ZONARE

z.one *ultra* and z.one *ultra sp* Ultrasound Systems

Operator Manual

ZONARE

The **z.one *ultra*** Convertible Ultrasound™ System is covered by one or more of the following Patents:
6,251,073;6,569,102;6,618,206;6,663,567;6,685,645;6,733,455;6,773,399;6,866,631;6,866,632;6,896,658;6,936,008;
6,980,419;6,997,876;7,022,075;7,087,020;7,226,416;7,238,157;D461,814;D462,446;D467,002;D469,539;D469,877

CAUTION: United States Federal Law restricts this device to sale by or on the order of a licensed physician or licensed veterinarian.

Part Number Q00239-00E

CE
0086

For information and pricing on ZONARE system upgrades, transducers, accessories, and new features, please call 1-877-966-2731.

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Introduction

z.one *ultra* Convertible Ultrasound Systems

The ZONARE **z.one *ultra*** and **z.one *ultra sp*** Convertible Ultrasound™ Systems are the world's first convertible ultrasound systems, incorporating a full-featured ultrasound cart and a portable **Scan Engine** into one system. This configuration gives the clinician the flexibility to acquire the same premium-quality ultrasound images on a conventional cart-based system or a small compact unit, depending on the requirements of the clinical workflow.

- The **z.one *ultra*** Convertible Ultrasound™ System is the combination of the **SmartCart** with the **Scan Engine** connected to the docking deck.
- The **z.one *ultra sp*** Convertible Ultrasound™ System is the combination of the **SmartCart *sp*** with the **Scan Engine** connected to the docking deck.

z.one *ultra* Ultrasound Systems

The **z.one *ultra*** ultrasound systems (nonconvertible) comprise the new **z.one *ultra* Scan Module** mounted on a **SmartCart** or **SmartCart *sp***.

- The **z.one *ultra*** Ultrasound™ System is the combination of the **SmartCart** with the **Scan Module** connected to the docking deck.
- The **z.one *ultra sp*** Ultrasound™ System is the combination of the **SmartCart *sp*** with the **Scan Module** connected to the docking deck.

NOTE: For information and pricing on ZONARE system upgrades, transducers, accessories, and new features, please call 1-877-966-2731, ext. 3.

Intended Use

The **SmartCart/SmartCart *sp*** Workstations are intended to be used for the following types of ultrasound examinations:

- Fetal
- Abdominal
- Intraoperative
- Pediatric
- Neonatal/adult cephalic
- Pelvic
- Vascular
- Equine Endorectal
- OB/GYN
- Transvaginal
- Transcranial
- Cardiac
- Transesophageal Echocardiography
- Intracardiac Echocardio-graphy (ICE) *New!*
- Ocular
- Contrast Imaging *New!*
- Elastography
- Small organ/parts (including breast/testes, thyroid, etc.)
- Transesophageal (TEE) transducer
- Musculoskeletal (superficial musculoskeletal and peripheral vascular applications)
- 3D
- 4D (realtime 3D) *New!*

WARNING: To avoid injury to the patient, use only the **Ocular** Preset when performing imaging through the eye. The FDA has established lower acoustic energy limits for ophthalmic use. The system will not exceed these limits only if the **Ocular** Preset is selected. See the **Safety Manual** for information about the lower acoustic energy limits established for ophthalmic use.

CAUTION: Cardiac rhythm disturbances during perfusion studies using gas ultrasound contrast agents have been observed in the diagnostic range of MI values. See the specific package insert for the contrast agent being used for details.

In This Manual

Chapter		Overview
1	Introduction	Brief introduction to ZONARE **z.one *ultra*** systems.
2	The Basics: SmartCart and SmartCart *sp* Workstations	Describes the hardware and its setup for these workstations.
3	Imaging Controls: SmartCart and SmartCart *sp*	Describes the imaging controls for these Carts and how to use.
4	The Basics: Scan Engine and Scan Module	Describes the hardware and its setup for these components.
5	Imaging Controls: Scan Engine	Describes the imaging controls for the Scan Engine and how to use.
6	Transducers and MTP Option	Describes ZONARE transducers, MTP option, and how to use.

Chapter	Overview
7 Imaging	Describes procedures for all imaging modes.
8 Annotations	Describes how to place annotations and graphics on scan images.
9 Measurements and Calculations	Describes the measurements and calculations that can be performed on live and frozen images.
10 Echocardiography Option	For **z.one *ultra* SmartCart** only: Describes the cardiac calculation package and the basics of cardiac imaging.
11 Archive and Review	Describes the tools and procedures for archive and review.
12 Peripherals	Describes the ZONARE-approved peripherals.
13 DICOM and FTP Connectivity	Describes how to set up DICOM for ZONARE systems.
14 User Maintenance	Describes user maintenance procedures.
15 Troubleshooting	Describes troubleshooting procedures for common problems.
16 Specifications	Lists the technical specifications for ZONARE systems.
17 Glossary, Abbreviations, and Body Markers	Describes the technical terms and abbreviations used in this manual; provides list of Body Markers and their associated Exam Types.

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The Basics: SmartCart and SmartCart *sp*

z.one *ultra* Systems: SmartCart

- The **z.one *ultra*** Convertible Ultrasound™ System is the combination of the **SmartCart** with the **Scan Engine** connected to the docking deck (Figure 2-1).
- The **z.one *ultra*** Ultrasound™ System is the combination of the **SmartCart** with the **Scan Module** connected to the docking deck (Figure 2-2).

z.one *ultra* Systems: SmartCart *sp*

- The **z.one *ultra sp*** Convertible Ultrasound™ System is the combination of the **SmartCart *sp*** with the **Scan Engine** connected to the docking deck (Figure 2-3).
- The **z.one *ultra sp*** Ultrasound™ System is the combination of the **SmartCart *sp*** with the **Scan Module** connected to the docking deck (Figure 2-4).

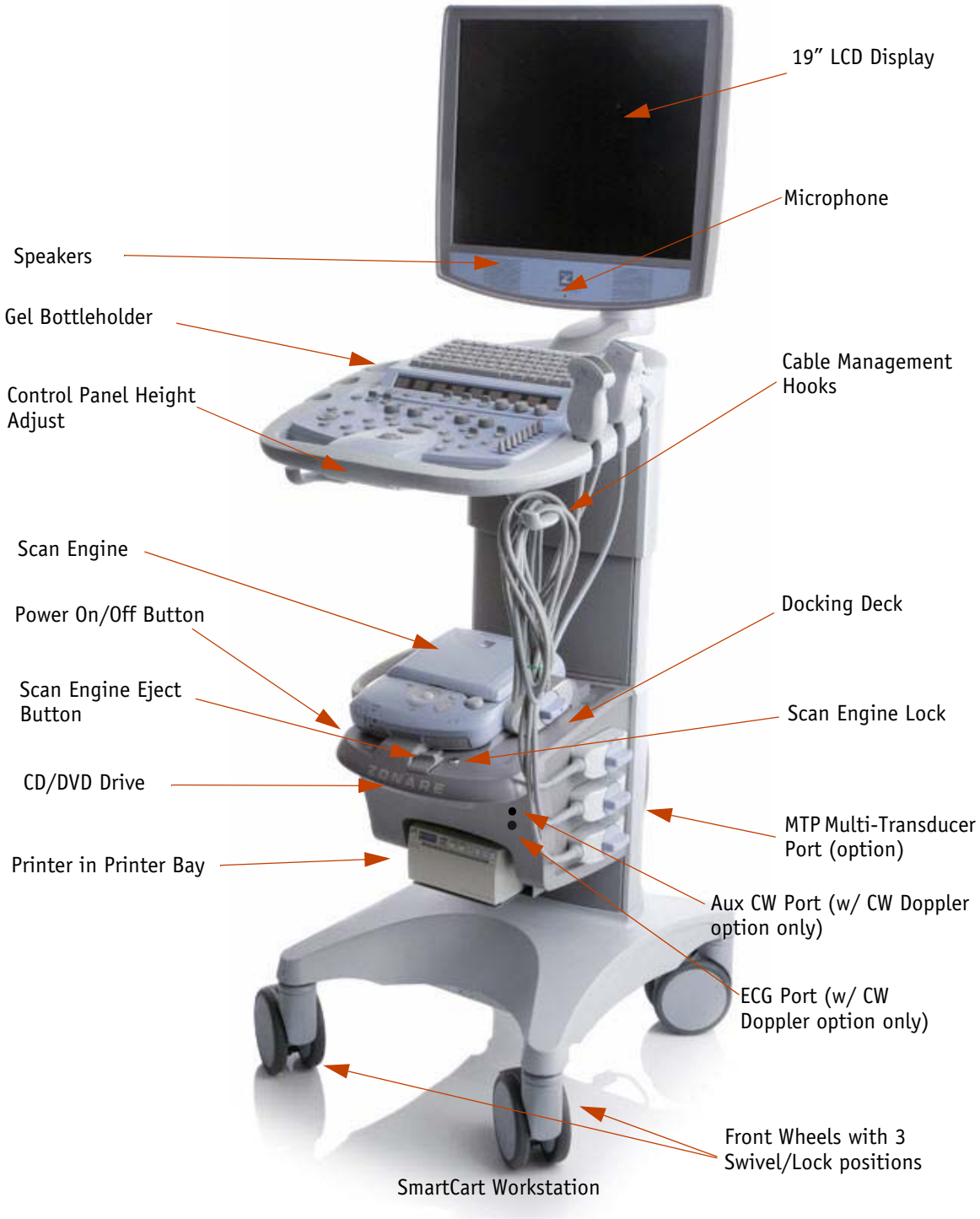

Figure 2-1. z.one *ultra* Convertible Ultrasound System

Figure 2-2. z.one *ultra* Ultrasound System (nonconvertible)

Figure 2-3. z.one ultra *sp* Convertible Ultrasound System

Figure 2-4. z.one *ultra sp* Ultrasound System (nonconvertible)

SmartCart/SmartCart *sp* Features

The **SmartCart/SmartCart *sp*** are full-function ultrasound workstations that are smaller and lighter than conventional systems of equivalent image quality. They can be used in situations where a conventional ultrasound system might not fit.

LCD Display

The **SmartCart/SmartCart *sp***'s full-sized 19-inch LCD Display shows the ultrasound image, plus patient and imaging information in designated areas of the screen. The screen can displayed as shown in Figure 2-5 or in full-screen mode (Figure 2-6). For complete information about the **SmartCart/SmartCart *sp*** LCD Display, see page 3-7.

- Overall screen display = 1280 x 1024 pixels
- Imaging area = 800 x 600 pixels

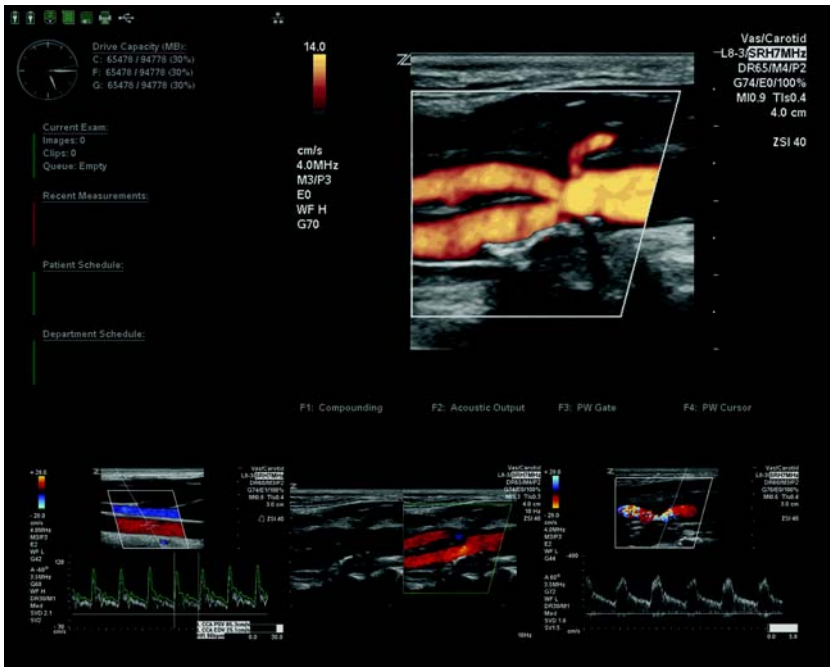

Figure 2-5. SmartCart/SmartCart *sp* LCD Display

Full Screen Image Display

The **SmartCart/SmartCart *sp*** allows you to enlarge the imaging portion of the monitor to use the full (1280 x 1024) display. You can easily go from the imaging portion display of (800 x 600) to (1280 x 1024) with the push of a **Function Key** (see “Programmable Keys” on page 7-9**).**

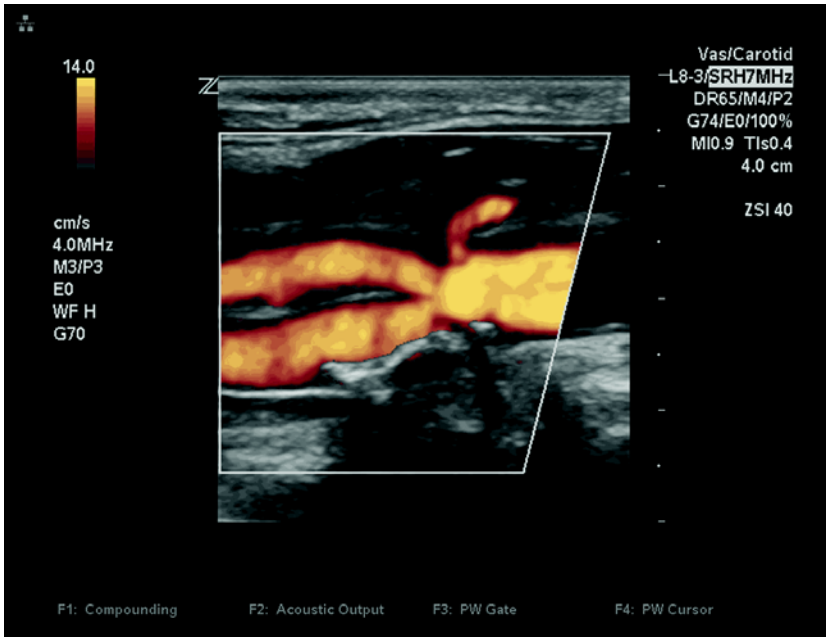

Figure 2-6. Full-Screen Image Display

Video Level Adjustment

All adjustments are performed from an onscreen setup menu. Available adjustments and suggested starting settings:

- Color Temperature
  - Red: 102
  - Green: 98
  - Blue: 125
- Brightness: 215
- Contrast: 62

▶ *To Adjust LCD Display Video Settings*

1. Select **Setup button | System Setup | Display | Audio/Video** to access the **Audio/Video Configuration** screen (Figure 2-7).

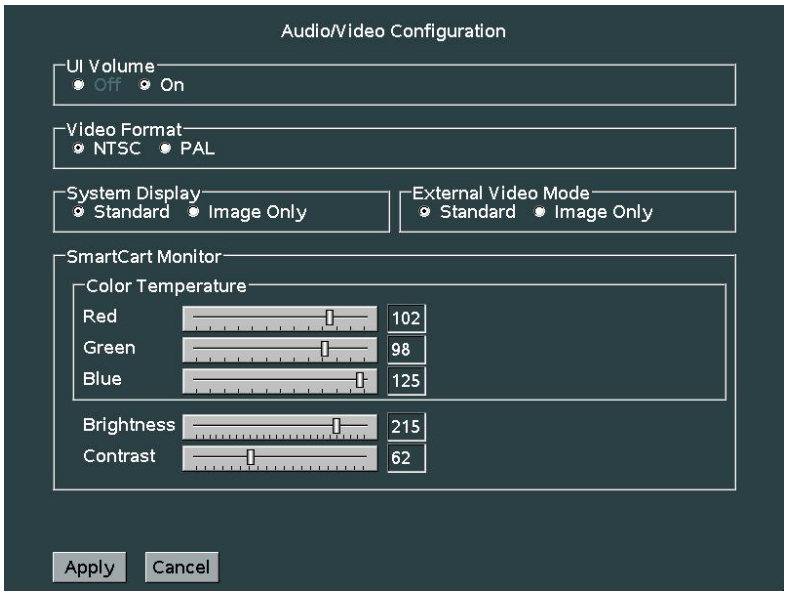

Figure 2-7. Audio/Video Configuration Screen (SmartCart Example)

2. Using the **Trackball**, place the cursor arrow to the desired position on the sliding bar scale (of the desired display control). Press the **Set** button to mark the setting.
3. Repeat the steps above for any additional display settings that are desired for change.
4. To save the new settings and exit, select **Apply**.
5. Visually inspect the output of the LCD Display to confirm the desired video levels are achieved. Repeat the above steps, if required.

Microphone

See “Programmable Keys” on page 7-9 for setting up a **Function** key for the microphone.

External Video Mode

The external digital video output, which is produced on the HDMI (DVI) video connector at the rear panel of the **SmartCart/SmartCart *sp*** (Figure 2-17), can be configured in the **Audio/Video Configuration** screen (Figure 2-7) for one of two modes (formats):

- Standard: 1280 x 1024 (includes image area, reference images, scheduling, etc.)
  - If selected for System Display, the image area, system icons, reference images, etc, will be displayed while scanning.
  - If selected for External Video Mode, the image area, system icons, reference images, etc, will be displayed when connected to an HDMI (DVI) video connector.
- Image Only: 800 x 600 (imaging area only)
  - If selected for System Display, only the image area will be displayed while scanning.
  - If selected for External Video Mode, only the image area will be displayed when connected to an HDMI (DVI) video connector.

Select the desired format that is compatible with the external device being connected to the HDMI port on the **SmartCart/SmartCart *sp***.

Control Panel

The **SmartCart/SmartCart *sp*** has a full-featured Control Panel/User Interface (see page 3-1).

Transducer Holders

Safe storage for ZONARE transducers is provided on both sides of the **SmartCart/SmartCart *sp*** (Figure 2-16).

Internal Cart Hard Drive (CartHD)

All current exam images are initially captured and archived to the **Scan Engine**'s hard drive. This data can be automatically saved to the **SmartCart/SmartCart *sp*** internal hard drive (**CartHD**) (see "To Automatically Store to Cart HD" on page 11-4) or transferred via the **Export** function or retrieved from the drive via the **Import** function. The size of the internal hard drive will not be less than 160 GB.

NOTE: The **SmartCart/SmartCart *sp*** internal hard drive is not intended to be used as a long-term archive. All exam and other data on the hard drive should be backed up regularly. See "Exporting Exams" on page 11-21, "Importing Exams" on page 11-34, and "Presets" on page 14-6 for more information.

CD/DVD Burner

The built-in CD/DVD burner allows users to import/export exams from the **Scan Engine**'s hard drive or from the **CartHD** (see "To Export Exams to SmartCart/SmartCart sp Built-in CD/DVD Drive" on page 11-22 for more information).

NOTE: Wide variability in CD and DVD quality may prevent the system from reliably writing to and reading from some commercially available discs. ZONARE has tested the CD and DVD in the table below and currently recommends their use. For up-to-date CD/DVD recommendations, go to: www.zonare.com/products/accessories.

Manufacturer	Part No.	Media	Capacity	Speed
CD-R				
Maxell	648200	100 Pack Spindle	700 MB	48X (Max)
DVD+R				
Taiyo Yuden	DVD+ZZ100SB16	YUDEN000T03	4.7 GB	16X (Max)

IMPORTANT: **Before deleting any Exam data from the Scan Engine or Cart hard drive, *always* verify that data was successfully transferred to the CD/DVD by viewing it on an external reader/player.**

When exams are exported onto the CD/DVD, a DICOM viewer program (Showcase®) is simultaneously exported onto the CD/DVD, allowing the exams to be opened, annotated, and saved in several formats on any commercial PC (see "Showcase® CD/DVD Viewer Basics" on page 11-27).

IMPORTANT: You must install system software as described in "To Install System Software (SmartCart/SmartCart sp)" on page 14-16 for the Showcase® viewer program to work properly.

New! Barcode Reader

You can enter patient ID numbers or accession numbers via a selection of ZONARE-approved barcode readers that can connect to a system USB port (Figure 2-17). See "Barcode Reader (Option)" on page 3-22.

Multi-Transducer Port (Option)

The optional Multi-Transducer Port (MTP) allows simultaneous connection to the system of up to three transducers. The user can easily activate any of the transducers connected to the cart. For more information about the MTP and its use, see Chapter 6.

Backup ZPak Battery (Option)

The **SmartCart**/**SmartCart *sp*** may be ordered with an optional ZPak battery that can power each cart for up to 2 hours. The battery allows the System to be operated in normal use without connection to an active AC power outlet.

The battery is mounted at the base of the **SmartCart**/**SmartCart *sp*** and is automatically kept charged by the DC power supplies within the System. The battery is charged (as needed) whenever the **SmartCart**/**SmartCart *sp*** is connected to active AC power.

NOTE: If the ZPak battery is used, two status icons display on the **SmartCart**/**SmartCart *sp*** LCD monitor: One for the ZPak battery and the other for the **Scan Engine** internal battery. See Table 3-3 on page 3-8. The ZPak battery charging status is also displayed onscreen (see Figure 3-4 on page 3-7).

Printers & Other Peripherals

ZONARE offers a number of optional medical grade (IEC 60601 compliant) peripherals. Basic information on **SmartCart/SmartCart *sp*** peripherals can be found in Chapter 12, of this manual. Detailed instruction for proper use is covered in the manufacturer's instructions provided at the time of shipment.

Docking/Undocking Scan Engine/Scan Module

The **Scan Engine/Scan Module** must be docked on the **SmartCart/SmartCart *sp*** for the cart to work.

NOTE: All imaging functions are available on the **Scan Engine** when it is undocked.

