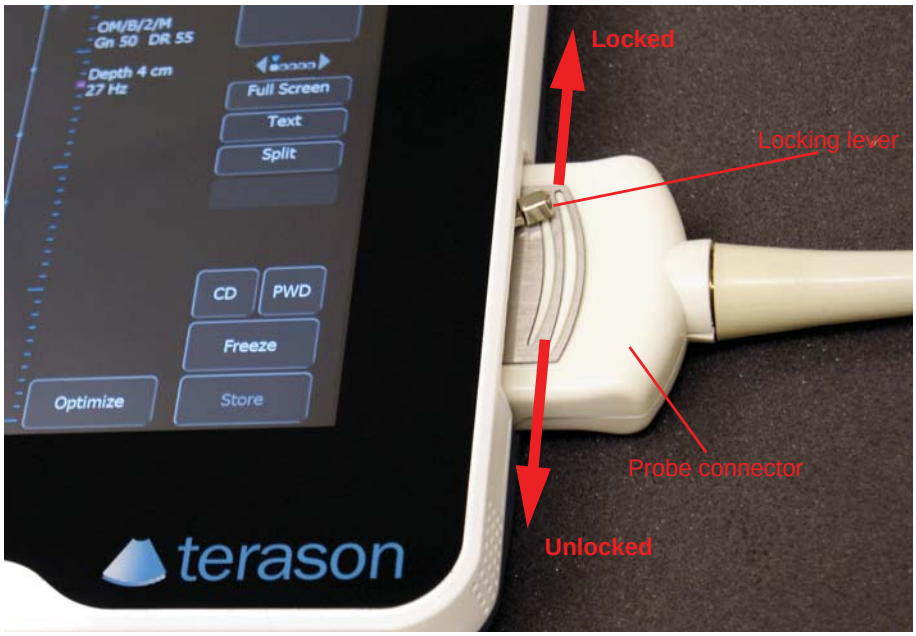
Note: When running a tablet on battery power, always check the amount of power left. To check the battery power status, refer to the charge indicator at the top right of the Terason Ultrasound window (see Status Bar on page 24.) Since the ultrasound engine also uses the tablet battery for power, running the system on the battery discharges the battery more quickly than running the tablet alone would do. Terason recommends that you be prepared to power the system with the AC power adapter.

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

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

Connecting a Probe

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



To connect a probe:

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

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

To disconnect a probe:

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

Switching Probes

The Terason uSmart3200T Ultrasound System lets you change probes without exiting the program.

To switch between probes, complete these steps:

1. If necessary, **save** the active image or image loop. See Saving Images and Loops on page 89 for instructions.
2. Rotate the locking lever to the **unlocked position** and carefully unplug the probe.

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

   The Patient window closes, and the Imaging window opens, showing the new probe in the imaging information display (see Terason Imaging Window on page 23).

Conducting an Ultrasound Exam

To conduct an exam, complete this general procedure:

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

   See Setting Up Patient Information on page 37.
2. Start **live imaging**.
3. Select an **exam type** and preset.

   (See Opening an Exam on page 116.)
4. Select a **scan mode** and adjust image controls.

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

   See Working with Annotations on page 59 and Working With Measurements on page 102.
7. **Save** or print the image.

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

- Conducting a 2D, M-Mode, or Color Doppler Exam on page 52
- Conducting a PWD Exam on page 53
- Conducting an Exam in Triplex Mode on page 53

Using the Imaging Controls

For information on using the controls to set exam parameters, see The Imaging Controls on page 29. For information that is specific to a selected mode, see the section on that mode in Chapter 4 - Working With Scan Modes.

Choosing a Scan Mode

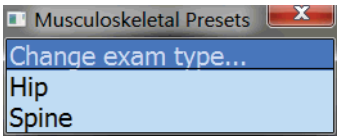
To choose a scan mode, tap the appropriate buttons:

- For 2D, tap the 2D button.
- For M-Mode, tap the 2D button, then tap the M-Mode button.
- For Color Doppler, tap the CD button.
- For Pulsed-Wave Doppler, tap the PWD button.
- For Triplex imaging, tap the CD button, then tap the PWD button

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

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

1. Load or create the **patient information**. See Setting Up Patient Information on page 37 for instructions.
2. Tap the **button** for the required scan mode: See Choosing a Scan Mode on page 52.
3. Tap the **uSmart3200T** name at the top left of the screen.
4. Tap the **Presets** button, then select a preset from the Presets menu.



Presets Menu (example)

The Terason software loads preset image control settings that are optimized for the selected preset and the connected probe. See Chapter 7 - Working With Exams for information about exam types and defining your own presets.

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

5. If necessary, use the image control buttons to adjust the **image controls**.
   - For 2D, See Using the Image Control Buttons on page 68 for instructions.
   - For M-Mode, see Using M-Mode Image Controls on page 74.
   - For Color Doppler scan mode, see Using Color Doppler Image Controls on page 81.
   - For Pulsed-Wave Doppler, see Using Spectral Doppler Image Controls on page 75
6. Tap the **Freeze** button.
7. Add **annotations** as needed See Working with Annotations on page 59.

8. **Save or print** the ultrasound image. See Saving Images and Loops on page 89 and Printing Images on page 98.

Conducting a PWD Exam

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

1. Conduct an **exam** in 2D mode, as described in Conducting an Ultrasound Exam on page 51 (do not freeze the scan).
2. Tap the PWD button.
3. Move the **range gate** to the proper location...
4. Use the **image control buttons** to adjust any image control settings as needed.
5. Tap the **Freeze button**.

   The button controls change to allow printing, measurements, and other functions.
6. Add **annotations** (see Working with Annotations on page 59) as needed.
7. **Save** and/or print the ultrasound image. See Saving Images and Loops on page 89 and Printing Images on page 98.

Conducting an Exam in Triplex Mode

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

1. Conduct an **exam** in Color Doppler mode as described in Conducting an Ultrasound Exam on page 51 (do not freeze the scan).
2. Tap the **PWD** button.

   The software launches Triplex mode.
3. Move the **range gate** to the proper location.
4. Use the buttons to adjust any **image control settings** as needed. See Using Spectral Doppler Image Controls on page 75 for instructions.
5. Tap the **Freeze** button. The control buttons change to allow printing, measurements, and other functions.
6. Add **annotations** (see Working with Annotations on page 59) as needed.
7. **Save or print** the ultrasound image. See Saving Images and Loops on page 89 and Printing Images on page 98.

When you switch to Triplex mode, both the original 2D scan mode and PWD mode are active. This depends on whether the options are set to simultaneous mode. See Updating the Displays on page 81 for more information.

Freezing Images

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

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

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

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

To freeze the displayed image when performing an ultrasound scan, tap the Freeze button. When the scan is frozen, the word Freeze is blue.

To start a new scan, tap the Freeze button.

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

Working with Image Loops

Reviewing an image loop is useful for focusing on images during short segments of a scan session. When you freeze an image, you can drag the frame indicator to review an entire loop, frame by frame, to find a specific frame. You can also do this when viewing a saved loop.Drag until the desired frame is displayed, then tap the Store button.

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

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

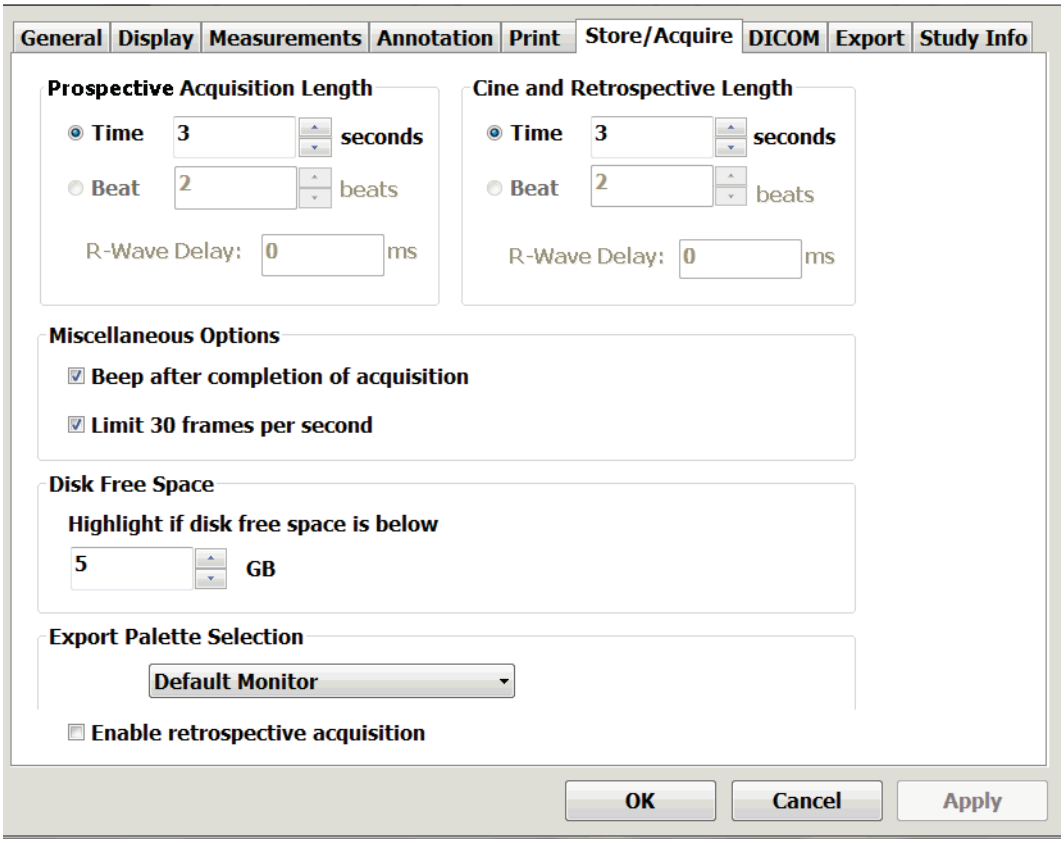
To stop a playing loop, tap the Pause button.