▶ *To Dock Scan Engine/Module on SmartCart/SmartCart sp*

1. Place the **Scan Engine**/**Scan Module** in the molded area on the docking deck so that it aligns itself in the cradle.
2. Gently pull the **Scan Engine**/**Scan Module** towards you until you hear the release lever click, securing the unit in place.

Figure 2-8. Docking/Undocking Scan Engine/Scan Module

▶ *To Undock Scan Engine/Module from SmartCart/SmartCart sp*

NOTE: If **Scan Engine**/**Scan Module** is connected to an MTP, disconnect the MTP before undocking (see "To Disconnect MTP from Scan Engine/Scan Module" on page 6-4).

1. Push and hold the **Scan Engine**/**Scan Module** release lever away from you (Figure 2-8).
2. Then slide the **Scan Engine**/**Scan Module** away from you to undock it from the **SmartCart**/**SmartCart *sp***.

Security Lock

The keylock enables/disables the removal of the **Scan Engine**/**Scan Module** from the **SmartCart**/**SmartCart *sp*** docking deck.

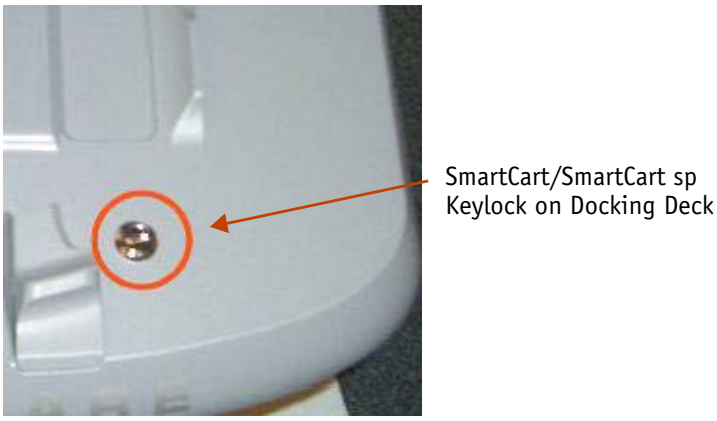

Figure 2-9. SmartCart/SmartCart *sp* Keylock Location

Powering ON/OFF

Please read and understand "**Warnings** - **SmartCart/SmartCart *sp***" in the **Safety Manual** before powering on the **SmartCart/SmartCart *sp***.

The **SmartCart/SmartCart *sp*** can be powered by AC or an optional ZPak battery that is mounted at the base of the cart. A fully charged ZPak battery allows the **SmartCart/SmartCart *sp*** to run for up to 2 hours.

- When the **Scan Engine** is docked on the **SmartCart/SmartCart** sp, the **Scan Engine**'s internal battery will charge whether the **SmartCart/SmartCart *sp*** is AC-powered or running off the ZPak battery.
- If the **SmartCart/SmartCart *sp*** is running off the ZPak battery, the battery will drain faster if it also needs to charge the **Scan Engine** battery.

NOTE: If the optional ZPak battery is used, two status icons display on the **SmartCart/SmartCart *sp*** LCD monitor: One for the ZPak battery and the other for the **Scan Engine** internal battery. See Table 3-3 on page 3-8.

▶ *To Power ON the SmartCart/SmartCart sp*

1. Locate the power button on the front/left of the docking deck. Press and release the ON/OFF button to turn on the System (see Figure 2-10).

NOTE: If the **Scan Engine** is already powered ON when docked on the **SmartCart/SmartCart *sp***, press the **SmartCart/SmartCart *sp*** power button to activate and power the 19" LCD Display.

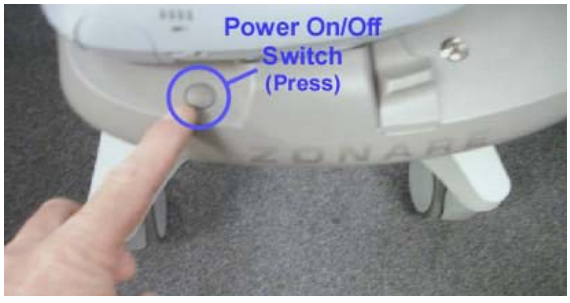

Figure 2-10. Power ON/OFF Button (SmartCart/SmartCart *sp*)

2. The System will take approximately 30 seconds to complete the normal power on sequence.
3. Check the **SmartCart**/**SmartCart *sp*** display to ensure the ZONARE startup screen displays. When initializing is complete, the System is ready for imaging.

Figure 2-11. ZONARE Startup Screen

NOTE: If the startup screen does not display, make sure the **Scan Engine** power is turned on and properly connected to the docking deck.

▶ *To Power OFF the SmartCart/SmartCart sp*

1. Press and release the power button on the **SmartCart/SmartCart sp** docking deck (Figure 2-10).

NOTE: When servicing the **SmartCart/SmartCart *sp***, always be sure to turn the circuit breaker to the OFF position.

1. Locate the circuit breaker to the left of the power cord.
2. Press the circuit breaker to the OFF position (see Figure 2-12).

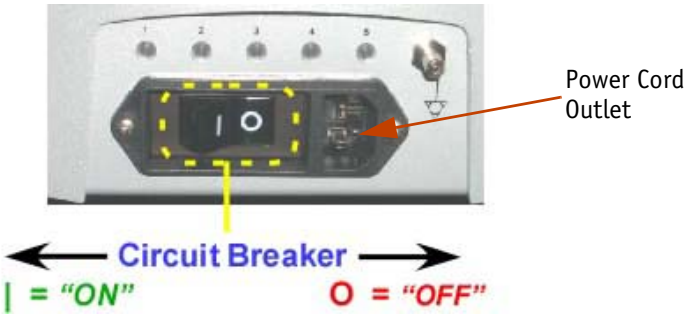

Figure 2-12. AC Circuit Breaker (SmartCart/SmartCart sp)

Height Adjustment

▶ *To Adjust Height of User Interface Panel*

1. Squeeze the release lever located on the inside of the right-front handle to adjust the height (Figure 2-13). When the desired position is reached, release the lever.

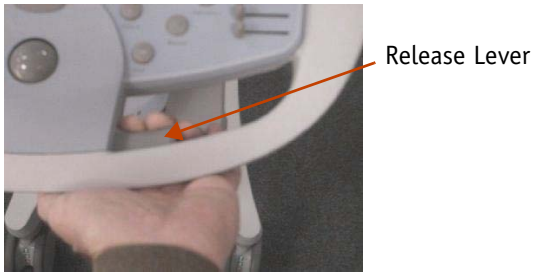

Figure 2-13. Height Adjustment Release Lever

LCD Display Position

The **SmartCart**/**SmartCart *sp*** LCD Display can tilt and rotate. To do so, grasp the sides of the LCD Display and pivot it to the desired viewing angle.

Wheels & Brakes

The **SmartCart**/**SmartCart *sp*** has three swivel/lock positions on the front wheels (Figure 2-14):

- Pedal all the way up: Allows the front wheels to lock in a straight position and the back wheels to swivel, making it easy to maneuver down long corridors.
- Pedal in middle position: Allows all four wheels to swivel for easy positioning in tight spaces.
- Pedal all the way down: Applies the brake to the wheels.

NOTE: The front wheels may be rotated to a 90-degree angle before locking to provide additional System stability during shipping.

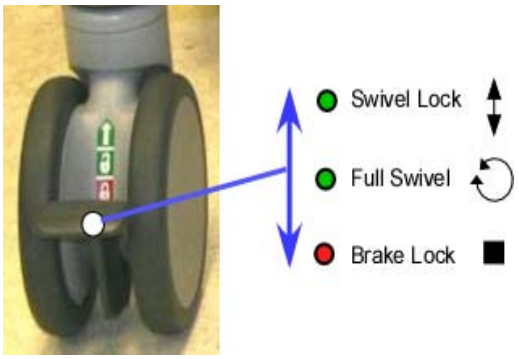

Figure 2-14. Wheel Locking/Brake Pedal (SmartCart/SmartCart *sp*)

Moving the SmartCart/SmartCart *sp*

▶ *To Prepare the SmartCart/SmartCart sp for Moving*

1. To maximize the stability of the **SmartCart/SmartCart *sp*** during movement, use the release lever to adjust the height of the console to its lowest possible position (see "Height Adjustment" on page 2-12).
2. Rotate the LCD Display arm to its center-most position (display facing directly forward) (see "LCD Display Position" on page 2-12).
3. Pivot the LCD Display forward until it is folded into a horizontal position for transport (Figure 2-15).
4. Make sure the transducer cables are wrapped over the cable hooks (Figure 2-16).

Figure 2-15. SmartCart/SmartCart *sp* LCD Display Position for Transport

CAUTION: To prevent possible damage to the LCD Display during transport, always position the LCD Display to the front and then fold it downward into a horizontal position (as shown in Figure 2-15). Make sure there are no objects (gel bottles, etc.) in the way that might come in contact with the LCD Display and potentially damage it.

Figure 2-16. Cable Hooks

CAUTION: To avoid possible damage to transducer cables during movement, wrap them over the cable hooks to prevent them from wrapping around the cart wheels.

▶ *To Move SmartCart/SmartCart sp*

1. Push the cart from the *front* of the system (unless moving over obstacles).

CAUTION: To ensure maximum maneuverability and stability (to prevent potential tipping), always push the **SmartCart/SmartCart *sp*** from the *front* of the system.

2. If moving the cart over obstacles, *pull* the cart from the *front*. Do not push the cart over obstacles.

Footswitch (Option)

An optional remote 2-pedal footswitch is available for **SmartCart/SmartCart *sp***.

- The footswitch connects to the System via any one of the free USB ports on the Cart.
- The left pedal activates **Freeze** and the right pedal activates **Store**.

Rear I/O Panel

The input/output (I/O) panel on the rear of the **SmartCart/SmartCart *sp*** is for connecting peripheral devices and networking (Figure 2-17).

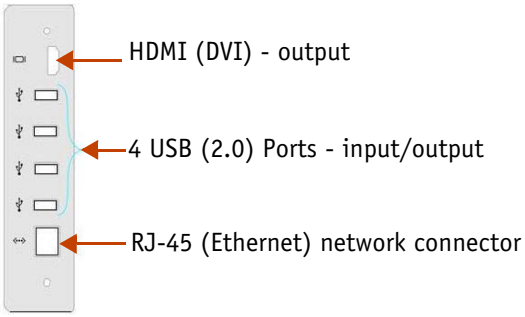

Figure 2-17. SmartCart/SmartCart *sp* I/O Panel

USB Memory Sticks

The **SmartCart**/**SmartCart *sp*** uses removable media (e.g., USB Memory Sticks) for two (2) purposes:

- Software Installer & User Preset - System Backup
- Patient Image Archive

NOTE: A USB Memory Stick can be inserted while the **SmartCart**/**SmartCart *sp*** is powered ON or OFF.

▶ *To Insert a USB Memory Stick*

When a USB Memory Stick is plugged into a USB port, a status icon is displayed on the top left of the **SmartCart**/**SmartCart *sp*** imaging screen (see Table 3-3 on page 3-8).

- Plug the USB Memory Stick into any available USB port (see Figure 2-17). Make sure the Stick is correctly oriented for the port.

▶ *To Remove a USB Memory Stick*

- Firmly grasp the USB Memory Stick and pull it out all the way.

CAUTION: Make sure the **SmartCart**/**SmartCart *sp*** has fully completed downloading upgrades, importing/exporting, or collecting log data to the USB Memory Stick before removing it from the **SmartCart**/**SmartCart** sp. Failure to do so will result in loss of data.

WARNING: The USB Memory Sticks supplied by ZONARE are the recommended brand, type, and sizes for use in **SmartCart**/**SmartCart *sp*** Systems. They have been verified for optimum reliability and performance. If users purchase their own USB Memory Stick, ZONARE is not responsible for any errors associated with file corruption or file-transfer time increases. For a list of USB Memory Sticks approved by ZONARE, go to www.zonare.com/products/accessories.

WARNING: USB Memory Sticks designated on the labeling as *U3 Smart Technology* will ***not*** operate on **SmartCart**/**SmartCart *sp*** Systems.

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3

Imaging Controls: SmartCart and SmartCart *sp*

Control Panels

Figure 3-1. SmartCart Control Panel

Figure 3-2. SmartCart *sp* Control Panel

Table 3-1. SmartCart/SmartCart *sp* Control Panels: System Controls and Functions

Number	System Control	Description
1	**Set-up or Setup Button**	Press to display the **SETUP** menu
2	**Function Keys** F1 - F4 (**SmartCart**) F1, F2 (**SmartCart *sp***)	Programmable Function Keys; see page 7-10 for information on programming **Function** keys
3	**M-Mode Button** **M-Mode Gain**	Press to enter **M-Mode**; rotate to adjust gain
4	**Doppler Button** **Doppler Gain**	Press to enter **Doppler Mode**; rotate to adjust gain
5	**Zoom Button**	Press to zoom
6	**Color Mode Button** **Color Mode Gain**	Press to enter **Color Mode**; rotate to adjust gain
7	**2-D Mode (B-Mode) Button** **2-D Mode Gain**	Press to enter **2D Mode** (B-Mode); rotate to adjust gain

Table 3-1. SmartCart/SmartCart *sp* Control Panels: System Controls and Functions (Continued)

Number	System Control	Description
8	**Exam Type Button**	Press to display the **Exam Type/Presets** menu and 6 **Preset** softkeys configured for the active transducer **NOTE:** To customize which **Preset** softkeys display for the transducer, see page 7-8
9	**Transducer Button**	Press to display the transducer softkeys for transducers connected to the system
10	**Depth Button**	Press to adjust **Depth**
11	**Frequency Button**	Press to adjust **Frequency**
12	**Menu Button**	Press to display the **Imaging** menu
13	**Print Button**	Press to print the displayed image
14	**Store Button**	Press to store the displayed image
15	**Set (2 buttons, left & right of Trackball)**	Press when instructed
16	**Freeze Button**	Press to the freeze the image
17	**Optimize Button**	Press to initiate **Optimize** function
18	**Measure Button**	Press to display the **Measure** menu for the specific exam and imaging mode
19	**Calcs Button**	Press to display the **Calculations** menu for the specific exam and imaging mode
20	**Enter/Select or Enter Button**	Press when manual instructs
21	**Back/Delete or Delete Button**	Press when manual instructs
22	**Report Button**	Press to display the Report associated with the exam, if present
23	**Trackball**	Rotate and scroll to make selections. For information about adjusting Trackball sensitivity, see "Trackball Sensitivity" on page 3-18
The following Controls are only available on the SmartCart Control Panel.		
24	**Harmonics Button**	Press to toggle On/Off tissue harmonic imaging
25	**DGC Slide Pots**	Move a DGC slider to the right to increase gain, and to the left to decrease gain for the depth zone controlled by each slider
26	**Record Button**	Press and hold to eject disk from CD/DVD drive, if present
27	**Dual Button**	Press to toggle **Dual** imaging function On/Off
28	**Image Width Button**	Press to activate **Image Width** function

Table 3-1. SmartCart/SmartCart *sp* Control Panels: System Controls and Functions (Continued)

Number	System Control	Description
29	**Annotation Button**	Press to display **Annotation** softkeys for the selected **Exam/Preset** and transducer. See also page 7-10.
30	**Protocol Button**	Press to display softkey for programming **Clip Store** modes for **Clip A** and **Clip B**
31	**Programmable Mode Keys (3)**	See page 7-11 for information on programming **Mode** keys

SmartCart/SmartCart *sp* Keyboard

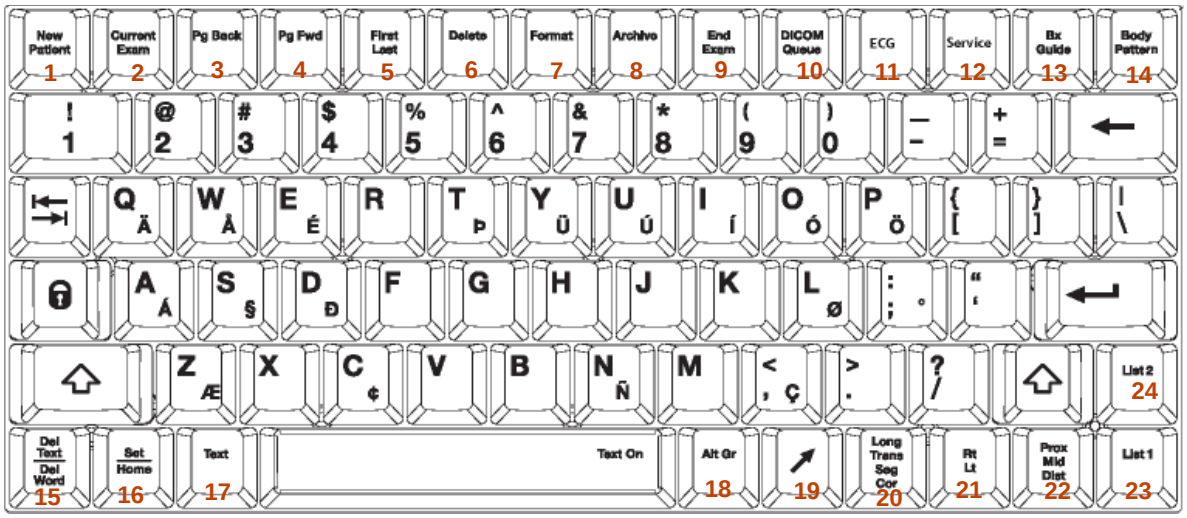


Figure 3-3. SmartCart/SmartCart *sp* Keyboard

Table 3-2. SmartCart/SmartCart *sp* Keyboard: Keys and Functions

Number	System Control	Description
1	**NEW PATIENT**	This is a toggle key. The first press displays the Patient Information page. The second press returns to the imaging display.
2	**CURRENT EXAM**	If there is an exam in progress, pressing this key displays the in-progress exam's images, with the most recently stored image displayed first. If there is no exam in progress, pressing this key has no effect.
3	**PG BACK**	This key only works when in an in-progress exam review or in an archived exam review. Pressing this key displays the previous image or a page of images if in a multi-image display format. If there are no further images, the key press has no effect.

Table 3-2. SmartCart/SmartCart *sp* Keyboard: Keys and Functions (Continued)

Number	System Control	Description
4	**PG FWD**	Same as PG BK, except the image advances in direction.
5	**FIRST LAST**	This key only works when in an in-progress exam review or in an archived exam review. Pressing this key toggles the display between the first stored image (or first page of images in a multi-image display format) and the last stored image (or last page of images in a multi-image display format).
6	**DELETE**	This key only works when in an in-progress exam review or in an archived exam review. When an image has been selected, pressing the **Delete** key tags the image for deletion by drawing a red **X** through it. If the selected image already has been tagged for deletion (red **X**), pressing the **Delete** key removes the red **X**, untagging the image.
7	**FORMAT**	This key only works when in an in-progress exam review or in an archived exam review. Pressing this key toggles the display between the following image formats: ■ 2 x 2 [displaying 2 rows of 2 images (4 images)] ■ 3 x 2 [displaying 2 rows of 3 images (6 images)] ■ A full-size image
8	**ARCHIVE**	This is a toggle key. The first press displays the Patient Selection Table. The second press returns to imaging.
9	**END EXAM**	When an exam is in progress, pressing the End Exam key closes the exam. If no exam is in progress, pressing this key has no effect.
10	**DICOM QUEUE**	This is a toggle key. The first press displays the DICOM queue. The second press returns to imaging.
11	**ECG**	**SmartCart** only: Press to activate **ECG**
12	**SERVICE**	Press to access the **User Diagnostics Panel** and other Service screens (see page 15-10 and page 14-3).
13	**BX GUIDE**	Biopsy guide. Press to toggle through the available guide lines and biopsy guide on/off, in live or freeze modes.

Table 3-2. SmartCart/SmartCart *sp* Keyboard: Keys and Functions (Continued)

Number	System Control	Description
14	**BODY PATTERN**	This is a toggle key. Pressing the **Body Pattern** key displays a **Body Pattern** for the **Exam Type** in use. Pressing the key again removes the displayed **Body Pattern**. When a **Body Pattern** is displayed, pressing left/right on the **Menu Control** will cycle through all available **Body Patterns**. For a complete list of **Body Patterns**, see Chapter 17.
15	**DEL TEXT | DEL WORD**	Pressing **Del Word** deletes the most recently entered text annotation, whether it is free text, POT, or List entry. Pressing Shift + **Del Text** removes all text annotations and arrow graphics displayed.
16	**SET | HOME**	Pressing **Home** moves the text annotation cursor to its default home position. Pressing **Shift + Set** Home will set the current cursor position as the new **Home** position.
17	**TEXT**	■ Press **Text** to display the text annotation cursor. Press **Text** again to remove the text annotation cursor. ■ You can also activate **Text** by pressing the Spacebar.
18	**ALT GR**	Used in conjunction with the QWERTY keyboard to support international characters.
19	**(Arrow)**	This is a toggle key. It works when the image is live or frozen. Pressing the key displays an arrow graphic in the middle of the display. Up to 15 arrows may be displayed simultaneously.
20	**LONG TRANS SAG COR**	This is a cycling key. Pressing this key will cycle among displaying the text values of LONG, TRANS, SAG, and COR.
21	**RT LT**	This is a cycling key. Pressing this key will cycle between displaying the text word of RIGHT and LEFT.
22	**PROX MID DIST**	This is a cycling key. Pressing this key will cycle between displaying the text values of PROX, MID, and DIST.
23	**LIST 1**	Pressing List1 key will display a list of text items entered in List1.
24	**LIST 2**	Pressing List 2 key will display a list a text items entered in List2.