Saving Loops

In 2D and Color modes, the Terason system can acquire loops of a live scan. Loops are acquired prospectively - the acquired loop is of the scan after the Store button is tapped.

Saving Loops

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



Setup Store/Acquire Window

Adjusting the Displayed Image

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

- Enlarging an Area of the Image on page 55
- Resizing the 2D and Time-series Displays on page 56
- Enhancing the Image Using TeraVision™ Optimization on page 57

Enlarging an Area of the Image

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

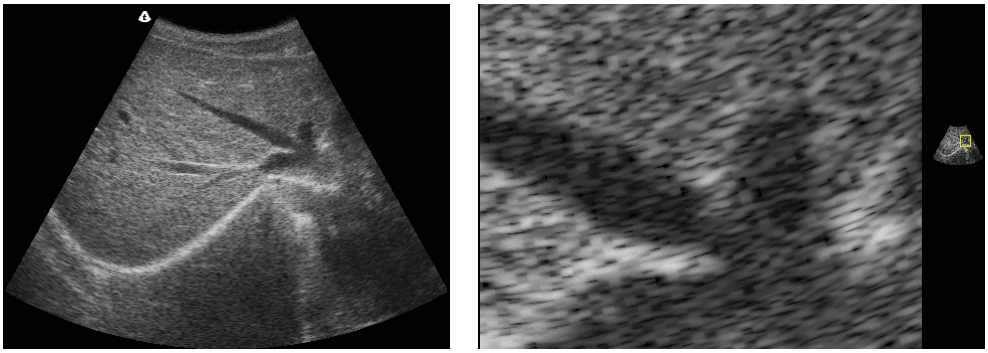
To zoom into the middle of the image, place your thumb and index finger together on the image and spread them apart.

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

1. Tap the **Zoom Off** button.

   The blue word below Zoom on the button shows what zoom function is currently active. The functions are: Box, On, and Off. Repeatedly tapping the button cycles through these functions.

2. Drag the **zoom box** to the area you want large.



Normal Image (Left) and Zoomed Image (Right)

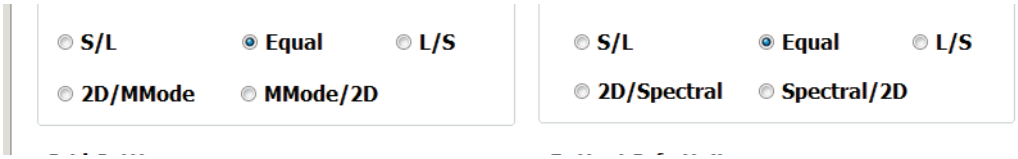
To return to the original image view, use the button to turn Zoom off.

Resizing the 2D and Time-series Displays

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

To resize the scanning displays:

1. Tap the **uSmart3200T** name at the top left of the screen.
2. Tap the **Setup** button.
3. Tap the **Display** tab.



M-Mode and Time-Series Scanning Display Size Options

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

4. Tap **OK** to apply the change.

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

Enhancing the Image Using TeraVision™ Optimization

TeraVision is an optional image-optimization package that sharpens images produced by the Terason uSmart3200T Ultrasound System. TeraVision requires a license. See the *TeraVision Image Enhancement Installation Guide* for instructions on installing the TeraVision software.

The default configuration starts TeraVision when the Terason uSmart3200T Ultrasound System starts. To change this so the Terason system starts with TeraVision off, make a preset with the TV Level button control set to 0.

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

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

To adjust the TeraVision level, when live imaging, tap the left or right side of the TV Level button until the desired level is set.

Adding Guides to the Image Display

The View Options section of the General tab on the Setup window lets you add or remove several guides on the scanned image. These guides provide details about the patient. probe, and image control settings. See Using General Setup Controls on page 130.

Working With Split Screen Mode

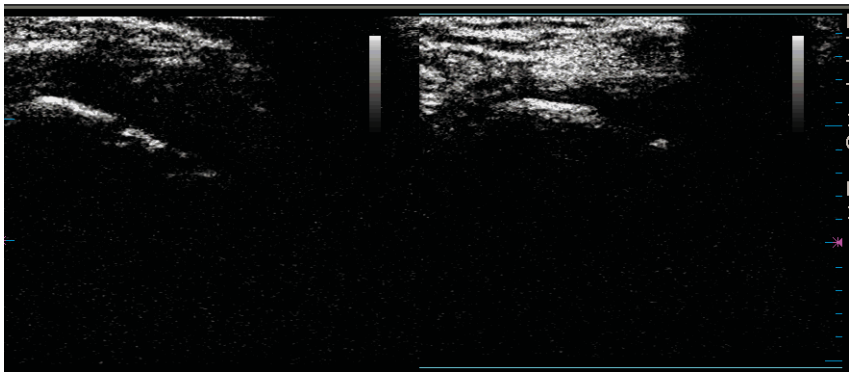
The Terason software lets you split the Imaging screen into two sections to view two current scans for a patient. You can acquire one scan for the patient, select Split Screen, and then acquire another scan from a different angle or location. Split Screen mode works with the 2D scanning modes (2D, Color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

Using Split Screen Mode

To enter split screen mode, tap the Split button.

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

The following figure shows an example of a split screen.



Split Screen

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

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

- Tap the desired screen.
- Tap the Toggle Screen button.

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

- Select a different exam
- Select M-Mode, PWD, or Triplex scan modes
- Tap the Split button

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

Note: If you create a custom exam in Split Screen mode, make sure the active window contains the Image Control settings you want to save before you proceed. When finished saving your custom exam, the Terason software displays a single screen in the Imaging window. See Creating Custom Presets on page 117 for information on saving custom exams.

Saving Split Screen Images and Loops

When you tap the Store button, the software saves both screens as a single image. When you tap the Save Loop button, the software saves the active screen as a loop, and the other screen as a single image.

Working with Annotations

This section explains the following topics:

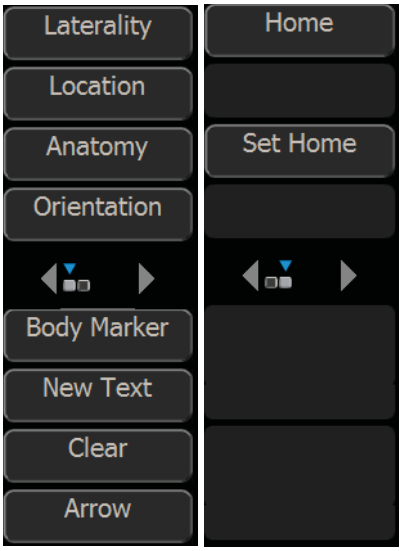
Working with Text

To place text on an image, you must first view the image in the Imaging window. If the image has been saved, retrieve it from the Patient window. See Reviewing Patient Studies on page 90 for instructions.