Imaging Screen

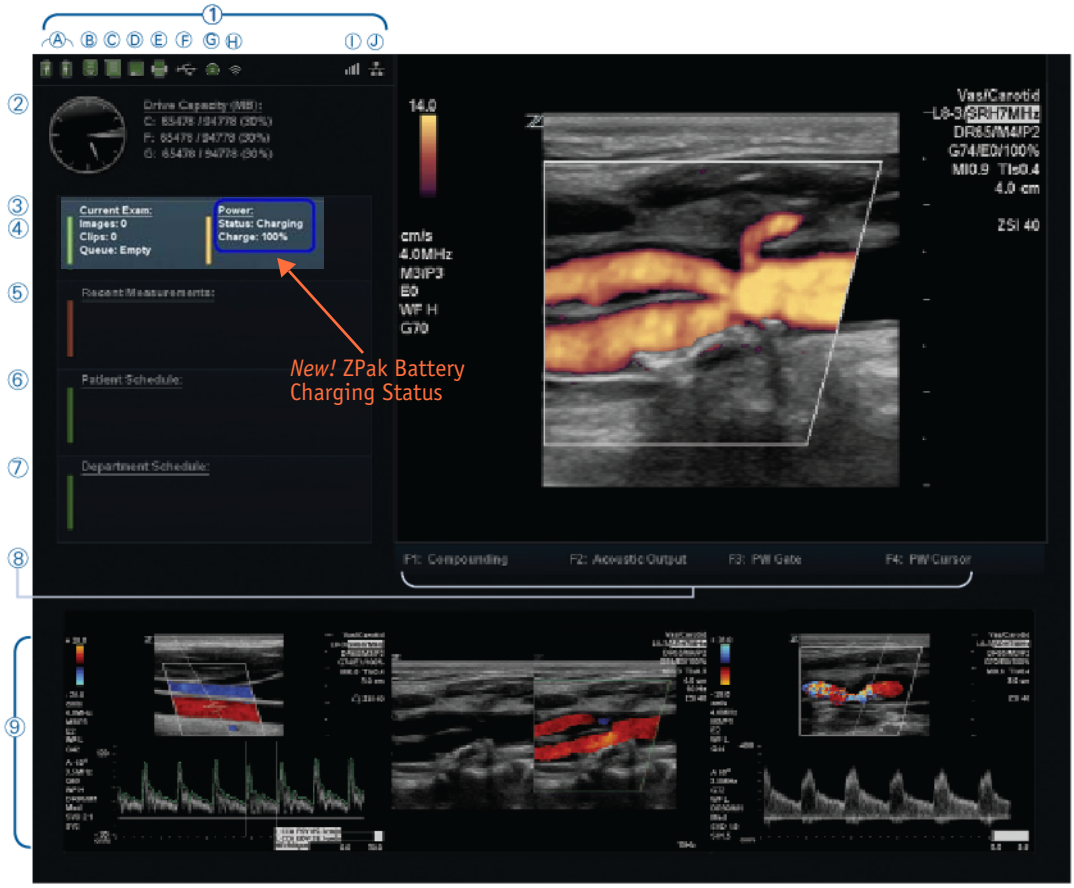


Figure 3-4. SmartCart/SmartCart *sp* Image Screen

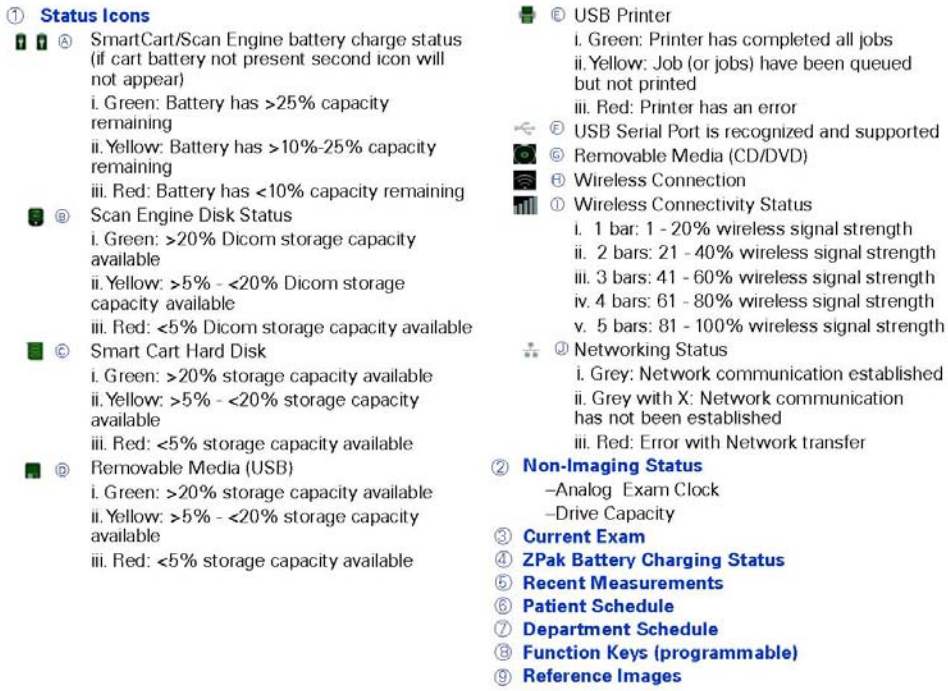


Figure 3-5. Image Screen - Description of Layout

Status Icons

Table 3-3 shows all status icons that may be displayed on the **SmartCart**/ **SmartCart *sp*** screen.

NOTE: If the **SmartCart/SmartCart *sp*** is equipped with the optional ZPak battery, two (2) battery icons will display: One for the **SmartCart/SmartCart *sp*** battery and the other for the **Scan Engine** battery.

Table 3-3. SmartCart/SmartCart *sp* Onscreen Status Icons

Icon	Function	Status Description
	Scan Engine/Module Battery	Battery is fully charged
	Scan Engine/Module Battery	Battery is currently charging
	Scan Engine/Module Battery	Battery is in use (more than 25% remaining)
	Scan Engine/Module Battery	Battery is in use (10%-25% remaining)
	Scan Engine/Module Battery	Battery is in use (less than 10% remaining)
	Scan Engine/Module Battery	Battery is in process of a user-initiated **Recalibration** cycle

Table 3-3. SmartCart/SmartCart *sp* Onscreen Status Icons (Continued)

Icon	Function	Status Description
	Scan Engine/Module Battery	Battery status is unknown
	SmartCart/SmartCart *sp* Battery	Battery is fully charged
	SmartCart/SmartCart *sp* Battery	Battery is currently charging
	SmartCart/SmartCart *sp* Battery	Battery is in use (more than 25% remaining)
	SmartCart/SmartCart *sp* Battery	Battery is in use (less than 10% remaining)
	SmartCart/SmartCart *sp* Battery	Battery is in use (10%-25% remaining)
	SmartCart/SmartCart *sp* Battery	Battery is in process of a user-initiated **Recalibration** cycle
	SmartCart/SmartCart *sp* Battery	Battery status is unknown
	SmartCart/SmartCart *sp* Battery (Full Screen Mode)	Battery is fully charged
	SmartCart/SmartCart *sp* Battery (Full Screen Mode)	Battery is charging: >80% Full Charge
	SmartCart/SmartCart *sp* Battery (Full Screen Mode)	Battery is charging: 20 – 85%
	SmartCart/SmartCart *sp* Battery (Full Screen Mode)	Battery is charging: >20%
	SmartCart/SmartCart *sp* Battery (Full Screen Mode)	Battery is in use (more than 25% remaining)
	SmartCart/SmartCart *sp* Battery (Full Screen Mode)	Battery is in use (10%-25% remaining)
	SmartCart/SmartCart *sp* Battery (Full Screen Mode)	Battery is in use (less than 10% remaining)
	SmartCart/SmartCart *sp* Battery (Full Screen Mode)	Battery is reconditioning
	SmartCart/SmartCart *sp* Battery (Full Screen Mode)	Battery status is unknown
	Scan Engine/Scan Module Internal Media	Internal media is not available for storage
	Scan Engine/Scan Module Internal Media	Internal media is initializing in preparation for storage

Table 3-3. SmartCart/SmartCart *sp* Onscreen Status Icons (Continued)

Icon	Function	Status Description
	Scan Engine/Scan Module Internal Media	Image storage is occurring to the internal media
	Scan Engine/Scan Module Internal Media	>20% of internal media storage capacity remaining
	Scan Engine/Scan Module Internal Media	5-20% of internal media storage capacity remaining
	Scan Engine/Scan Module Internal Media	<5% of internal media storage capacity remaining
	Scan Engine/Scan Module or Cart Removable Media (USB)	Removable storage media (USB) is being initialized
	Scan Engine/Scan Module or Cart Removable Media	Storage operation is actively in-process to removable storage media
	Scan Engine/Scan Module or Cart Removable Media	>20% of capacity of removable storage media still remains
	Scan Engine/Scan Module or Cart Removable Media	5-20% of capacity of removable storage media still remains
	Scan Engine/Scan Module or Cart Removable Media	<5% of capacity of removable storage media still remains
	SmartCart/SmartCart *sp* Hard Drive Media (option)	SmartCart hard drive is initializing for DICOM storage
	SmartCart/SmartCart *sp* Hard Drive Media (option)	SmartCart hard drive is storing DICOM images
	SmartCart/SmartCart *sp* Hard Drive Media (option)	>20% of SmartCart hard drive storage capacity remaining
	SmartCart/SmartCart *sp* Hard Drive Media (option)	>5% - <20% of SmartCart hard drive storage capacity remaining
	SmartCart/SmartCart *sp* Hard Drive Media (option)	<5% of SmartCart hard drive storage capacity remaining
	SmartCart/SmartCart *sp* CD/ DVD Disc (option)	CD/DVD disc inserted but not ready to be used
	SmartCart/SmartCart *sp* CD/ DVD Disc (option)	CD/DVD disc is inserted, is empty, and is ready to be used.
	SmartCart/SmartCart *sp* CD/ DVD Disc (option)	CD/DVD disc is inserted, is usable, but is full.

Table 3-3. SmartCart/SmartCart *sp* Onscreen Status Icons (Continued)

Icon	Function	Status Description
	SmartCart/SmartCart *sp* CD/DVD Disc (option)	CD/DVD disc is inserted and ZONARE system is writing to it.
	USB Local Printer (option)	Local USB printer is connected and active
	USB Local Printer (option)	Local USB printer has a printing job in progress
	USB Local Printer (option)	Local USB printer has an error condition (job will not print)
	Network	Network connected and active
	Network	Network disconnected
	Network	Network transfer has an error (re-queuing of job, etc) preventing transfer
	Wireless Network	Wireless network communication has been established. For information on wireless networking, see page 13-3.
	Wireless Network	Wireless network communication has not been established
	Wireless Network	Error is preventing wireless network data transfer
	Wireless Network	Wireless signal strength: 1% – 20%
	Wireless Network	Wireless signal strength: 21% – 40%
	Wireless Network	Wireless signal strength: 41% – 60%
	Wireless Network	Wireless signal strength: 61% – 80%
	Wireless Network	Wireless signal strength: 81% –100%

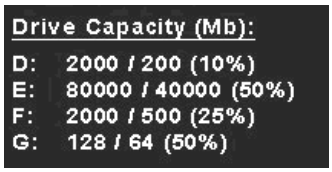
Non-Imaging Status

Exam Clock

The exam clock shows:

- Current time of day (analog clock)
- Duration of time since start of current exam (shaded sector area)

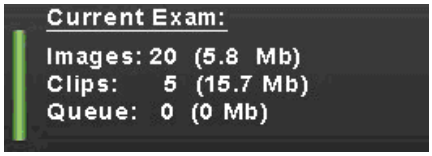
Drive Capacity



The **Drive Capacity** area provides information on the storage capacity and the amount of space used of the internal storage devices (i.e., the internal 80MB hard drive).

- All capacities are shown in megabytes (Mb).
- The storage devices are listed by alphabetical letter assignment.

Current Exam

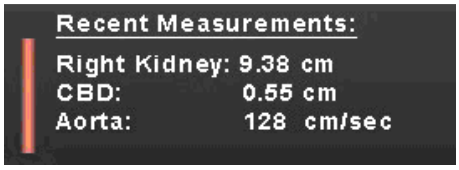


Current Exam provides status on the number of still images and clips captured, as well as the number of jobs that have been queued during the current exam. Status of the current exam is indicated as follows:

- **Green**: All criteria below are satisfied.
  - Network transferring successfully
  - Queue has < 10 items
  - Default image/clip storage space remaining OK
- **Amber**: One (or more) of the following conditions exist:
  - Queue has > 10 items
  - Default image/clip storage space remaining below minimum threshold
- **Red**: One (or more) of the following conditions exist:
  - Network NOT transferring successfully
  - Queue has > 20 items

- Default image/clip storage space insufficient for transfer

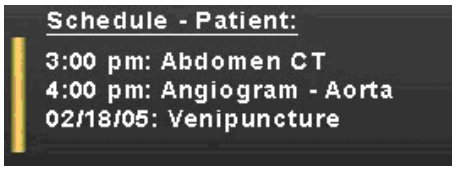
Recent Measurements



Recent Measurements provides a quick review of the latest measurements performed during the current exam. Recent measurement information is indicated as follows:

- **Green**: Any of the following criteria exist.
  - No Calcs added since the prior image store
  - Calc Report printed to a Postscript printer
  - Calc Report \ stored via Image store or print
  - Calc Data has been exported
- **Amber**: One (or more) of the following conditions exist:
  - Calc data entered after Store
  - Calc data added after Report Print, Report Store, or Report Export
- **Red**: One (or more) of the following conditions exist:
  - Calculation data has been taken
  - No image/ clip has been stored
  - Calculation Report not printed, stored or exported

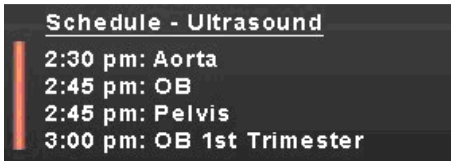
Patient Schedule



Patient Schedule provides quick reference to the examinations that have been scheduled for a patient by a **DICOM Modality Worklist** server (optional) (see Chapter 8 for more information on DICOM). Status of scheduled items is indicated as follows:

- **Green**: Patient Schedule has been successfully updated in the past 30 minutes
- **Amber**: Patient Schedule has not been updated in the last 30-60 minutes
- **Red**: Patient Schedule has not been updated in >60 minutes

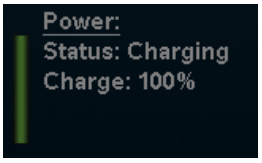
Department Schedule



Department Schedule provides quick reference to the ultrasound examinations scheduled in the department by a DICOM Modality Worklist server (optional). Status of scheduled items is indicated as follows:

- **Green**: Department Schedule has been successfully updated in the past 30 minutes. Exam is in progress and the time is earlier than the next scheduled procedure time.
- **Amber**: Department Schedule has not been updated in the last 30-60 minutes Exam is in progress and the time is >15 minutes later than the next scheduled procedure time.
- **Red**: Department Schedule has not been updated in >60 minutes. Exam in progress and time is >30 minutes after next scheduled procedure or time is later than three scheduled procedures.

ZPak Battery Charging Status *New!*



Shows charging status of optional ZPak battery as follows:

- **Green**: Full Charge (> 25%)
- **Amber**: Warning (10 - 25% charge)
- **Red**: Error (< 10% charge)

SmartCart/SmartCart *sp* - System Navigation

NOTE: Virtually all menus for the **Scan Engine** are accessed by pressing **Menu Control** on the **Scan Engine** console (Figure 5-3 on page 5-3).

▶ *To Access Frequently Used Menus*

Frequently used menus are accessed by pressing the following Control Panel buttons.

Table 3-4. Frequently Used Menus

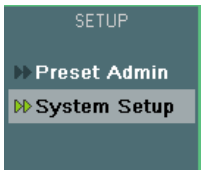
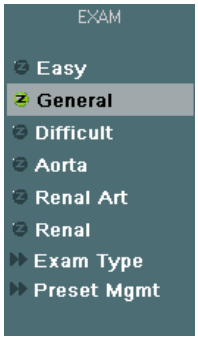
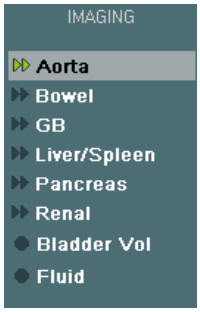
Button	Button Name	Menu
	**Setup *or* Set-up**	 Menu that appears when user presses **Setup** button
	**Menu**	 *Example:* Menu that appears when user presses **Menu** button while doing live B-Mode (2D) imaging
	**Exam Type**	 *Example:* Menu that appears when user presses **Exam Type** button while doing **Abdominal** exam

Table 3-4. Frequently Used Menus (Continued)

Button	Button Name	Menu
	**Calc**	 *Example:* Menu that appears when user freezes image, then presses **Calc** button while doing **Abdominal** exam in B-Mode (2D)
	**Measure**	 *Example:* Menu that appears when user freezes image, then presses **Measure** button while in B-Mode (2D)

- After you push one of the buttons listed in Table 3-4, its menu appears on the LCD Display. The items on the menu may vary depending on the **Exam Type/ Preset**, imaging mode, or transducer that is active.

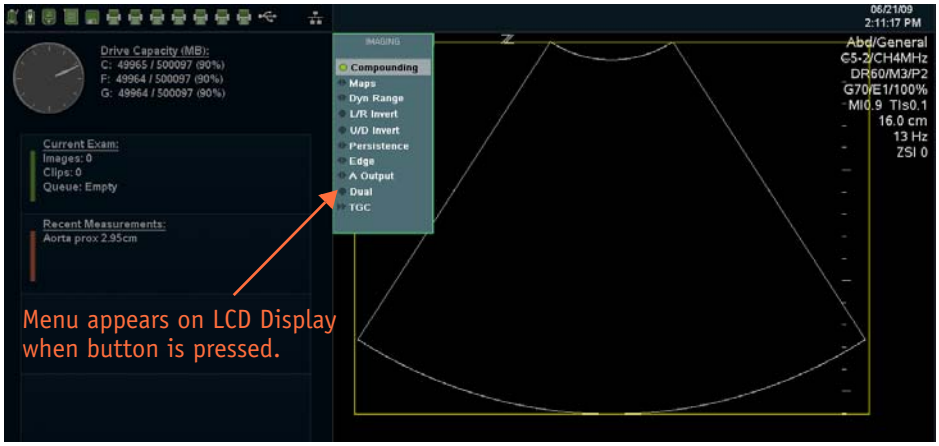


Figure 3-6. Menu on LCD Display

- To remove the menu from the screen, press the button again.
- To move the menu to the right side, press the **R** key on the QWERTY keyboard. Press the **L** key to move the menu back to the left side.

▶ *To Navigate System Menus*

NOTE: All users must be familiar with the following procedure.

The **Trackball** is the main control used to highlight and select items on system menus.

1. Press one of the buttons listed in Table 3-4. A menu will display.
2. To choose an item on the menu, scroll the **Trackball** up or down to *highlight* the selection.

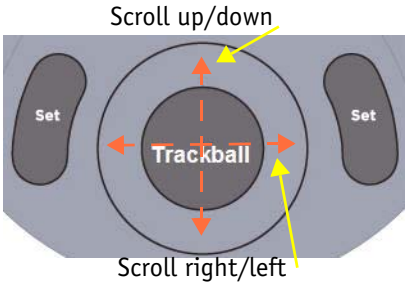


Figure 3-7. Trackball with Set Buttons

3. To select a *highlighted* item, scroll the **Trackball** as described in Figure 3-8.

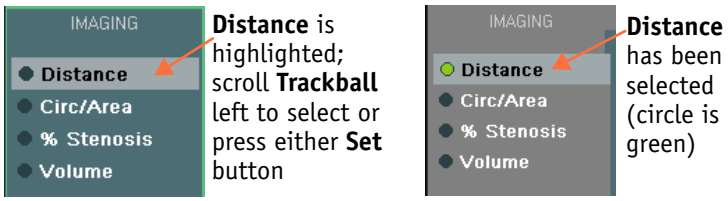


Figure 3-8. Trackball: Highlight and Select ON/OFF Item

NOTE: Figure 3-8 describes the procedure for an ON/OFF item.

NOTE: For information about adjusting **Trackball** sensitivity, see "Trackball Sensitivity" on page 3-18.

Menu Items

Table 3-5. Menu Icons

Icon	Control	Selection and Action
ON OFF	**ON/OFF**	Highlight item with **Trackball**. Scroll **Trackball** right to select item or press either **Set** button. The icon is green in the ON state.
	Factory Preset	Press **Set** to toggle between ON/OFF states. Used in the **Exam Type** menu only.
	Arrows Pointing Left and Right	Scroll **Trackball** left\right to cycle through options associated with the function. Or press right and left **Set** buttons to cycle forward and back.

Table 3-5. Menu Icons (Continued)

Icon	Control	Selection and Action
	Double Arrows Pointing Right	Scroll **Trackball** to the right to select the item and bring up next menu with further selections. Or press right **Set** button.
	Single Arrow Pointing Left	Highlight with **Trackball**; then scroll **Trackball** to the left to return to previous menu. Or press left **Set** button.

Trackball Sensitivity

SmartCart/SmartCart *sp* users can adjust the sensitivity of the **Trackball** for 2D and strip cine viewing and for scrolling menus and selecting menu items. (See Table 3-6).