To work with text annotation, you should understand:

Text Mode

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



Text Mode Buttons

Button controls available in Text mode:

- Laterality places the word Left or Right on the image. Tapping the Laterality button cycles between Left, Right, and no text.
- Location opens a menu of body locations, or increments through a list of body locations. If a menu opens, tap the appropriate item to place it on the image.
- Anatomy opens a menu of names for different anatomies, or increments through a list of anatomies. If a menu opens, tap the appropriate item to place it on the image.
- Orientation opens a menu of patient orientations, or increments through a list of patient orientations. If a menu opens, tap the appropriate item to place it on the image.
- Body Marker opens the Body Marker menu.
- Text New starts a new line of text at the home location.
- Clear deletes all text (including manually typed text and arrows) from the image
- Arrow places an arrow at the text home position, or if there is text on the image, at the middle of the last line of text (see Placing Arrows on the Image on page 64.)
- Home moves the text cursor or selected text to the text home position.
- Set Home sets the text home position. Move the text cursor to the desired location, then tap the Set Home button.

To enter text mode, use one of the following methods:

- Tap the **Text button**.
- Tap any **text-entry field**, then tap the keyboard  button that appears.

The Terason software opens a virtual keyboard and places a text cursor (I-beam) on the Imaging screen. Drag it to where you want the new text, and either type the text, or use one of the Text-mode buttons. When the text is done, tap the Close button on the virtual keyboard.

If you added custom text using the Annotation tab of the Setup window, (see Custom Predefined Text on page 61), that text shows in the button list that it was added to.

Typing Text on an Image

To type text on an image:

1. Tap the **Text button**.

   The keyboard appears, and the buttons change to controls for text and annotations.

2. If necessary, drag the **keyboard** to uncover the text home position.

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

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

4. Type the desired **text** using the onscreen keyboard.

   The text appears in green.

5. Tap the **Freeze** button to add the typed text to the image and exit Text mode.

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

6. Tap the **Close button** on the keyboard.

Predefined Text

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

To place predefined text on the image:

1. Tap the **Text button**.
2. Tap one of the **buttons** for predefined text:
   - Laterality places the word Left or Right on the image. Tapping the Laterality button cycles between Left, Right, and no text.
   - Location opens a menu of body locations, or increments through a list of body locations. If a menu opens, tap the appropriate item to place it on the image.
   - Anatomy opens a menu of names for different anatomies, or increments through a list of anatomies. If a menu opens, tap the appropriate item to place it on the image.
   - Orientation opens a menu of patient orientations, or increments through a list of patient orientations. If a menu opens, tap the appropriate item to place it on the image.

   Selecting an item with one of the buttons places it on the image.
3. When all the desired predefined text is in place, tap the **Imaging window**.