▶ *To Configure Trackball Sensitivity*

1. Go to:

SmartCart/SmartCart *sp*	**Setup button | System Setup | Display | Trackball**

2. The **Trackball Configuration** screen displays.

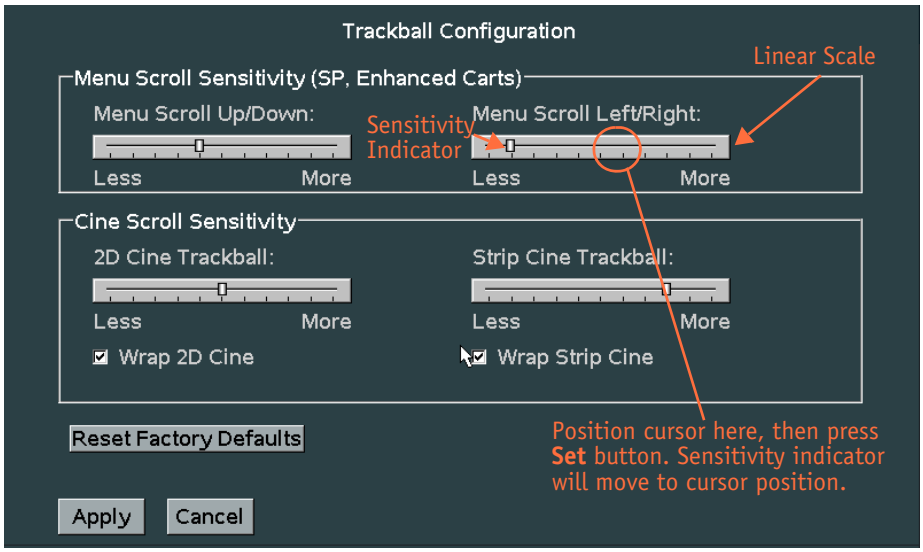


Figure 3-9. Trackball Configuration Screen

3. Using the **Trackball**, move the cursor over the linear scale you want to adjust (e.g., **Menu Scroll Left/Right** in Figure 3-9).
4. Position the cursor at a point on the scale; then press the **Set** button. The sensitivity indicator will move to the cursor position on the scale.
5. Click **Apply** to save your changes.

NOTE: You may have to adjust **Trackball** sensitivity a few times before you find the settings you like.

Table 3-6. Trackball Sensitivity Options

Option	Description
Menu Scroll Up/Down	Sets speed of **Trackball** movement by User when moving up/down through menu selections.
Menu Scroll Left/Right	Sets speed of **Trackball** movement by User when moving left/right to select menu options.
2D Cine Trackball (2D & Color modes)	Controls the number of frames advanced in response to each sweep of **Trackball** movement by User.
Strip Cine Trackball (PW, CW, M modes)	Controls the rate at which the time axis sweep is advanced per sweep of **Trackball** movement by User.
Wrap 2D Cine	Default is checked. Uncheck to prevent wrapping (when scrolling to last frame, system automatically scrolls/wraps to first frame and vice versa). See also "Clip/Cine Review (Frozen)" on page 7-12.
Wrap Strip Cine	Default is checked. Uncheck to prevent wrapping (when scrolling to last frame, system automatically scrolls/wraps to first frame and vice versa). See also "Clip/Cine Review (Frozen)" on page 7-12.
Reset Factory Defaults	Restores all **Trackball** settings to factory defaults.

Softkeys

Softkeys are a quick, convenient way to access certain System functions on **SmartCart**/**SmartCart *sp*** workstations. Softkeys display above the **Control Panel** when the user presses a button on the **Control Panel** or selects an item from a menu. The lighted label above the button describes its function.

The softkeys displayed vary depending on the image mode, **Exam Type**/**Preset**, transducers connected to the system, and **Control Panel** button that is pressed.

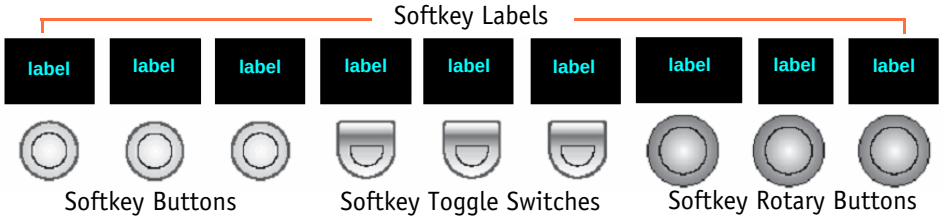


Figure 3-10. Softkey Display - Generic

▶ *To Activate a Softkey*

1. Press, toggle, or rotate the selected softkey depending on the type of softkey (see Figure 3-10).

NOTE: See page 7-8 for information on configuring the **Exam Type**/**Presets** softkeys that are displayed for an active transducer.

Set Time, Date, and Language

▶ *To Set Time, Date, and Language*

1. Go to:

SmartCart/SmartCart *sp*	**Setup | System Setup | Display | Time/Region**
Scan Engine	**Tools | System Setup | Display | Time/Region**

2. The **Date & Time Configuration** screen displays (Figure 3-11).

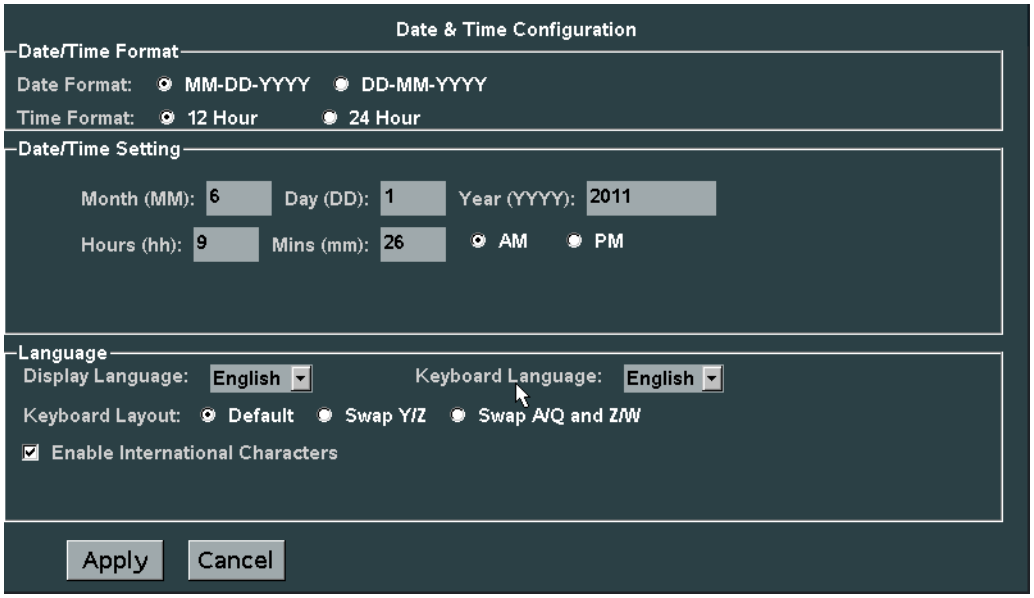


Figure 3-11. Date & Time Configuration Screen

3. Select date (**Date Format**) and time (**Time Format**) formats you want.
4. Set clock in **Date/Time Setting** area.
5. **Display Language** and **Keyboard Language**: Default is **English**. (Choices for **Display Language**: **English**, **Deutsch**, **Espanol**, **Francais**, **Italiano**, **Portuguese**, **Russian**, **Svenska**. Choices for **Keyboard Language**: **English**, **Russian**.)
6. Click **Apply** to save.

NOTE: Check the box to **Enable International Characters** if desired.

NOTE: Users may choose to **Swap Y/Z** or **Swap A/Q and Z/W**.

Sleep and Shutdown

▶ *To Set Sleep and Shutdown Parameters*

1. Go to:

SmartCart/SmartCart *sp*	**Setup button| System Setup | Power Save**
Scan Engine	**Tools | System Setup | Power Save**

2. Select the parameters you want and click **Apply** to save.

Password Protection

Password protection can be enabled to prevent unauthorized use of the **Scan Engine** and **SmartCart/SmartCart *sp*** workstations. User passwords are set on the **Access Control** screen.

▶ *To Assign a Password*

NOTE: If password logon has been configured, a logon screen will appear. Enter your password to enable System operation.

1. Go to:

SmartCart/SmartCart sp	**Setup button| System Setup | Security | Logon Config**
Scan Engine	**Tools | System Setup | Security | Logon Config**

2. The **Access Control** screen displays (Figure 3-12).
3. Select your **Logon Type** and enter a **Logon Password**.
4. Click **Apply** to save.

Figure 3-12. Access Control Screen

CAUTION: If password protection (**Access Control**) is used, make sure user-assigned passwords are retained in a safe place by the System Administrator. If a password is lost or forgotten, no master password is available for recovering access to the **SmartCart/SmartCart *sp*** for normal operation. A complete reinstallation of system software will be required.

Barcode Reader (Option) *New!*

▶ *To Configure Barcode Reader*

1. Go to **Setup | System Setup | Display | Barcode**. The **Barcode Reader Configuration** screen displays.

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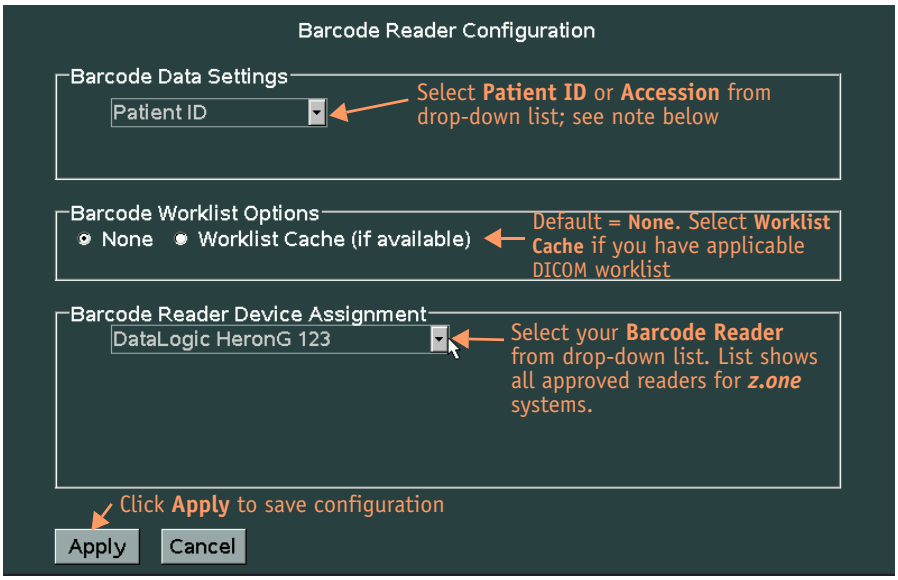


Figure 3-13. Barcode Reader Configuration Screen

NOTE: The barcode you scan will populate *only* the field in you select above: **Patient ID** or **Accession** on the **Patient Information** screen (Figure 7-1 on page 7-1). To change your selection, return to the **Barcode Reader Configuration** screen.

IMPORTANT: You can use an approved barcode reader without configuring it on the **Barcode Reader Configuration** screen. Instead, plug the barcode reader into a USB port and open a **Patient Information** form (Figure 7-1 on page 7-1). Place the cursor in *any* field, then scan a barcode, and the barcode will display in that field. You are not limited to the **Patient ID** or **Accession** fields.

Using the Barcode Reader

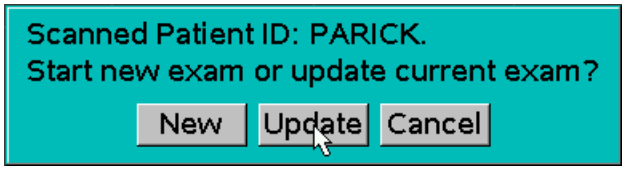
▶ *New Patient or Exam*

1. Plug barcode reader into a USB port on the system.
2. If barcode reader has not been configured on the system, the **Barcode Reader Configuration** screen displays. See Figure 3-13 for instructions to configure your reader. Click **Apply** to save your settings.

3. Press **New Patient** key on QWERTY keyboard to display **Patient Information** form (Figure 7-1 on page 7-1).
4. Scan barcode with barcode reader. Barcode information will automatically populate **Patient ID** or **Accession** field (as selected above) on **Patient Information** form.
5. Fill out rest of **Patient Information** form as described in "To Edit Patient Information Form" on page 7-3.

Exam in Progress

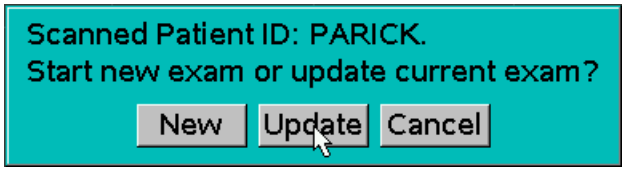
1. If you scan a barcode while an exam is in progress, the following message displays:



- If barcode information is not for patient being scanned, select **New** to end current exam and begin a new exam.
- To apply barcode information to current exam/patient, select **Update**.
- To proceed with exam and cancel barcode operation, select **Cancel**.

Patient Information Form for a Patient is Already Open

1. If you scan a barcode while a patient's **Patient Information** form is already open, the following message displays:



- If barcode information is not for this patient, select **New** to close currently displayed **Patient Information** form and open a new one.
- To apply barcode information to currently displayed **Patient Information** form, select **Update**.
- To remain on currently displayed **Patient Information** form and cancel barcode operation, select **Cancel**.

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4

The Basics: Scan Engine and Scan Module

Scan Engine

The **Scan Engine** serves as the main processing device for the **z.one *ultra*** Convertible Ultrasound™ System and the **z.one *ultra sp*** Convertible Ultrasound™ System (see Chapter 2). For either cart to function, the **Scan Engine** must be placed on the docking deck.

- When the **Scan Engine** is docked, the user can acquire images using the full-featured control panel.
  - Patient images can be archived (saved) to the internal flash memory or moved to the internal drive of the **SmartCart/SmartCart *sp***.
  - If Ethernet connectivity is enabled, images can be saved to the network (DICOM) archive device.
- Images archived to internal flash memory can later be recalled for post-study analysis.
- The user can annotate images and perform measurements if the exam is restarted during the user-selectable restart period. For more information about the restart period, see “Restarting an Exam” on page 11-20.

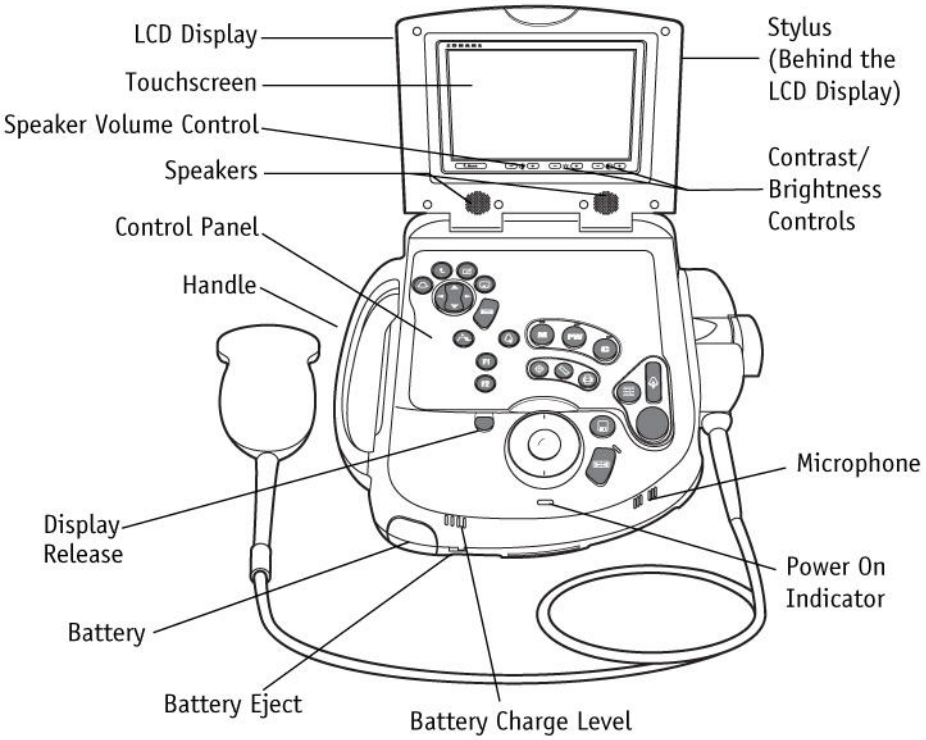


Figure 4-1. Scan Engine with Transducer (Front View)

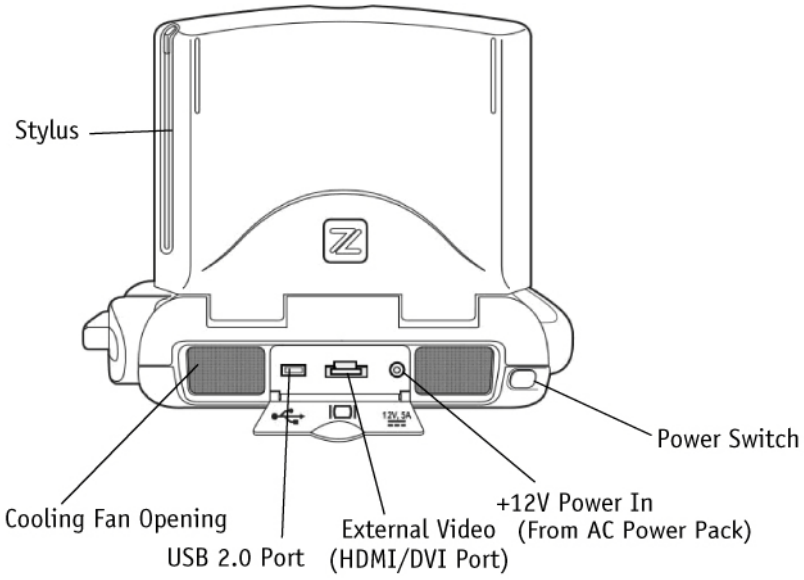


Figure 4-2. Scan Engine (Back View)

The **Scan Engine** may be used for complete examinations or limited procedures.

- When **Scan Engine** is docked on the Cart:
  - Images are processed internally using the LCD Display on the Cart.

- The **Scan Engine**'s internal battery is automatically recharged while the **Scan Engine** is docked.

- When the **Scan Engine** is undocked:
  - Images are displayed on the **Scan Engine**'s local LCD Display (see "Scan Engine LCD Display" on page 5-1).
  - User operations are performed on the **Scan Engine**'s local Control Panel (see "Scan Engine Control Panel" on page 5-3).
  - The **Scan Engine** is powered by an internal rechargeable battery (or the optional AC adapter; see page 4-4).

Internal Archive Storage

The **Scan Engine** base model comes standard with 512 MB of internal storage capacity. Storage capacity of 2 GB is available as an option.

NOTE: The **Scan Engine** internal hard drive (**SSD/C:**) is not intended to be used as a long-term archive. All patient exams and system presets should be backed up regularly. See page 11-21 and page 14-6 for more information.

NOTE: You can also save exams directly to the **SmartCart/SmartCart sp**'s internal hard drive (**CART HD**); see Table 11-1 on page 11-3 and page 11-4.

Scan Engine (Undocked)

▶ *To Power ON the Scan Engine*

1. Make sure the **Scan Engine** battery is charged. See "Checking Scan Engine Battery Charge" on page 4-5.
2. Press the power switch on the **Scan Engine** (Figure 4-2). After pressing the switch, it remains illuminated for 10 seconds and then turns off.

NOTE: The system is still ON even though the light is out.

3. The ZONARE startup screen displays while the system initializes. When initializing is complete (takes about 20 seconds), the System is ready for 2D (B-Mode) imaging.
   - If the screen is blank or not the default display, check the transducer connections and reconnect the transducer.
   - If a normal display is still not present, connect a different transducer.
   - If the normal display is still not present, power the system OFF and call Technical Support (see "ZONARE Contact Information" on page 15-1).

▶ *To Power OFF the Scan Engine*

1. Press and release the **Scan Engine** power switch. The **Scan Engine** takes about 10 seconds to power OFF.

NOTE: **Do not** press *and hold down* the power switch. Instead, just press and release.

USB Memory Sticks

The **Scan Engine/Scan Module** uses removable media (e.g., USB Memory sticks) for two (2) purposes:

- Software Installer & User Preset - System Backup
- Patient Image Archive

NOTE: A removable media stick can be inserted while the **Scan Engine/Scan Module** is powered ON or OFF.

▶ *To Insert Removable Media*

1. Open the door located at the back of the **Scan Engine/Scan Module** and plug the removable media into the port.

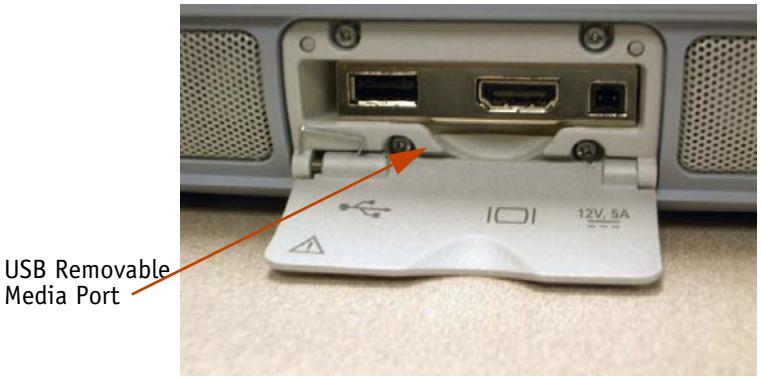


Figure 4-3. Scan Engine Example: Rear View - Removable Media Port

▶ *To Remove Removable Media*

- Firmly grasp the removable media and pull it out all the way.

CAUTION: Make sure the **Scan Engine/Scan Module** has fully completed downloading upgrades, importing/exporting, or collecting log data to the removable media ***before*** removing it from the **Scan Engine/Scan Module**. Failure to do so will result in loss of data.

WARNING: The USB Memory Sticks supplied by ZONARE are the recommended brand, type, and sizes for use in **SmartCart/SmartCart *sp*** Systems. They have been verified for optimum reliability and performance. If users purchase their own USB Memory Stick, ZONARE is not responsible for any errors associated with file corruption or file-transfer time increases. For a list of USB Memory Sticks approved by ZONARE, go to www.zonare.com/products/accessories.