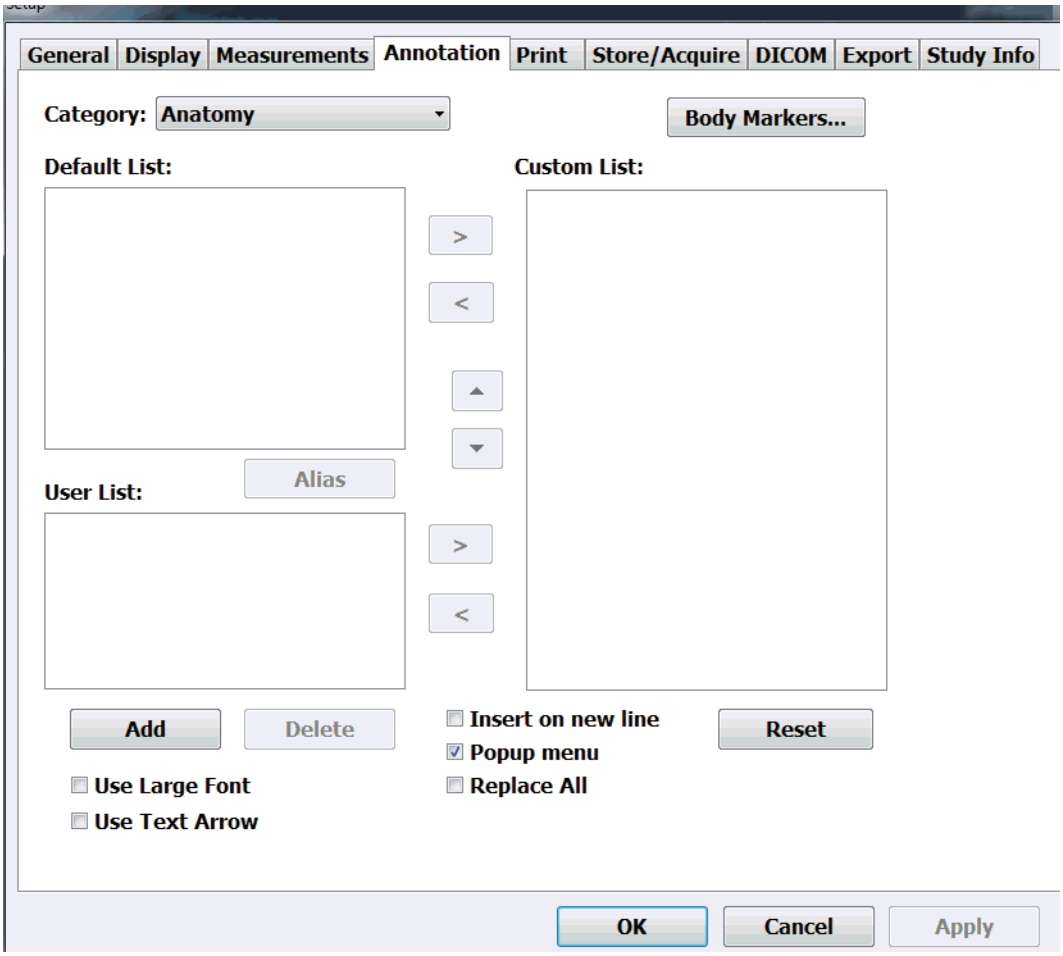
Custom Predefined Text

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

To add custom predefined text to the button lists:

1. Tap the **uSmart3200T** name at the top left corner of the screen.
2. Tap **Setup**.
3. On the Setup window, tap the **Annotation** tab.

   The Setup/Annotation window opens.

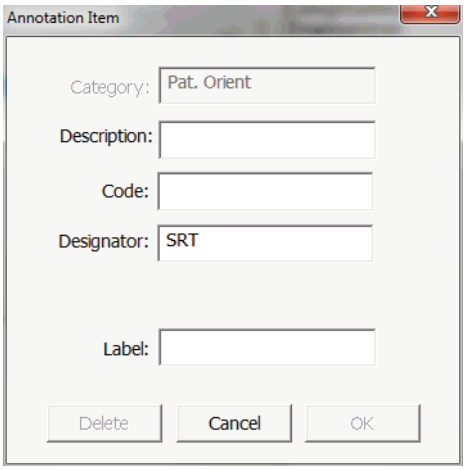


Setup/Annotation Window

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

   a. Tap **Add**

   The Annotation Item window opens.



Annotation Item Window

b. Tap one of the text-entry fields, then tap the **keyboard button**  that appears.

The virtual keyboard appears.

c. In the Label: field, type the **text** you want to have available for the button selected in step 4.

d. Tap **OK**.

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

f. Tap the **right-pointing arrow**.

7. When the lists are configured properly, close the keyboard and tap **OK**.

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

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

Setting the Text Home Position

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

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

To set a text home position, complete these steps:

1. Tap the Text **button** to enter Text mode.

2. Drag the **text cursor** to the desired text home position.

3. Tap Set Home.

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

Placing Arrows on the Image

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

Marker Arrows

Marker arrows are short, hollow arrows that indicate a spot on the image. When you place an arrow (see the procedure below), the arrow is green. You can drag the arrow while it is green. You can select an arrow by tapping on it. When an arrow is selected, you can move it by draggling and rotate it with a gesture.