WARNING: USB Memory Sticks designated on the labeling as *U3 Smart Technology* will ***not*** operate on the **SmartCart/SmartCart *sp*** Systems.

Scan Engine Battery

When the **Scan Engine** is docked on the **SmartCart/SmartCart sp**, a battery status icon is displayed at the top left of the **SmartCart/SmartCart *sp*** LCD Display. It

shows whether the battery is charging and how much charge is left. See Table 4-3 on page 4-9.

If the optional ZPak battery is used, two status icons display on the **SmartCart/ SmartCart *sp*** LCD monitor: One for the ZPak battery and the other for the **Scan Engine** internal battery.

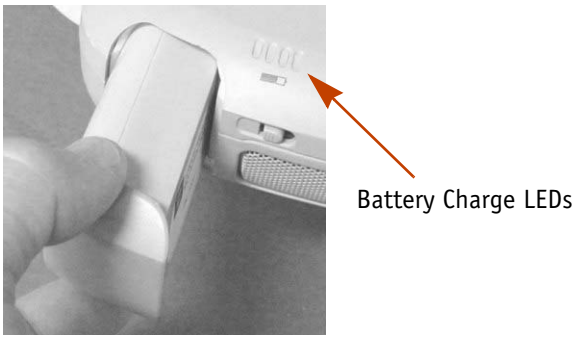


Figure 4-4. Scan Engine Battery Slot

▶ *To Install Battery*

NOTE: Remove the **Scan Engine** from the **SmartCart/SmartCart *sp*** before installing/replacing the battery.

1. Verify the charge on the battery (see "Checking Scan Engine Battery Charge" on page 4-5).
2. Locate the battery slot on the left side of the **Scan Engine** (Figure 4-4).
3. Line up the prominent groove on the battery with the corresponding tongue on the left inside surface of the battery slot.
4. Push the battery in until it is fully locked in place.
5. The battery charge LEDs to the right of the battery pocket will light up showing the amount of charge left.

▶ *To Eject Battery*

1. Push the battery release latch to the right of the battery slot.
2. Remove the battery.

Checking Scan Engine Battery Charge

There are two locations on the **Scan Engine** for checking battery charge:

1. A status icon displays below the menu of the **Scan Engine** screen.
   - The icon displays the % of charge remaining. In Figure 4-5, the remaining charge is **100%**.
   - The icon turns amber when less than 25% of the charge remains.
   - The icon flashes, followed by a system shutdown message when less than 5% of the charge remains.

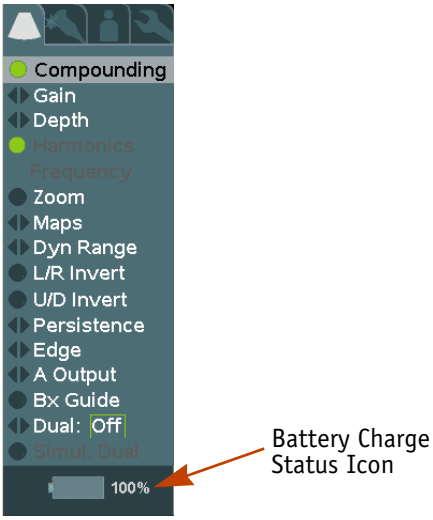


Figure 4-5. Scan Engine Onscreen Battery Charge Icon

2. Four battery charge LEDs on the front panel of the **Scan Engine** (see Figure 4-4) indicate the % of charge remaining as follows:
   - 4 LEDs illuminated: ≥75% of charge remains
   - 3 LEDs illuminated: 50–74% of charge remains
   - 2 LEDs illuminated: 25–49% of charge remains
   - 1 LED illuminated: <25% of charge remains

NOTE: The battery charge LEDs remain illuminated for approximately 10 seconds after the ultrasound system is powered ON. After 10 seconds, they turn off.

Another method for checking the amount of charge left on the battery is to fully remove the battery from the **Scan Engine**:

- Press the test button located on the back side of the battery.
- The number of LEDs that light up indicate % of charge remaining just as the LEDs on the **Scan Engine** front panel do (see above).

Scan Engine Battery Operating Range

Table 4-1. Battery Operating Range

Usage	Duration
Active use	~ 30 – 40 minutes (depending on modes and display brightness)
Sleep when idle (Standby mode)	~ 1 hour
Storage mode (in **Scan Engine**)	~ 3 weeks

Scan Engine Battery Level Messages

Table 4-2. Battery Charge Level Messages

Battery Level	Onscreen Message	Corrective Action
<25%	■ Less than 25% Charge Remains	Timed out message only
<10%	■ Less than 10% Charge Remains. Plug-in Or Dock Z.ONE To Charge Battery	Timed out message only
< 5%	■ System Will Power Down In 1 minute. Plug-in Or Dock Z.ONE To Continue Imaging ■ Battery dangerously low. Shutdown pending.	Message cancels if user does not acknowledge message after 30 seconds. After 1 minute system will shutdown
< 3%	■ Battery charge is too low to support imaging. Please charge the battery. Shutting down now.	Message up for 5 seconds. System shuts down immediately.

WARNING: Battery Thermal Protection
To protect the **Scan Engine** battery from potential thermal damage, the System monitors the temperature of the battery at all times. If the battery exceeds the maximum safe operating temperature, a warning message will appear on the **Scan Engine** LCD monitor.

The Operator should immediately complete all active operations because the System is about to shut down.

Scan Engine Battery Charger

The **Scan Engine**'s internal battery is recharged during normal use when the **Scan Engine** is docked on the **SmartCart/SmartCart *sp***, and the Cart is plugged into an AC power outlet.

During standalone (undocked) operation, the **Scan Engine** requires battery replacement after approximately 1 hour of continuous use.

The user can recharge the battery using the Battery Charger. The Battery Charger has two functions:

- Charge the battery
- Recalibrate and fully recharge the battery

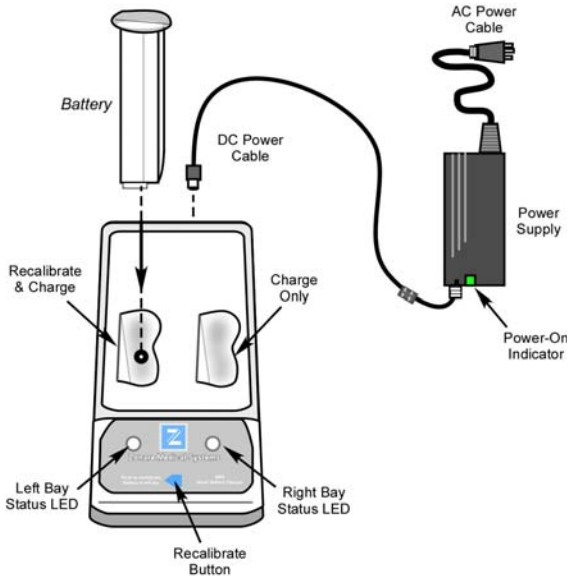


Figure 4-6. Scan Engine Battery Charger

▶ *To Charge a Battery*

Refer to Figure 4-6 as you read the following instructions.

1. Connect the AC power cable of the Battery Charger's power supply to an active wall outlet.
2. Connect the DC power cable of the Battery Charger's power supply to the Battery Charger.
3. Insert the battery into the either bay of the Battery Charger.
4. Charging of the battery will begin. While charging, the status LED for that bay will flash GREEN.
5. When the battery is fully charged, the status LED becomes solid **GREEN** (no flashing). (See also Table 4-3.)

NOTE: You can place two batteries for recharging in the Battery Charger at the same time. The charger will recharge them sequentially, fully charging one battery before charging the other battery.

▶ *To Recalibrate a Battery*

1. Connect the Battery Charger's AC and DC power cables as described for charging a battery (above).
2. Insert the battery into the LEFT bay of the Battery Charger only (see Figure 4-6). You cannot recalibrate a battery if placed in the other bay.
3. Press the **Recalibrate** button on the Battery Charger. Recalibration will begin.
4. During recalibration, the left status LED will flash ORANGE.
5. When the battery is fully recalibrated, the left status LED will flash **ORANGE** and **GREEN** (see also Table 4-3).

NOTE: Recalibration may take 14 hours. Do not remove the battery before recalibration is complete because the battery charge will be at an unknown level.

Table 4-3. Battery Charger LED Status Indicators

Status LED Condition	LED	Definition
OFF		No battery pack detected in bay
ORANGE – "Flashing"		"Recalibration" of battery pack in progress
ORANGE/GREEN – "Flashing"		"Recalibration" complete (fully charged)
GREEN – "Flashing"		"Charging" of battery pack in progress
GREEN - Solid		"Charging" of battery pack complete
ORANGE - Solid		"Standby" – Battery in bay, waiting to be charged
RED – "Flashing"		ERROR: - Ensure no foreign objects are in bays - Inspect battery pack for defective condition - Battery temp has exceeded 65°C (149°F)

AC Power Adapter

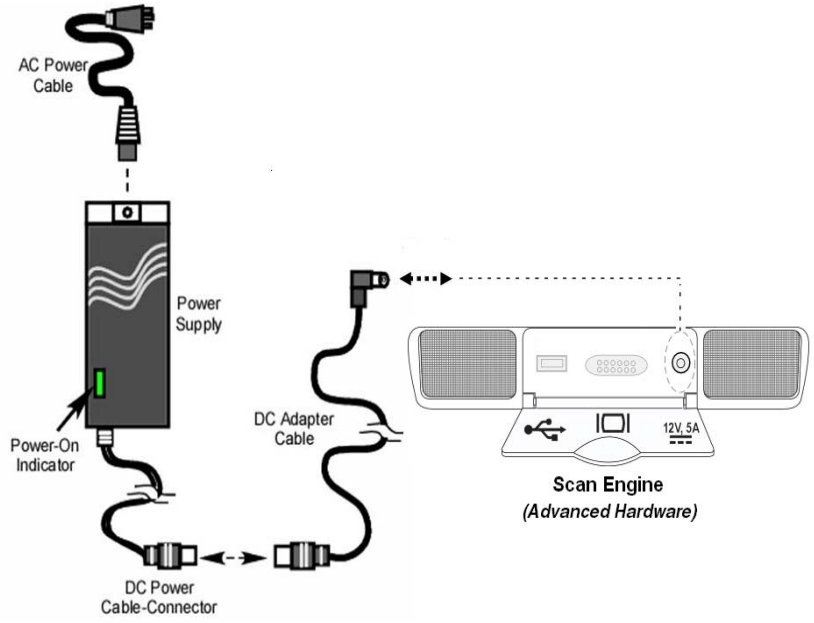


Figure 4-7. AC Power Adapter

The **Scan Engine** AC Power Adapter enables use of the undocked **Scan Engine** when the one-hour battery is not sufficient.

▶ *To Connect the AC Power Adapter*

Make sure the **Scan Engine** is undocked from the **SmartCart/SmartCart *sp***. Refer to Figure 4-7 as you read the following instructions.

1. Power OFF the **Scan Engine**.
2. Connect the DC Adapter Cable to the +12VDC connector of the **Scan Engine**.
3. Connect the DC Power Cable-Connector to the DC Adapter Cable.
4. Plug the AC Power Cable into the Power Supply.
5. Plug the other end of the AC Power Cable into an AC wall outlet.
6. Check the Power-On Indicator on the Power Supply. If it is lit, the Power Supply is successfully connected to the **Scan Engine**.
7. Power on the **Scan Engine** and begin normal operation.

Scan Module

The **Scan Module** serves as the main processing device for the **z.one *ultra*** Ultrasound™ System and the **z.one *ultra sp*** Ultrasound™ System (see Chapter 2). For either cart to function, the **Scan Module** must be docked on the docking deck.

Figure 4-8. Scan Module

Unlike the **Scan Engine**, the **Scan Module** has no separate LED display, battery, or user interface and is not convertible to a fully handheld, independently functioning ultrasound system.

5

Imaging Controls: Scan Engine

Scan Engine LCD Display

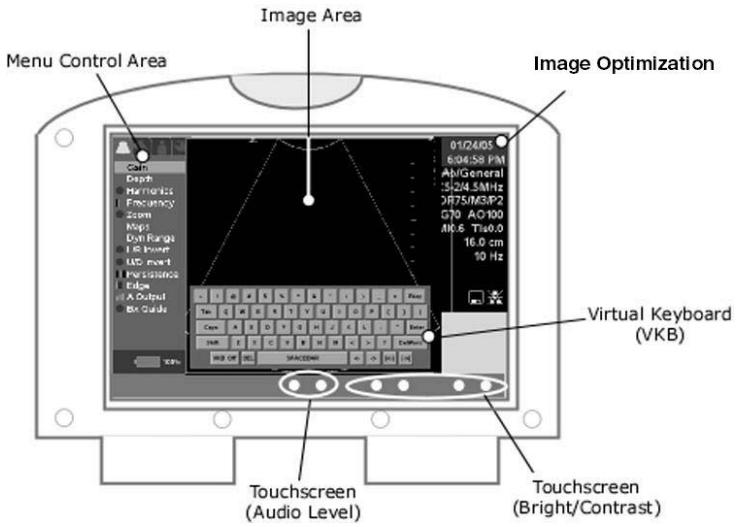


Figure 5-1. Scan Engine LCD Display

The **Scan Engine** LCD Display is divided into:

- Image area (center)
- Menu Control area (left)
- Image Optimization area (right)

The screen displays image, patient, and information areas as shown in Figure 5-1. The active onscreen menu displays in the **Menu Control** area.

Virtual Keyboard (VKB)

A touchscreen keyboard, called the virtual keyboard (**VKB**), can be displayed on the **Scan Engine** LCD Display.

Figure 5-2. Scan Engine VKB

▶ *To Display the Scan Engine VKB*

1. Go to **Tools | Annotate | Text** and press **Select**.
2. The green text cursor appears at the default **Home** position and the virtual keyboard (**VKB**) displays.

The **VKB** enables the user to make standard alphanumeric data entries when the **Scan Engine** is being operated undocked. It is used for all functions requiring user data entry. Free-text annotations and other text/data entries (e.g., patient data entry and system configuration data entry) are inserted by touching virtual alphanumeric keys on the Touchscreen with the stylus. The bezel surrounding the display includes additional touchscreen functionality, including adjustments for brightness, contrast, and audio volume.

User Controls

Scan Engine Control Panel

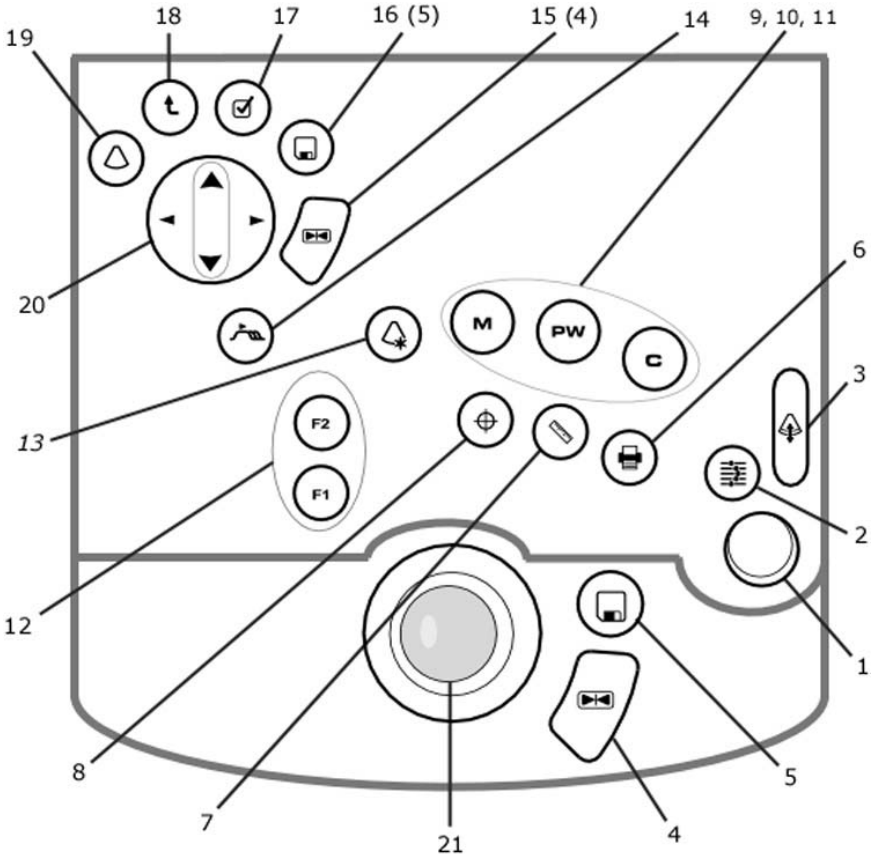


Figure 5-3. Scan Engine Control Panel

Table 5-1. Scan Engine Control Panel: Buttons and Functions

Number	System Control	Description
1	**GAIN**	There are two options: ■ Controls the overall gain for the active mode: B, M, Color, PW ■ Adjusts the DGC for the selected region when the virtual DGC graphic is displayed
2	**DGC**	Turns on the virtual DGC graphic
3	**DEPTH**	There are two options: ■ Adjusts the imaging depth shown on the display ■ Changes the selected DGC region when the virtual DGC graphic is displayed
4, 15	**FREEZE**	Halts or restarts active imaging

Table 5-1. Scan Engine Control Panel: Buttons and Functions (Continued)

Number	System Control	Description
5, 16	**STORE**	Stores current still image, or clip store sequence, to device(s) previously specified in System Setup menu (internal compact flash, DICOM printer, DICOM store). When external printer is selected, button press also initiates external “print trigger” signal to the external printer
6	**PRINT**	Prints the current images (s) to selected printer, by initiating an external “print trigger” signal. **NOTE:** The PRINT button may also be configured to initiate the same storage operations as the STORE button.
7	**MEASURE**	**Single-Press**: Brings up dynamic caliper (live) or calculation menu (frozen). **Double-Press**: In PW Doppler mode, turns on **Auto-Dop Trace** function
8	**SET**	Used to toggle the currently selected item/ function on-screen
9	**C**	COLOR (Doppler) mode, activates/deactivates
10	**PW**	PULSED WAVE (Doppler), activates/deactivates
11	**M**	M-MODE (tissue motion), activates/deactivates
12	**F1, F2**	Function keys, user configurable in System Setup menu
13	**OPTIMIZE**	Enables **AutoOpt** (Auto DGC) and **Sound Speed Correction** *(Option)*
14	**TAB**	Advances through the four (4) on-screen main menus (Imaging, Presets, Patient Info, Tools)
15, 16	**see items 4 and 5 above**	
17	**SELECT**	Activates/selects the currently highlighted selection in the on-screen menu
18	**BACK**	Returns back one window, in the on-screen display menu
19	**MODE**	Brings up the active scanning mode (C, PW, M) selection screen

Table 5-1. Scan Engine Control Panel: Buttons and Functions (Continued)

Number	System Control	Description
20	**Menu Control**	Functions like a computer mouse or joystick, for scrolling through the on-screen menu selections Up/Down arrows scroll to selections Left/Right arrows toggle through values
21	**Trackball**	Used for positioning the cursor, defining size/position of ROI in color mode, positioning measurement tools, reviewing clip store images and navigating form/tables/worksheets/reports

System Navigation

▶ *To View Main System Menu*

NOTE: All users must be familiar with the following procedures.

1. Press **Menu Control** to view the main System menu.

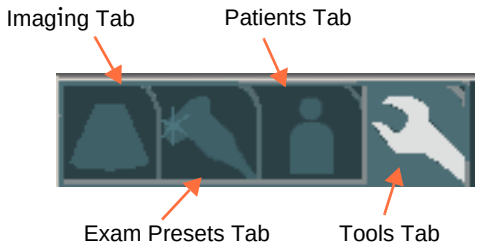


Figure 5-4. Main System Menu and Tabs - Tools Tab is Highlighted

▶ *To Navigate System Menus*

1. Press the **Tab** button to move to and highlight the tab you want. In Figure 5-4, the **Tools** tab is highlighted.
2. Press the **Select** button. A menu appears. (Figure 5-5 shows the **Tools** menu, which displays after tabbing to the **Tools** tab and pressing **Select**.)
3. To choose a selection on the menu (e.g., **Preset Admin** or **System Setup**), press the up/down arrows on **Menu Control** to highlight the selection. Then press **Select**.

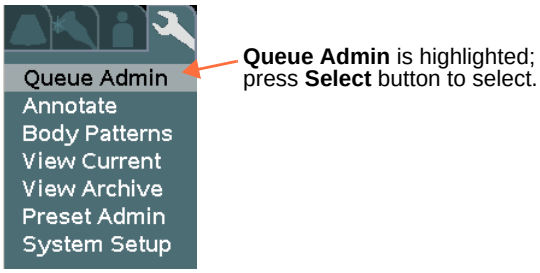


Figure 5-5. Scan Engine Tools Menu

NOTE: In some cases, a submenu will appear. **System Setup**, for example, has a submenu (Figure 5-6), and the submenu items have further submenus. All menus and submenus are navigated in the same way.

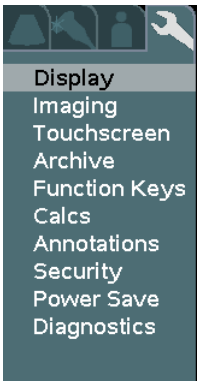


Figure 5-6. System Setup Submenu

4. If a menu item has further options, it will be preceded by left/right arrows and the final letter(s) will be in a **GREEN** box (see Figure 5-7).
   - Press the **Menu Control** left/right arrows to cycle through the options.

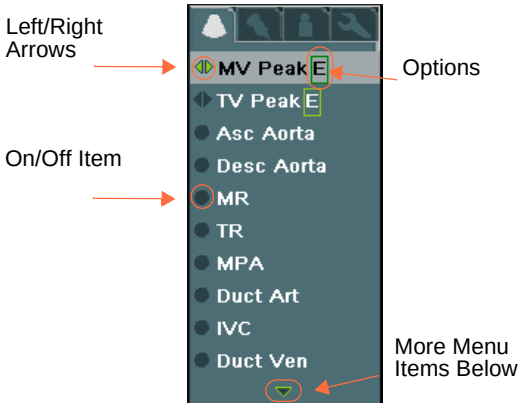


Figure 5-7. Menu Items with Options and Items Below

5. If there are more menu items below, a **GREEN** down arrow will be present at the bottom of the menu (Figure 5-7).
   - Press the **Menu Control** down arrow to view the additional items.

6. For **ON/OFF** selections (Figure 5-7), highlight the item using the **Menu Control** up/down arrow keys and press **Select** to toggle the control ON/OFF.
7. To return to the previous menu, press the **Back** button.

Menu Icons

Table 5-2. Menu Icons

Icon	Control	Selection and Action
ON OFF	**ON/OFF**	Press **Select** button to toggle between ON/OFF states. The icon is green in the ON state.
	Factory Preset	Press **Select** to toggle between ON and OFF states. Used in the **Preset** menu only.
	Incrementable/ Decrementable function	Press **Menu Control** left\right arrows to cycle through options associated (highlighted) with the function.
	More Menu Items Below	Press **Menu Control** down arrow to view the additional items.

Tabs

On the **Scan Engine** are four **Tabs** representing the top-level menus: imaging modes, exam presets, patient information, and system tools (see Figure 5-4). Repeatedly press the **Tab** button to select the **Tab** you want.

Imaging Tab

The **Imaging** tab menu lists the controls available in the active imaging mode. 2D (B-mode) imaging is the system default, so the **Imaging** tab displays the 2D menu by default.

Presets Tab

Presets are a complete set of imaging parameters optimized for a specific exam type. The **Presets** menu is a convenient way to switch from one to another of the **Presets** defined for the exam type.

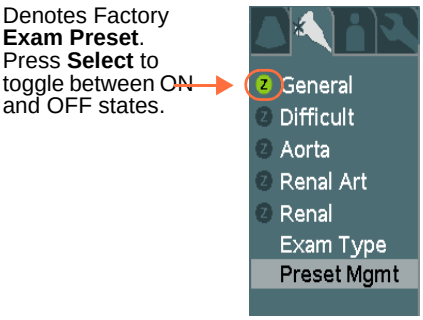


Figure 5-8. Presets Tab Menu

Patient Tab

The **Patient** tab allows access to patient demographic information. Use the **Patient** tab to view the **Patient Information** form (see "Patient Information Form" on page 7-1). Select **Exam Type** and **Preset** when beginning a new study.

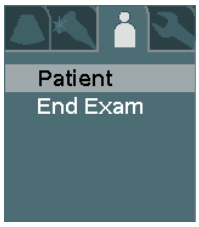


Figure 5-9. Patient Tab Menu

Tools Tab

Figure 5-10. Tools Tab

The **Tools** tab provides access to a wide range of system setup and maintenance procedures.

6

Transducers and MTP Option

ZONARE Transducers

NOTE: See “Transducer Maintenance” on page 14-20 for information on maintaining, cleaning, and disinfecting all ZONARE transducers except the P8-3TEE transducer. For the TEE transducer, see page 6-14.

ZONARE transducers are lightweight and have a number of ergonomic features to maximize their ease of use, including tactile orientation markers and grip ridges. Transducer holders on both sides of the **SmartCart/SmartCart *sp*** provide safe and accessible storage.

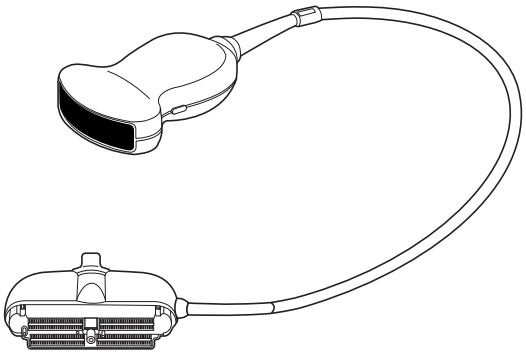


Figure 6-1. Transducer

Connecting/ Disconnecting

All ZONARE transducers connect directly to the **Scan Engine/Scan Module**. You can connect or disconnect a transducer while the **SmartCart/SmartCart *sp*** or **Scan Engine/Scan Module** is ON or OFF.

NOTE: If your system has the optional Multi-Transducer Port (MTP), go to page 6-3.

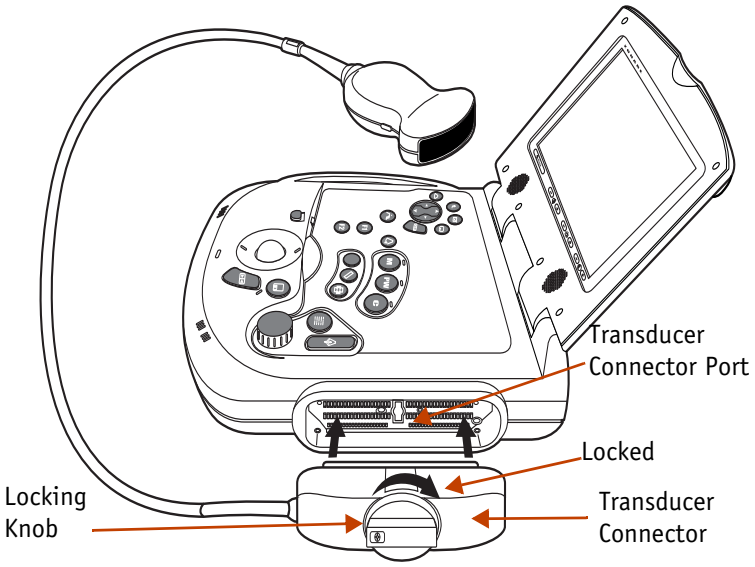


Figure 6-2. Scan Engine and Transducer

▶ *To Connect a ZONARE Transducer*

NOTE: Refer to Figure 6-2 as you read the following instructions. The Transducer Connector Port on the **Scan Module** is exactly the same as on the **Scan Engine**.

1. Inspect the transducer (face, housing, cable, connector) for damage.

WARNING: Inspect transducers before each use. Do not use transducers if damaged.

WARNING: Bent, broken, or missing pins on the transducer connector may cause poor image quality, including possible mirror image artifact. Be sure to check pins before connecting transducer to the ZONARE ultrasound system. If pins are bent, broken, or missing, do not use the transducer and call ZONARE Technical Support.

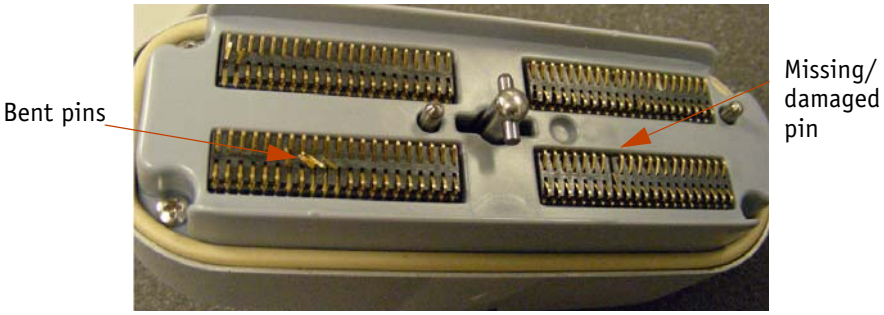


Figure 6-3. Bent, Broken, or Missing Pins on Transducer

2. Insert the Transducer Connector into the **Scan Engine/Scan Module**'s Transducer Connector Port. Ensure it is fully seated.
3. Turn the Locking Knob on the Transducer Connector one-quarter turn clockwise to lock the transducer in place.
4. If properly connected to the System, the LCD monitor will display the message **Initializing transducer**.
5. After ~10 seconds, a basic 2D (B-mode) image will display on the screen. The transducer is ready for scanning.

▶ *To Disconnect a ZONARE Transducer*

1. Turn the Locking Knob on the Transducer Connector one-quarter turn counterclockwise.
2. Remove the Transducer Connector from the Transducer Connector Port.
3. The message **No transducer connected** will display on the screen if user is in live imaging mode.

NOTE: To store the transducer, place it in the transducer connection holders on the **SmartCart/SmartCart *sp***.

Multi-Transducer Port Option

SmartCart/SmartCart *sp* systems with the optional Multi-Transducer Port (MTP) are able to simultaneously connect up to 3 separate transducers at one time.

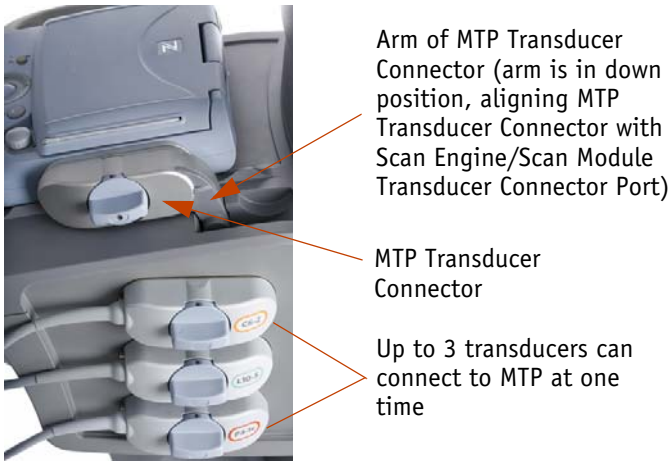


Figure 6-4. Multi-Transducer Port (attached to Scan Engine)

To Connect MTP to Scan Engine/Scan Module

1. Slide the arm of the MTP Transducer Connector (Figure 6-4) down to align it with the Transducer Connector Port on the **Scan Engine/Scan Module** (Figure 6-2).
2. Press the MTP Transducer Connector towards the Transducer Connector Port until the connector is fully seated.
3. Turn the Locking Knob on the MTP Transducer Connector one-quarter turn clockwise to lock it in place. If properly connected you will hear a clicking sound as the **Scan Engine/Scan Module** initializes the MTP.

To Disconnect MTP from Scan Engine/Scan Module

1. Turn the Locking Knob on the MTP Transducer Connector one-quarter turn counterclockwise to unlock the MTP Transducer Connector from the Transducer Connector Port on the **Scan Engine/Scan Module**.
2. Swing the MTP arm up and away from the **Scan Engine/Scan Module**.

To Activate MTP Transducer Softkeys

1. Press the **Transducer** button (see Table 3-1 on page 3-2). The transducer softkeys will display.
2. To activate the desired transducer, press the corresponding transducer softkey.

Figure 6-5. MTP Transducer Softkeys

Transducer Protective Sheath

▶ *To Apply a Transducer Protective Sheath*

IMPORTANT: For the protection of both the patient and healthcare worker, sonographers should be properly gloved throughout the entire procedure when performing ultrasound examinations.

NOTE: ZONARE recommends the use of a market-approved sterile protective sheath. Follow the user instructions for the particular sheath.

1. Remove the sheath from its packaging.
2. Apply water-based ultrasound gel to the inside of the sheath.
3. Pull the sheath securely over the transducer and remove any wrinkles or air bubbles.
4. Secure the sheath to the transducer with plastic bands.

IMPORTANT: ZONARE recommends the use of sterile/pyrogen-free protective sheaths to ensure safe and effective operation during invasive exams (i.e., intraoperative, transvaginal, transrectal, and transesophageal) and to prevent the transmission of disease (i.e., Creutzfeldt-Jacob disease) during intraoperative neurological examinations. For further information on transducer proper care, see “Transducer Maintenance” on page 14-20.

IMPORTANT: To prevent the spread of infectious disease, use a disposable transducer cover. If a sterile transducer cover becomes compromised during an application involving a patient with Creutzfeldt-Jacob and/or other infectious disease, follow the guidelines of the US Centers for Disease Control and the World Health Organization’s publication: WHO/CDS/APH/2000/3, WHO Infection Control Guidelines for Transmissible Spongiform Encephalopathies. This may result in having to destroy the transducer if cross-contamination is possible.

ZONARE recommends CIVCO protective sheaths. To order, go to www.civco.com/ultrasound/endo_cover. For information about infection control when using a CIVCO protective sheath, go to www.civco.com/customer_support/customer_tools/ultrasound/Why_use_a_cover.pdf. See also “Cleaning and Disinfecting Transducers” on page 14-21.

CAUTION: Please refer to the FDA's Medical Alert on latex products (FDA 1991) prior to use of a protective transducer sheath.

Biopsy Guide

▶ *To Attach a Nondisposable Biopsy Guide (E9-4 Transducer Only)*

IMPORTANT: To avoid cross-contamination of infectious disease, follow the manufacturer’s instructions for use, disinfection, and/or sterilization of reusable needle guides. See also “Cleaning and Disinfecting Transducers” on page 14-21.

1. Read the information supplied with the biopsy guide.
2. Apply a sterile transducer cover as described in the preceding section.

3. Attach the sterile needle guide over the transducer cover.
4. To activate the onscreen needle guide graphics:

SmartCart/SmartCart *sp*	Press **Bx Guide** (top row of keyboard).
Scan Engine	Activate the **Imaging** tab. On the 2D (B-mode) menu, select **Biopsy Guide**.

NOTE: The relative path of the needle is displayed between the two lines on the B-Mode image. Refer to the instructions that came with the biopsy guide.

▶ *To Attach a Disposable Biopsy Guide (E9-4 Transducer Only)*

1. Apply a sterile transducer cover (see "Transducer Protective Sheath" above).
2. Attach the biopsy guide over the transducer cover. Make sure the biopsy guide is locked.
3. Apply another sterile transducer cover (optional).
4. To activate the onscreen needle guide graphics:

SmartCart/SmartCart *sp*	Press **Bx Guide** (top row of keyboard).
Scan Engine	Activate the **Imaging** tab. On the 2D (B-mode) menu, select **Biopsy Guide**.

The relative path of the needle is displayed between the two lines on the 2D (B-Mode) image. Refer to the instructions that came with the biopsy guide.

TEE Transducer (P8-3TEE)

The P8-3TEE transducer is a phased array 64-element transducer, mounted in a sealed tip at the end of a gastroscope. The transducer is intended for imaging of the heart through the esophagus and the stomach. Scan plane rotation is controlled by two push-buttons on the control handle and can be rotated from 0° to 180°. The wheels on the handle of the transducer control the deflection of the tip.

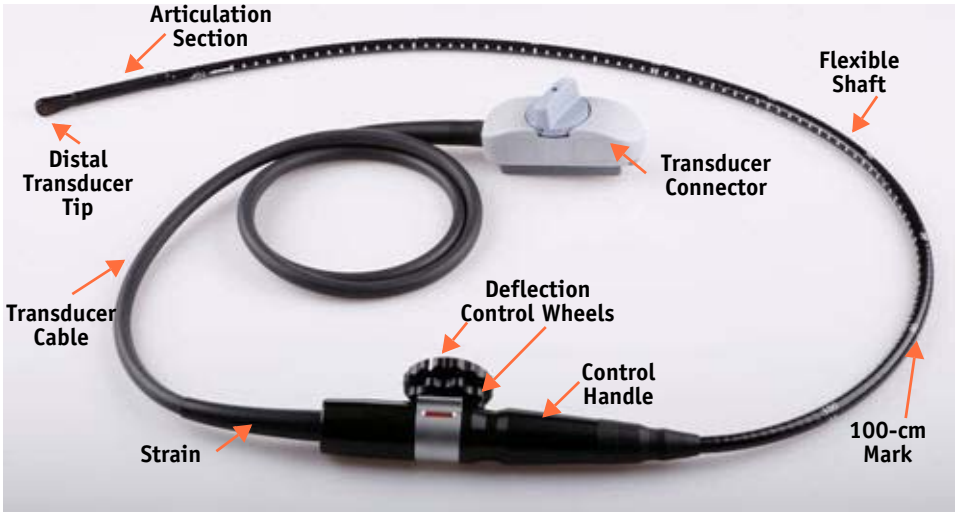


Figure 6-6. P8-3TEE Transducer

Intended Use

The physician conducting the examination must exercise sound medical judgement in the selection of patients for this transducer and be properly trained in endoscopic techniques as prescribed by current medical practices. The P8-3TEE transducer is intended to be used on adult patients.

The TEE examination is performed to give the physician a more extensive examination of the heart than could be obtained with standard transthoracic imaging. The transducer is inserted into the esophagus or stomach of the patient and is used to obtain 2-D, M-Mode, PW, CW, and Color Doppler images of the heart.

WARNING: The P8-3TEE transducer should be used only by a qualified physician who has received appropriate training in proper operation of the transducer and in endoscopic techniques as dictated by current relevant medical practices.

Visual Examination

Before use, visually examine and feel all portions of the transducer, especially the gastroscope shaft and the flexible section at the distal end of the gastroscope. Inspect the flexible section with the transducer deflection both straight and deflected. There should be no discontinuities, bumps, dents, holes, abrasions, bite-marks, or any other evidence of wear or damage found.

The hard plastic section at the distal end of the transducer should be smooth and firmly attached to the gastroscope shaft.

The cable and the connector that attach the transducer to the ultrasound console should be free from evidence of damage.

Check the proper mechanical operation of the transducer. Rotate the scan plane with the push-buttons on the handle (see “Transducer Scan Plane Rotation Control” on page 6-11). Make sure the rotation is smooth for all scanplanes. Deflect the tip in both anterior/posterior and left/right flexon using the deflection control wheel on the handle (see “Friction Lock Operation” on page 6-10). Make sure the deflection operates smoothly.

WARNING: Any visible evidence of damage or improper mechanical operation indicates the transducer cannot be used and should be returned to ZONARE for evaluation and repair. See page 15-1 for contact information.

General Safety

NOTE: See also the **Safety Manual**.

- The multiplane TEE transducer should be used only by a qualified physician who has received appropriate training in proper operation of the transducer and in endoscopic techniques as dictated by current relevant medical practices.
- The multiplane TEE transducer is a precision instrument that must be handled with care. It may be damaged when dropped or abused. In particular, do not allow the acoustic window in the tip of the gastroscope to come into contact with a sharp object. Do not touch this window unnecessarily. Never exert force onto the acoustic window.
- The transducer connector is not watertight, and should always be kept dry. The control handle, although spray-watertight, should not be immersed.
- This equipment contains no operator serviceable components. To prevent electric shock, do not remove any covers or panels.
- Avoid forceful manipulations and excessive force in using the transducer that could result in patient injury.
- Withdraw the transducer only with the deflection control in the unlock mode and with the distal end straight.
- Never manually deflect the distal tip; use only the deflection control wheels.
- Do not kink, tightly coil, or apply excessive force on the transducer cable or shaft. Insulation failure may result.
- Under normal conditions at full acoustic power the temperature of the tip does not exceed 43°C. Be sure to check at least monthly that the temperature increase of the tip is within limits:
  - Connect the transducer to the ultrasound system.
  - Adjust the acoustic power to the highest value possible.
  - Select Color Doppler mode.
  - Wait for 2 minutes.
  - Feel at the distal end of the transducer if there is a temperature increase that could be harmful for the patient.

Preparation for Use

- Clean and disinfect the transducer described in “Cleaning & Disinfecting TEE Transducer” on page 6-15.
- Inspect the transducer as described in “Inspecting Transducer” on page 6-14.
- Connect the transducer to the transducer port on the side of the ultrasound machine. The transducer may need to be activated by the **Transducer** button on the **Control Panel**.
- For patient protection a sterile, single-use, latex sheath can be used.

CAUTION: Ensure that the sheath's sterile surface is maintained.

CAUTION: Devices containing latex may cause severe allergic reaction in latex sensitive individuals. Refer to FDA's March 29, 1991, “Medical Alert on Latex Products.”

- Place the biteguard on the gastroscope prior to transducer insertion for easy placement in the patient's mouth. The biteguard can also be placed in the patient's mouth before inserting the gastroscope and transducer.

WARNING: The use of a biteguard is mandatory. Failure to use the biteguard may result in damage to the transducer, which could result in a safety hazard. Damage to the transducer due to biting is not covered by the transducer's warranty.

- Apply a sufficient amount of water-soluble acoustic coupling gel on the transducer tip.

CAUTION: Only use water-soluble acoustic coupling gel. Other coupling gels containing ingredients like ethanol, mineral oil, iodine, lotions, lanolin, aloe vera, or methyl or ethyl parabenzoic acid can cause transducer damage.

- If used, place the latex sheath over the gastroscope shaft up to but not covering the handle. Rub the tip carefully to ensure that all air bubbles have been removed from the transducer's tip. In addition to the gel on the acoustic window, apply a sufficient amount of acoustic coupling gel on the outside of the sheath at the tip of the transducer.

CAUTION: Do not exert force on the acoustic window area.

Patient Selection

There are some considerations in patient selection for safe use of the transducer:

- Any history of esophageal disease, problems with swallowing, or reasons for not accommodating the transducer must be considered as well as the possible effects of other therapies the patient is undergoing concurrently.
- Patients with dentures should remove them before the procedure.
- The P8-3TEE transducer should not be used on children.

Deflection and Scan Plane Rotation Control

- The control handle has two wheels for deflecting the TEE tip. The handle is designed for one-hand operation of deflection and rotation of the TEE tip.
- The smaller lower wheel is used to control the transducer **Left/Right** tip deflection (see Figure 6-8). The larger wheel on top of the handle is used to control the transducer **Anterior/Posterior** tip deflection. Both wheels have a friction *lock* and *freely moving* mode.
- In the *locked* mode, the movement of the deflection wheel is restrained. This is used to hold the tip in a certain position.
  - A metallic ring around the body of the handle, which clicks ON/OFF, controls the lock of the **Right/Left** tip deflection.
  - A shifting bar in the larger knob controls the lock of the **Anterior/Posterior** tip deflection.
  - On the side of the control handle are two buttons used for rotating the scan plane counterclockwise and clockwise between 0° and 180°.