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

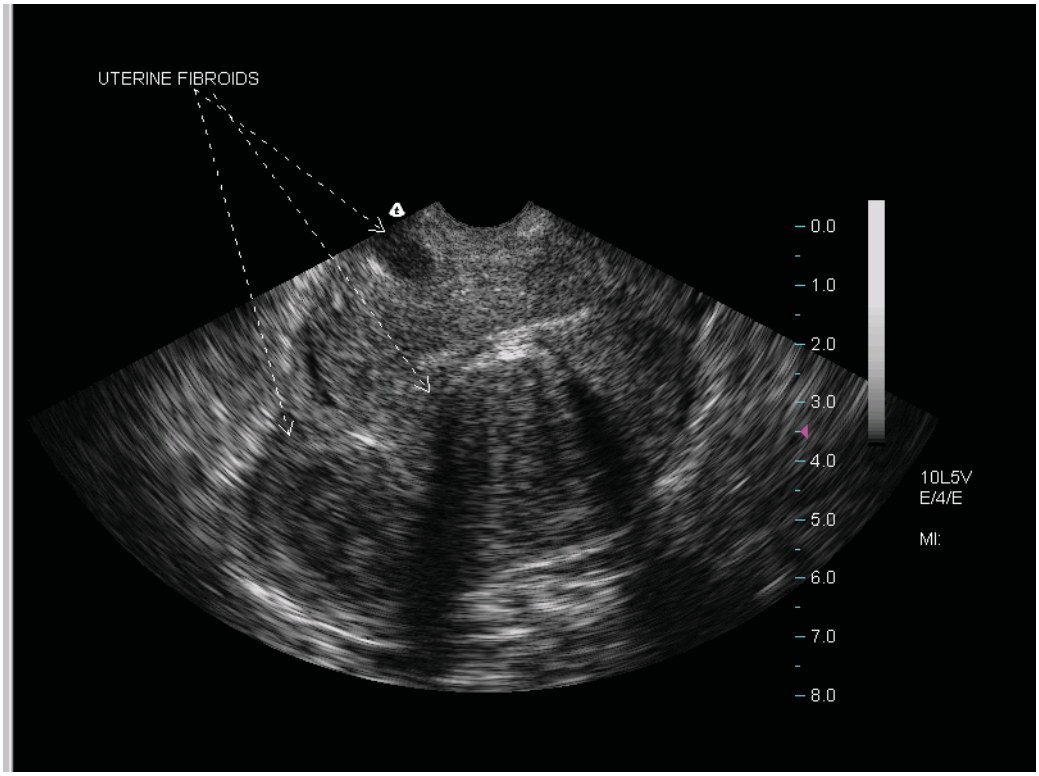
1. Tap the Arrow button.
2. Drag the **arrow** to where you want it
3. To place another arrow on the image, tap the Arrow button.

Text Arrows

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

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

1. Tap the **uSmart3200T name** at the top left corner of the screen.
2. Tap **Setup**.
3. Tap the **Annotation tab**.
4. On the Setup/Annotation window (see Setup/Annotation Window on page 62), tap the **Use Text Arrow** checkbox.
5. Tap **OK**.
6. Tap the **Text button**.
7. Tap the Arrow button.
8. Drag the **arrowhead** to the feature you want the text to refer to.
9. To **place another arrow**:
   - **a.** Tap the **Text button.**
   - **b.** Tap the **New Text** button.
   - **c.** Drag the **text cursor** to where you want the arrow to start.
   - **d.** Tap the Arrow button.
10. To manipulate a previously-set arrow:
    - **a.** Tap **one end** of the arrow.
    - **b.** To move the text, point, or beginning of the arrow, tap and drag.



Adding Arrows to Text

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

When working with text arrows, you can:

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

Moving Text

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

To move text, tap the text and move it to a new location. If an arrow is attached to the text, the origin of the arrow also moves.

Deleting Text from an Image

You can only delete text that you added to an image. You cannot delete any text that is part of an image display property, such as the probe image control values. You can hide that text (see Adding Guides to the Image Display on page 57), but you cannot delete it.

To delete the last line of text, tap the text to highlight it, then tap the Bksp button on the keyboard to delete the last character entered.

To delete all added text, tap the Text button, then tap the Clear button. This removes all added text and arrows from the image.

Using Body Markers

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

To work with body markers, you must understand:

Adding a Body Marker

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

1. Tap the **Text button** .
2. Tap the **Body Marker** button.

   A body marker displays on the image.

Shoulder Body Marker

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

   If another marker is available, it replaces the first marker.
4. When the marker you want displays, tap the **screen**.

Changing the Body Marker

To change the body marker, complete these steps:

1. Tap the **body marker**.

   The marker turns green and the buttons change to the Body Marker set.
2. Tap the **Next Marker** or **Prev Marker** button**.**

Moving the Body Marker

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

To move the body marker, complete these steps:

1. Tap the **body marker** to select it.
2. Tap the **Marker Position** button.
3. Drag the **body marker** to the correct location.

Moving the Probe Indicator

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

To move the orange marker, complete these steps:

1. Tap **Text**.
2. Close the **keyboard**.
3. Tap **Body Marker**.
4. Tap and drag the **probe indicator** to the desired location on the body marker.
5. To rotate the marker, **tap it again** and drag..

Removing Body Markers

To remove the Body Marker from the image

1. Tap the **Text button**.
2. Tap the **Body Marker** button.
3. Tap the **Erase Marker** button.