Tip Deflection Control

- The deflection control wheels found on the handle of the transducer control deflection of the transducer tip.

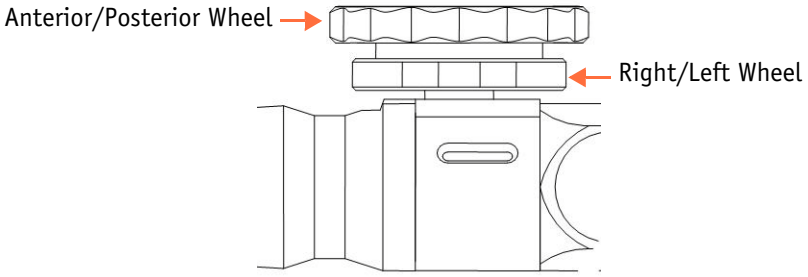


Figure 6-7. Tip Deflection Control Wheels

WARNING: Check if the maximum deflection of the tip is 90° to 120° upward, 60° to 90° downwards and 30° to 45° left/right. If the deflection shows an unwanted amount of free play or exceeds the maximal deflection (displaying a sharp “U- turn”), do not use the transducer. Contact a ZONARE service representative to report the problem.

Being aware of the tip deflection movement minimizes the risk of “folding over” or “U-turning” of the transducer in the patient. If you believe the transducer has folded over in the patient, make sure the wheels are in the unlock position and gently try manipulating the transducer. Try advancing the transducer into the stomach and attempt to straighten the folded over transducer and withdraw from the patient.

Friction Lock Operation

To protect the patient and the transducer, unlock the deflection controls when inserting or withdrawing the transducer. The friction lock is used for locking either the **Anterior/Posterior** or **Right/Left** TEE tip deflection.

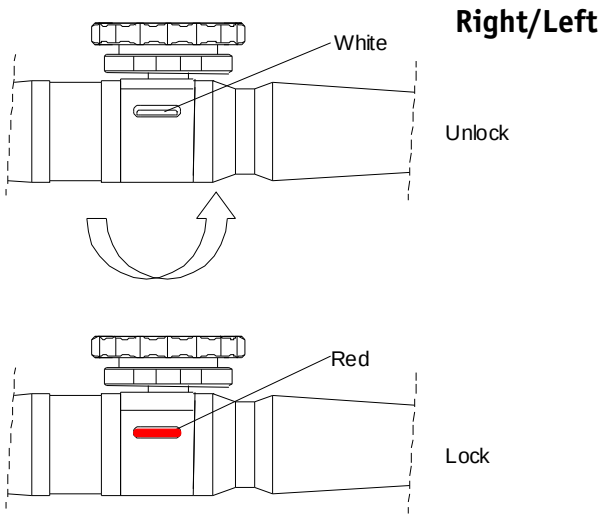


Figure 6-8. Friction Lock Operation - Right/Left

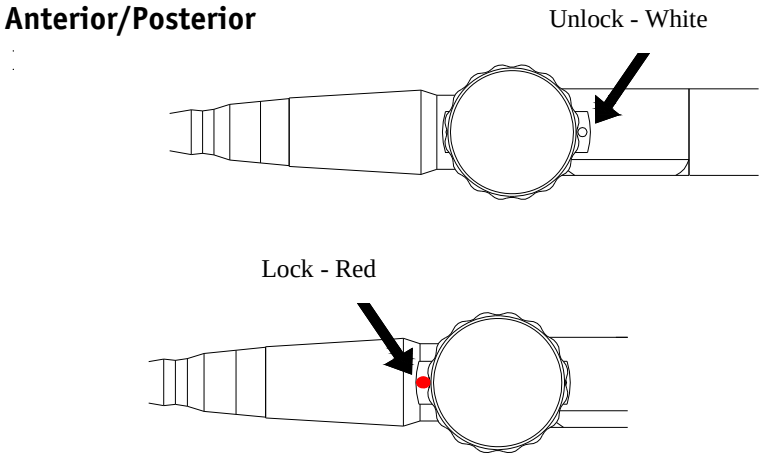


Figure 6-9. Friction Lock Operation - Anterior/Posterior

Transducer Scan Plane Rotation Control

The transducer scan plane can be rotated from 0° (transversal plane) to 90° (longitudinal plane) to 180° (transversal plane, left/right inverted). All planes in between can also be chosen (see Figure 6-10).

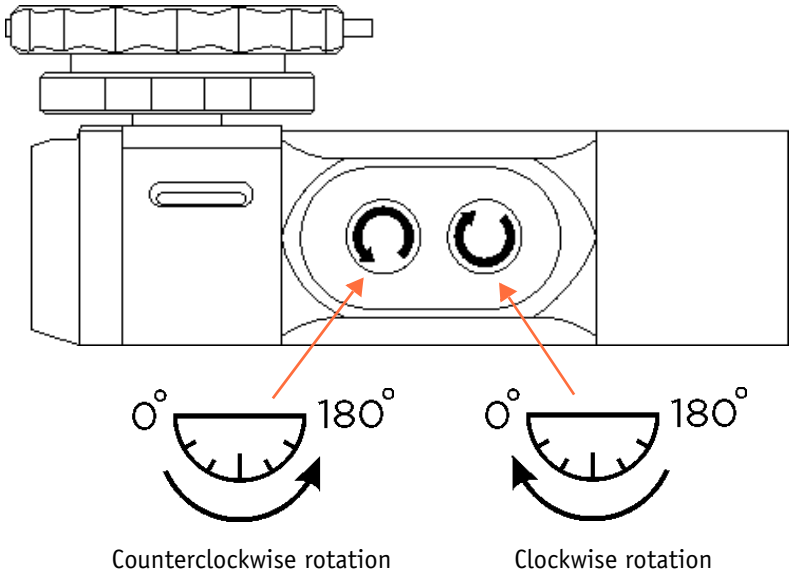


Figure 6-10. Scan Plane Rotation

Scan Plane Indicator

The transducer has a scan plane indicator that is continuously displayed on the ultrasound system monitor. It displays the scan plane orientation going from 0° to 180°.

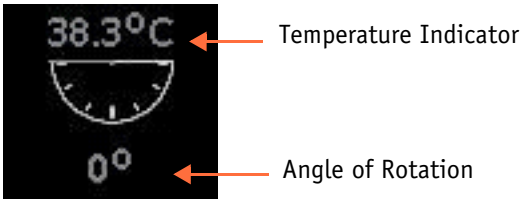


Figure 6-11. Scan Plane Indicator

Temperature Indicator

The transducer has a temperature indicator that is continuously displayed on the system monitor. Three upper limits of thermal temperature are displayed.

1. WARNING LEVEL – 40.5°C

- Temperature displays in WHITE between 40.5°C and 41.4°C

Figure 6-12. Temperature Indicator at 40.5°C

- Indicates scan plane temperature is increasing
- If image quality can afford some tolerance, lower **Acoustic Output** power
- TEE transducer is safe to use

2. THERMAL LIMIT REACHED – 41.5°C

- Temperature displays in YELLOW at 41.5°C

Figure 6-13. Temperature Indicator at 41.5°C

Figure 6-14. Temperature Warning at 41.5°C

- Image will freeze and display **Warning** in Figure 6-14
- Indicates scan plane temperature is increasing and approaching safety limit

- To lower temperature, freeze image for a short time or lower **Acoustic Output** power

3. MAXIMUM TEMP LIMIT EXCEEDED

Figure 6-15. Temperature Indicator When Max Temp Exceeded

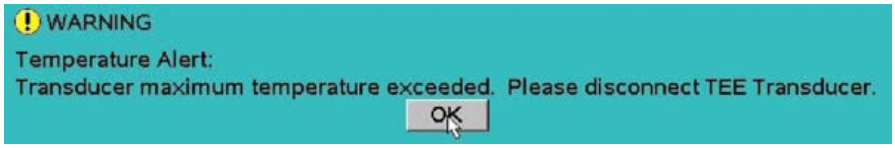
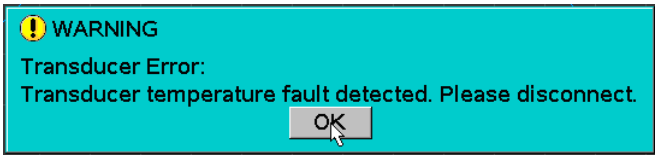


Figure 6-16. Temperature Warning When Max Temp Exceeded

- Image will freeze and display **Warning** in Figure 6-16.
- Click **OK** and disconnect TEE transducer. Wait a few minutes, then reconnect TEE transducer to MTP.
- Press TEE transducer softkey to reactivate transducer.
- If TEE transducer is cool enough, system will resume imaging.
- If TEE transducer is still too hot, system will display:



- Click **OK** and disconnect TEE transducer. Wait a few minutes, then reconnect TEE transducer to MTP.
- Press TEE transducer softkey to reactivate transducer.
- If TEE transducer is cool enough, system will resume imaging.

Examination

The actual examination with the P8-3TEE transducer is beyond the scope of this manual. There are many medical articles and books that thoroughly address this topic. There are however specific cautions that should be observed.

CAUTIONS

- Long-term exposure to ultrasound should be minimized. Although there have been no confirmed adverse effects produced by diagnostic levels of ultrasound, unnecessary patient exposure to ultrasound energy should be avoided, especially in the Doppler mode.

- Prolonged pressure on the esophagus by the tip of the transducer may lead to a *pressure necrosis* phenomenon. Thus, in monitoring applications, the tip should be removed from the esophagus wall when you are not scanning by releasing it in the neutral position. If continuous monitoring is required, the transducer tip should often be repositioned.
- Whenever active scanning is not desired 'freeze' the image and release the deflection control.
- Position the array so that good acoustical contact is made. Before rotating the array, actuate the friction ('brake') on the up/down movement. If this is not done, *rotating the array can mean loss of acoustical contact*.

TEE – Care and Maintenance

NOTE: The following sections are for TEE transducer maintenance only. See “Transducer Maintenance” on page 14-20 for information on maintaining, cleaning, and disinfecting all other ZONARE transducers.

Inspecting Transducer

WARNING: Regularly check transducer for signs of wear or damage. Inspect transducers at least weekly for the following problems:

- Cracks in case or transducer face.
- Cuts or gouges on any part of the transducer, case, cable, and connector.
- Cracks in the lens material on the transducer face.
- Any cracks or damage to the transducer connector.
- Proper mechanical operation of the transducer. Rotate the scan plane with the push-buttons on the handle. Make sure that the rotation is smooth for all scan planes. Deflect the tip in both anterior/posterior and left/right direction using the deflection control wheel on the handle. Make sure the deflection operates smoothly.
- Anterior/posterior and/or left/right deflection, which may, after prolonged use, develop an unwanted amount of free play. In that case, contact the service organization to readjust the tip deflection of the transducer. In this way, the risk of “buckling” or “U-turning” of the transducer in the esophagus is minimized.

WARNING: Inspect the transducer connector pins for any damage that might interrupt signal flow through the connection. Be sure to check pins before connecting transducer to the ZONARE ultrasound system (see Figure 6-3 on page 6-3). If pins are recessed, do not use the transducer and call ZONARE Technical Support.

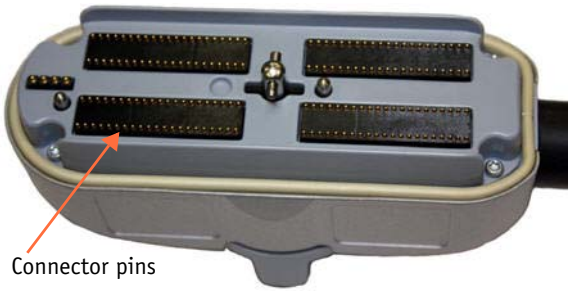


Figure 6-17. TEE Transducer - Connector and Pins

WARNING: Immediately replace a transducer that exhibits any damage.

Cleaning & Disinfecting TEE Transducer

NOTE: Do not use any cleaner or disinfectant on the transducer pins. A dry lint-free cloth can be used to wipe the pins or a lint-free cloth slightly dampened with an approved disinfectant. Never press the pins with your finger as the oils in your fingers could interrupt contact.

ZONARE recommends cleaning the transducer using the **Wipe Method** after each patient exam. The use of a soft cloth thoroughly moistened with an approved disinfectant is recommended for cleaning the strain relief, control housing, cable, and connector.

ZONARE recommends disinfecting the transducer using the **Immersion Method** after each patient exam. The use of a soft cloth thoroughly moistened with an approved disinfectant is recommended for cleaning the strain relief, transducer housing, cable and connector. ZONARE also recommends the use of either a sterile or nonsterile transducer cover/sheath when endocavity transducers are used.

NOTE: The transducers cannot be sterilized. When sterility is required, use a sterile transducer cover/sheath and sterile ultrasound/coupling transducer gel. Follow all sheath manufacturer prescribed techniques.

WARNING: Before cleaning any device, turn off the system and disconnect power cord from AC power source to avoid electrical shock.

WARNING: Always examine transducers for damage, such as cracks, splitting, holes, or fluid leaks. If damage is evident, discontinue use of the transducer and contact ZONARE Technical Support.

WARNING: Always use protective eyewear and clothing when cleaning or disinfecting the transducers.

WARNING: Do not allow the disinfectant to come in contact with metal surfaces (transducer connector). Use a soft cloth and warm soapy water to remove any disinfectant that remains on metal surfaces.

CAUTION: When a brush is used for cleaning the transducer, use only a soft brush; coarse/stiff-bristle brushes may cause transducer damage.

Cleaning

▶ *Wipe Method*

1. Disconnect the transducer from the Cart. If present, remove the transducer cover/sheath and discard.
2. Use a soft cloth dampened with a mild soap (Liquinox) and water solution to remove particulate, ultrasound coupling gel, or body fluids.
3. Next, ZONARE recommends the use of a disinfectant solution to wipe the strain relief, control handle, deflection wheel, push buttons, cable and transducer connector. Avoiding touching the internal pins with any cleaner. Follow the solution manufacturer's instructions for proper cleaning.

NOTE: A list of approved disinfecting solutions can be found later in this document

4. Air-dry (or towel dry) the transducer with a soft, clean cloth.
5. Examine the transducer for damage, such as cracks, splitting, holes, or fluid leaks. If damage is evident, discontinue use of the transducer and contact ZONARE Technical Support.

NOTE: The multiplane TEE transducer is a precision instrument that must be handled with care. It may be damaged when dropped or abused. In particular, do not allow the distal transducer tip to come in contact with a sharp object. Do ***not*** touch the ultrasonic window in the tip unnecessarily. Never exert force onto the window.

WARNING: Keep the control handle and transducer connector out of any cleaning or disinfection solutions. The control handle and cable may be cleaned with a damp cloth, but only the distal end of the transducer up to the 100-cm marker on the shaft may be placed into a disinfection solution.

Disinfecting

▶ *Immersion Method*

CAUTION: During immersion disinfection, never immerse transducers longer than 45 minutes. Damage may occur to the transducer housing and/or components if disinfection times exceed these recommended limits.

CAUTION: Using a nonrecommended cleaning or disinfectant solution, incorrect solution strength, or immersing the transducer deeper or longer than indicated can damage the transducer.

1. Follow the disinfectant manufacturer's recommendations for solution preparation, immersion time and rinsing.
2. Place the cleaned and dried transducer surface in contact with the disinfection solution. Take care that the flexible shaft is immersed up to no more than the 100-cm mark (see Figure 6-6).
3. Rinse the transducer tip and shaft with water and dry prior to storage.

WARNING: Do not use other disinfection methods like iodine, steam, heat, or ethylene oxide.

WARNING: The use of a biteguard is mandatory. Failure to use the biteguard may result in damage to the transducer, which could result in a safety hazard. Damage to the transducer due to biting is not covered by the transducer's warranty.

TEE Transducer Cleaning and Disinfecting Solutions

NOTE: Consult the manufacturer's *Instructions For Use* before using a TEE cleaner or disinfectant. For the latest list of TEE transducer disinfectants approved by ZONARE, go to www.zonare.com/products/accessories.

Cleaners (Wipe Method)

Cidezyme®/Enzol®	Prolystica® 2x conc. Enzymatic Presoak & Cleaner
Empower®	T-Spray™
Hycolin®	T-Spray II™
MetriZyme®	Wexcide 128

Disinfectants (Immersion Method)

Anioxyde 1000	Omnicide 14 NS®
Cidex ADS®	Omnicide 28®
Cidex Plus®	Perasafe®
Cidex OPA®	Steranios 2%®, 2% NGV, 2% ECS®
Gigasept AF®	TD-100™ & TD-5™
Gigasept FF®	Totacide 28
Korsolex® extra	Tristel One Day Concentrate (T1DC)
Metricide®	Virkon®
Metricide 28®	Wavicide-01®
Metricide Plus 30®	Wexcide 128
Metricide OPA Plus®	

Leakage Safety Testing

The leakage safety test is performed to evaluate the integrity of the transducer insulation that may become damaged from cuts or bites in the flexible shaft. Cuts or bites may cause serious electrical leakage that can be hazardous to the patient. Fluid can enter through the cuts and may cause mechanical and/or electrical problems.

NOTE: ZONARE recommends doing a leakage test after each patient exam to ensure patient safety.

Cidex® is a good electrically conductive medium that works well for testing the TEE transducer in the leakage tester. If Cidex or another disinfecting agent is used in the tester setup a Cidex-compatible soak tray should be used. BC Biomedical, the manufacturer of the leakage tester, has a Cidex-compatible soak tray available for purchase (BC Biomedical part number: BC20-42200). If Cidex is not used for the testing, a bath of 0.7% saline solution is also a suitable conductive solution for testing electrical leakage.

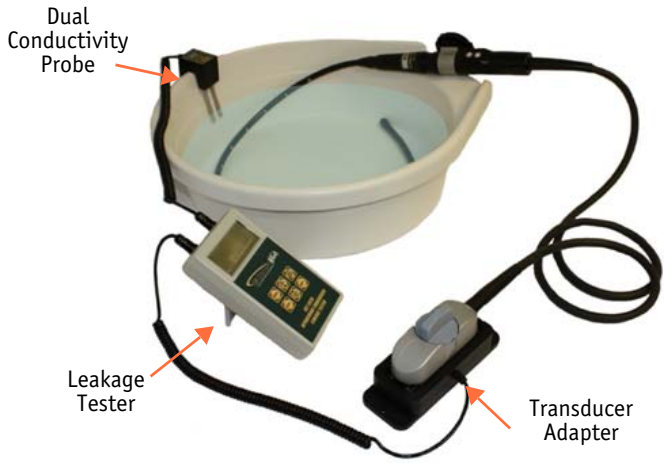


Figure 6-18. Typical Leakage Tester Setup

Leakage Test Setup

1. Fill soak tray or container that will be used for leakage tester with appropriate solution.
2. Connect dual conductivity transducer and adapter to the leakage tester.
3. Connect transducer to the adapter.
4. You can choose to use batteries or the AC adapter on the leakage tester. If using AC adapter plug this into the leakage tester.
5. Insert the transducer into the soak tray being careful not to go past the 100cm mark. Avoid having liquid go past the 100cm mark as this can damage the transducer electronics. The flexible shaft must be immersed at least to the 75cm mark to pass the minimum leakage current level.
6. The dual conductivity electrodes must be immersed into the soaking solution.
7. Power on the tester.
8. Verify that the display indicates **Zonare:TEE 230**
9. Press the **Full Test** button
10. The transducer is safe for use if the test window reads **Test Passed**.
11. If the test window says **Test Failed**, check the connections on the leakage set up and try testing again. See Figure 6-18 for proper connections to the leakage tester.
12. If the transducer is still registering **Test Failed**, check the transducer for damage and do not use on patients.
13. Contact ZONARE service (1-877-913-9663) for advice on how to further test the transducer or send it in for repairs.

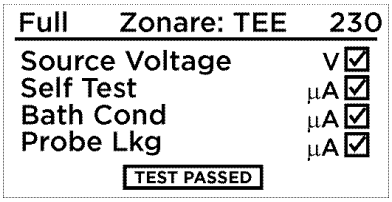
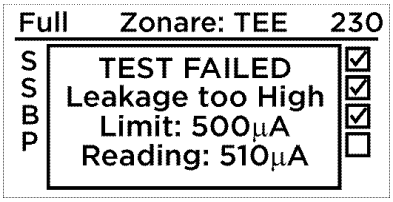
Figure 6-19. Leakage Tester

NOTE: The leakage tester comes already programmed from ZONARE. Please refer to the leakage tester user manual for any further adjustments.

Table 6-1. Leaker Tester Buttons and Screens

Button	Function
POWER	Powers the unit ON/OFF. When turned on, initiates with the **Main** screen.
FULL TEST ▲	Initiates the **Full System Test**, which includes both a bath conductivity test and a transducer electrical leakage test.
PRINT DATA SELECT	Selects the next available parameter.
MODE	Depress and hold this key to enter **SETUP** mode where configuration can be viewed and adjusted. When in **SETUP** mode, press to exit **SETUP** mode and return to previously viewed screen. Pressing **Mode** key also saves system settings to the internal **EEPROM** memory, retaining them even with the power turned off or battery removed.
▼ BATH TEST	Press to scroll down through the available settings.

Table 6-1. Leaker Tester Buttons and Screens (Continued)

	Press to **Reset** to the **Main** screen.
Leaker Tester Screens	
	

Storing the TEE Transducer

- Use great care when storing the TEE transducer.
- Make sure the transducer is adequately cleaned and disinfected prior to storage.
- Store in an adequately ventilated area or container.
- A wall mounted transducer hanger can also be used for storage. Make sure the transducer control handle, cable, and connector are adequately supported. The shaft should hang down freely.
- Always be sure to protect the transducer tip so that the acoustic lens is not damaged.
- Storage environmental conditions must fall within the following ranges:
  - Temperature: -10°C to 45°C
  - Humidity: 10% to 90%, noncondensing

Transporting TEE Transducer

The transducer can be stored in its original case for transport.

WARNING: Avoid damage to the transducer by allowing nothing to protrude beyond the case when closing the lid.

ViewFlex™ ICE Catheters (P9-3IC ICE Catheter)

The ViewFlex ICE Catheters connect to the **SmartCart** via the ViewFlex Catheter Interface Module. The ViewFlex Xtra ICE Catheter, ViewFlex PLUS ICE Catheter, and ViewFlex Catheter Interface Module are packaged, labeled, and supplied by St. Jude Medical Inc. (St. Paul, Minnesota). Please see the ***Instructions for Use*** supplied with these products for operational and safety information. Both versions of these catheters appear on the imaging screen as the **P9-3IC** transducer.

For basic instructions to connect ViewFlex ICE Catheters and the Viewflex Catheter Interface Module to the ultrasound system and begin ICE imaging, see the ***ViewMate™ Z Ultrasound System Quick Guide***.

Transducer Applications

NOTE: ZONARE transducers have a specific range of acceptable application use. Users are advised to restrict each transducer's use to those applications.

NOTE: For the latest information on biopsy guides approved by ZONARE, go to www.zonare.com/products/accessories.

Table 6-2. Transducers and Applications

Transducer	Biopsy Guide
A2CW **Applications:** Cardiac	**No**
A5CW **Applications:** Peripheral Vascular	**No**
C4–1 **Applications:** Abdominal Abdominal Vascular Obstetrics Fetal Heart Gynecology Contrast Agent Detection *New!*	**Yes** CIVCO Infiniti™ Needle Guidance System #698-013
C5–2 **Applications:** Abdominal Abdominal Vascular Obstetrics Fetal Heart Gynecology	**Yes** CIVCO Ultra-Pro II™ Needle Guidance System #698-003
C6–2 **Applications:** Abdominal Abdominal Vascular Obstetrics Fetal Heart Gynecology	**Yes** CIVCO Ultra-Pro II™ Needle Guidance System #698-003
C8-33D **Applications:** Obstetrics - 3D surface rendering & 3D multiplanar rendering (MPR)	**No**

Table 6-2. Transducers and Applications (Continued)

Transducer	Biopsy Guide
C9-3 **Applications:** 1st & 2nd Trimester Obstetrics Pediatric/Small Adult Abdomen Peripheral Vascular	**Yes** CIVCO Infiniti™ Needle Guidance System #698-009
C9-4t **Applications:** Abdominal Pediatric Neonatal cephalic Musculoskel (MSK) conventional&superficial Vet abdominal Cardiac pediatric Vet cardiac	**No**
C10-3 *New!* **Applications:** Neonatal Head Neonatal Abdominal Pediatric Echo Pediatric Abdominal General Cardiology	**No**
E9-33D (Endocavity) *New!* **Applications:** Obstetrics Gynecology	**None available**
E9-4 (Endocavity) **Applications:** Obstetrics Gynecology Prostate	**Yes** CIVCO Disposable Transvaginal Needle Guidance System #698-011 CIVCO Reusable Endocavity Needle Guidance System #698-002
L8-3 **Applications:** Peripheral Vascular Pediatric Hips Difficult Small Parts Needle Guidance	**Yes** CIVCO AccuSITE™ Needle Guidance System #698-005

Table 6-2. Transducers and Applications (Continued)

Transducer	Biopsy Guide
L10-5 **Applications:** Thyroid Breast Scrotum Pediatric Hips Peripheral Vascular Superficial Anatomy Ocular Needle Guidance	**Yes** CIVCO AccuSITE™ Needle Guidance System #698-008 CIVCO Ultra-Pro II™ Needle Guidance System #698-004
L12-4v **Applications:** Pediatric Small organ (thyroid, breast, testes, etc.) Musculo-skeletal (conventional & superficial) Peripheral vascular Vet/equine	**No**
L14-5sp **Applications:** Intraoperative Peripheral Vascular MusculoSkeletal Breast Thyroid Scrotum Superficial Anatomy Needle Guidance Ocular	**Yes** CIVCO AccuSITE™ Needle Guidance System #698-006
L14-5w **Applications:** Peripheral Vascular MusculoSkeletal Breast Scrotum Thyroid	**Yes** CIVCO AccuSITE™ Needle Guidance System #698-012 CIVCO Infiniti™ Needle Guidance System #698-007

Table 6-2. Transducers and Applications (Continued)

Transducer	Biopsy Guide
P4-1 **Applications:** Deep Abdominal Trauma Abdominal Vascular Obstetrics Fetal Heart Gynecology	**Yes** CIVCO Ultra-Pro II™ Needle Guidance System #698-001
P4-1c **Applications:** Transcranial Imaging Abdominal Vascular Cardiac Contrast Agent Detection *New!*	**No**
P8-3TEE **Applications:** Transesophageal Echocardiography	**No**
P9-3IC *New!* **Applications:** Intracardiac Echocardiography (ICE)	
P10-4 **Applications:** Neonatal/Pediatric Head/Abdomen Vascular Intraoperative Pediatric Cardiac	**No**

With the ZONARE Ultra ultrasound system, the L10-5, L14-5sp, P9-3ic, and P10-4 transducers are classified as Type-CF (Cardiac Floating). All other transducer types are Type-BF (Body Floating). The type can be easily identified by labeled symbols on the transducer system connector. Transducers built and tested to Type-CF are labeled with the “Heart-In-A-Box” symbol (IEC symbol 60417-5335). Transducers tested to Type-BF are labeled with a “Man-In-A-Box” (IEC symbol 60417-5333) (see “Symbols” in the **Safety Manual**). Earlier transducers labeled without these symbols are Type-BF. Type-CF is defined and regulated by International Medical Equipment Safety Standard IEC 60601 as having the most stringent of patient leakage current requirements. This classification is required for intraoperative applications that may contact the heart.

WARNING: To avoid injury to the patient, use only the Ocular Preset when performing imaging through the eye. The FDA has established lower acoustic energy limits for ophthalmic use. The system will not exceed these limits only if the Ocular Preset is selected. See the Safety Manual for information about the lower acoustic energy limits established for ophthalmic use.

CAUTION: Cardiac rhythm disturbances during perfusion studies using gas ultrasound contrast agents have been observed in the diagnostic range of MI values. See the specific *Instructions For Use* for the contrast agent being used for details.

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7

Imaging

Patient Information Form

The **Patient Information** form is the record of the exam (patient ID and demographic data, date and time of the exam, salient clinical details). It should be completed before imaging to select the correct transducer, **Exam** type, and **Preset** and to store scan images and study data in the correct exam directory.

If DICOM has been activated on the system, many data fields on the **Patient Information** page are completed automatically from the **DICOM Worklist** (see page 7-2).

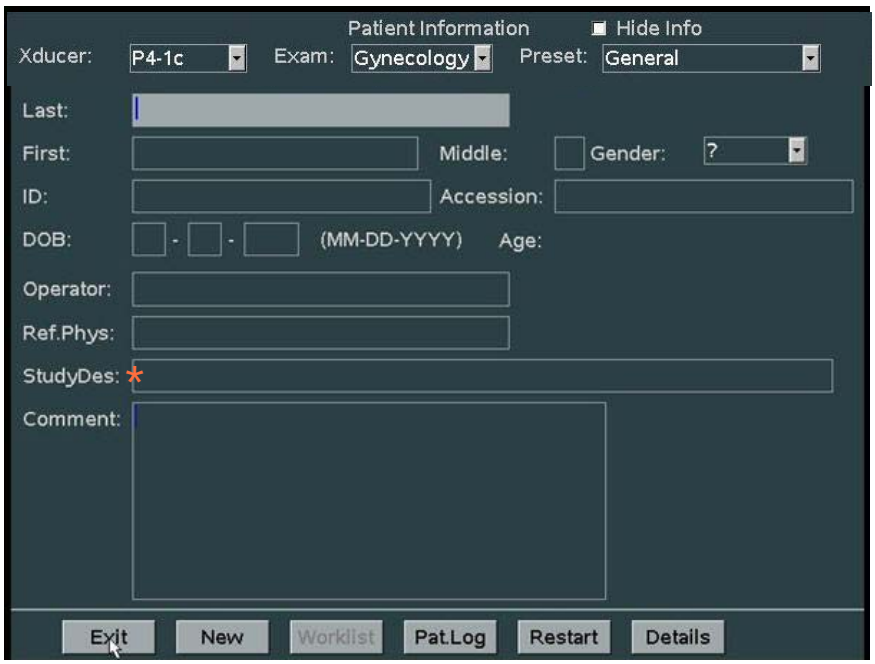


Figure 7-1. Patient Information Form

***** See "Study description option:" on page 11-38 for information on this feature.

Softkeys

The softkeys at the bottom of the **Patient Information** page have the following functions. Point with **Trackball**, and then press **Set** to activate the control.

- **Exit**: Saves and closes the **Patient Information** form. For a new exam, creates the exam directory. Activates imaging.
- **New**: Press to enter information for a new patient. System will display message: **Do you want to close the current exam? Yes** or **No**.
  - If you select **Yes**, exam in progress closes and data for that exam is saved. A blank **Patient Information** form displays for setting up a new patient.
  - If you select **No**, press **Exit** softkey and you will return to the exam in progress.
- **Worklist**: Displays the active DICOM **Worklist Selection Table** (Figure 7-2) if DICOM is configured and activated. When a new exam is initiated from the **Worklist**, some data fields on the **Patient Information** form are automatically completed from data in the **Worklist** entry.
- **Pat. Log**: Displays the **Exam Selection Table**, which is a list of all patients whose images are stored on the internal hard drive [**SSD (C:)**]. Populates the **Patient Information** form with the selected study's demographic data. This helps streamline workflow when creating another study on the same patient.
- **Restart**: Recalls a list of exams that meet the restart criteria. Restart interval is defined on the **Patient Exam Management** screen (Figure 11-19 on page 11-36).
- **Details**: Displays the current exam's **Study Description**, **Protocol Name**, and **Station Name**.

NOTE: See "Barcode Reader (Option)" on page 3-22 for entering patient ID numbers or accession numbers using a barcode reader.

DICOM Worklist

DICOM activation enables exam scheduling data to be transmitted to and displayed on the ZONARE ultrasound system.

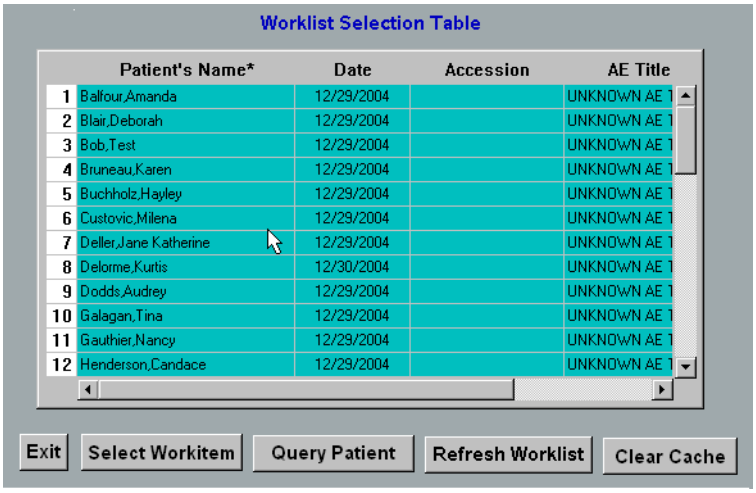


Figure 7-2. DICOM Worklist Selection Table

To quickly find a patient name in the **Worklist Selection Table**, click the **Query Patient** softkey. The **Patient Worklist Query** screen displays:

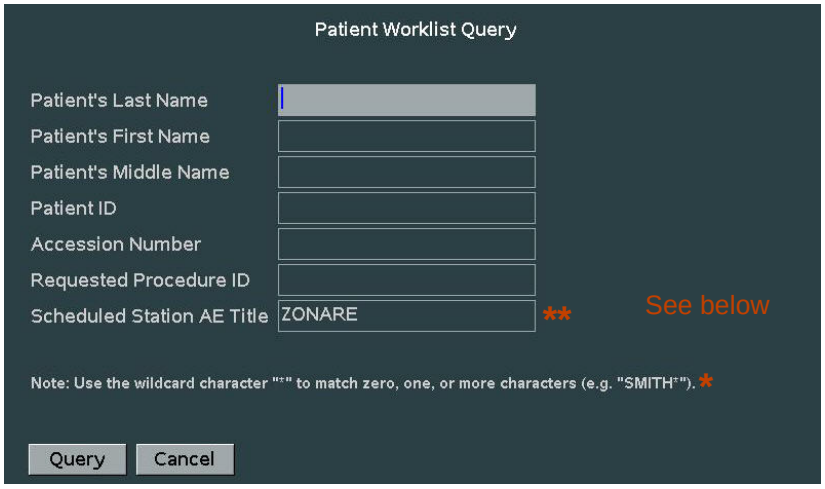


Figure 7-3. Patient Worklist Query Screen

1. Type in the **Patient's Last Name** in the field provided.

   ***** Wildcard Character (*): If you don't know exact spelling, begin typing a name, then type wildcard character to find names beginning with the letters you typed.

   **** Scheduled Station AE Title** = Filters the **Worklist** by scheduled station Application Entity (**AE**) title. Set according to department requirements.

- The user can view the interactive **Worklist**, i.e., a schedule of exams and patient data (Figure 7-2).
- A **Worklist** on the network is configured on the system to match the requirements of the department.

▶ *To Edit Patient Information Form*

The **Patient Information** form can be edited while the exam is open (i.e., within a calendar day of the beginning of the exam). In addition, you can **Restart** and edit the **Patient Information** form for any exam that was performed during the restart period specified on **Patient Exam Management** screen (Figure 11-19).

2. Highlight cells to edit. Use **Backspace** key to edit or **Tab** through to each cell to be edited.
3. To edit data fields (as required), use **Trackball** to position the cursor in the desired data field:

SmartCart/SmartCart *sp*	▪ To *delete text*: Use **Backspace** on keyboard to delete single characters. Highlight entire data field and use **Backspace** to clear entire data field. ▪ *To enter text*: **Tab** to cell. Use QWERTY keyboard to enter text.

Scan Engine	▪ *To delete text*: Use **Backspace** on **VKB** to delete single characters. Highlight entire data field and use **Backspace** to clear entire data field. ▪ *To enter text*: Use stylus on **VKB**.

4. When the **Patient Information** form is complete, select **Exit** or press **Freeze** to save the form and return to the image display.

Exam Basics: Begin, Close, Restart

NOTE: If DICOM is activated on your system, see "To Begin a New Exam From a DICOM Worklist" on page 7-5.

▶ *To Begin a New Exam*

1. Open a new **Patient Information** form (Figure 7-1):

SmartCart/SmartCart *sp*	Press the **New Patient** key on the upper left of the keyboard.
Scan Engine	Tab to the **Patient** tab, then select **New**.

2. **SmartCart/SmartCart sp with MTP option** – Select a transducer:

   a. Using **Trackball**, point to down arrow of **Xducer** data field. Press **Set** button to view drop-down list. Select desired transducer.

   b. On the list, point to the desired transducer and press **Set**.

   SmartCart/SmartCart sp without MTP – Go to Step 3.

3. Select the **Exam** type and **Preset**:

   a. Using the **Trackball**, point to the down arrow of the **Exam** data field. Press **Set** to drop down the selection list. Select the correct **Exam** type.

NOTE: The **Patient Information** form configuration may change, depending on the **Exam** type selected.

   b. After selecting the **Exam**, the **Presets** menu automatically drops down with the cursor on the first **Preset** of the menu. Select the desired **Preset**.

NOTE: The **Presets** menu will not appear unless a transducer is attached to the system. **Presets** are transducer-specific. Make sure the correct transducer is attached for the application.

NOTE: For those **Exam** types and **Presets** with calculation packages, selecting the correct **Exam** type and **Preset** activates the measurement and calculation packages.

WARNING: To avoid injury to the patient, use only the Ocular Preset when performing imaging through the eye. The FDA has established lower acoustic energy limits for ophthalmic use. The system will not exceed these limits only if the Ocular Preset is selected. See the Safety Manual for information about the lower acoustic energy limits established for ophthalmic use.

4. Enter patient demographic and clinical data:

SmartCart/SmartCart *sp*	Use the keyboard to enter text. Press **Tab** on the keyboard to advance to the next data field.
Scan Engine	View the **VKB** (Virtual Keyboard). Using the stylus, touch keys to enter text. Press **Tab** on the **VKB** to advance to the next data field.

NOTE: If you do not enter a patient ID on the **Patient Information** screen, the System *automatically* assigns the next available **ID** when the first image is stored.

5. To hide patient information data on the actively displayed images, select the **Hide Info** box at the top of the screen. The **Hide Info** feature will *not* display patient information. It will display **Date/Time**, **Institution**, and **Operator**.
6. Save and exit:
   a. Select **Exit** to save the **Patient Information** form and return to the image display.
   b. Verify that the patient's name and the correct **Exam** type and **Preset** display at the top of the Image area.

NOTE: You can also exit by pressing the **Freeze** key.

▶ *To Begin a New Exam From a DICOM Worklist*

1. Open a new **Patient Information** form as described above.
2. Press **Worklist** softkey. The open **Worklist** displays (Figure 7-2 on page 7-2).
3. To select desired patient exam:
   a. Using **Trackball**, point to **Worklist** entry for desired patient exam. Press **Set** once to highlight exam. Press **Set** again to select or highlight exam, then move cursor over **Select Exam** softkey and press **Set**.
   b. A **Patient Information** form displays. Patient demographic and some other data fields are automatically completed from information in the **Worklist** entry.
4. To complete the **Patient Information** form and make any necessary changes:

SmartCart/SmartCart *sp*	Use the keyboard to enter text. Press **Tab** on the keyboard to advance to the next data field.
Scan Engine	View the **VKB**. Using the stylus, touch keys to enter text. Press **Tab** on the **VKB** to advance to the next data field.

5. To save and exit:
   a. When the form is complete, select **Exit** or press **Freeze** to save the form and return to the image display.
   b. Verify that the patient's name and the correct **Exam** type and **Preset** display at the top of the Image area.

NOTE: For those **Exam** types and **Presets** with calculation packages, selecting the correct **Exam** type and **Preset** activates the measurement and calculation packages.

NOTE: Storing the first image opens a new exam. Storing the first image creates the exam directory on the internal storage media.

▶ *To Close an Exam*

SmartCart/SmartCart *sp*	Press the **End Exam** key on the keyboard or power OFF the System
Scan Engine	Select **New** on the **Patient Information** screen or power OFF the System

▶ *To Restart a Closed Exam*

See "Restarting an Exam" on page 11-20.

Presets

Presets are designed to optimize the ultrasound image for a particular application. Imaging **Presets** are **Exam** type-specific. To ensure optimal performance, always start by:

- Attaching an appropriate transducer for the application
- Selecting the appropriate **Exam** type
- Selecting the desired **Preset**

NOTE: For information on storing and backing-up **Presets**, see "Presets" on page 14-6 of this manual.

▶ *To Select a Preset (from Imaging Screen)*

SmartCart/SmartCart *sp*	Press **Exam Type** button and select desired **Preset**
Scan Engine	Go to **Preset** tab and select desired **Preset**.

▶ *To Create a New User Preset*

1. Attach the transducer that is appropriate for the application.
2. Press **Exam Type** button.
3. Select the factory-installed **Preset** to be modified.

NOTE: Choose a **Preset** that is the closest to your desired **Preset** parameters.

4. Press the **Menu** button.

   Modify any of the values on the factory-installed **Preset** by adjusting any system imaging parameters (user controls) to the values you wish to be stored in this new **User Preset**.

NOTE: Do this for each mode, i.e., B/2D, C, PW, M

5. Return to the **Presets** tab.
6. Select or highlight the **Preset Management** menu item.
7. Select **Create**.
8. Name the new **Preset**.
9. Click **Apply** on the screen to save the new **Preset**.

NOTE: You can name the new **Preset** the same name as the **Factory Preset.** The **Factory Presets** will have a **Z** icon next to the label. The **User Presets** will have a **dot** icon next to the label. These icons enable users to easily distinguish between **Factory** and **User Presets**.

▶ *To Modify an Existing Preset*

1. Attach the transducer that is appropriate for the application.
2. Press **Exam Type** button.
3. Select the **Preset** to be modified.
4. Press the **Menu** button.

   Modify any values on the factory-installed **Preset** by adjusting any system imaging parameters (user controls) to the values you wish to be stored in this new **Preset**.

NOTE: Do this for each mode, i.e., B/2D, C, PW, M

5. Return to the **Presets** tab.
6. Select or highlight the **Preset Management** menu item.
7. Select **Modify**. A window appears; click on **Yes**.

▶ *To Set a Default Exam Type and Preset*

1. Attach the transducer that is appropriate for the application.
2. Press **Exam Type** button.
3. Select the desired imaging **Exam Type**.
4. Return to the **Presets** tab.
5. Select the desired **Preset**.
6. Select the **Preset Management** menu item.
7. Highlight and select **Set Default.** This **Preset** is now the default for the selected exam type.

▶ *To Enable/Disable a Factory or User Preset in Menu*

NOTE: **Factory Presets** are identified by a Zonare **Z** inside the bubble to the left of their name in the main **Presets** menu. Customized **User Presets** can be identified by an empty bubble to the left of their name.

1. Press **Exam Type** button.
2. Ensure that the desired **Exam Type** is currently selected.

NOTE: If not, go to the **Presets** tab and select desired **Exam Type** prior to beginning the **Enable/Disable** steps below.

3. Select the **Preset Management** option.
4. Highlight and select **Enable/Disable** option. The **Enable/Disable Presets** screen displays.

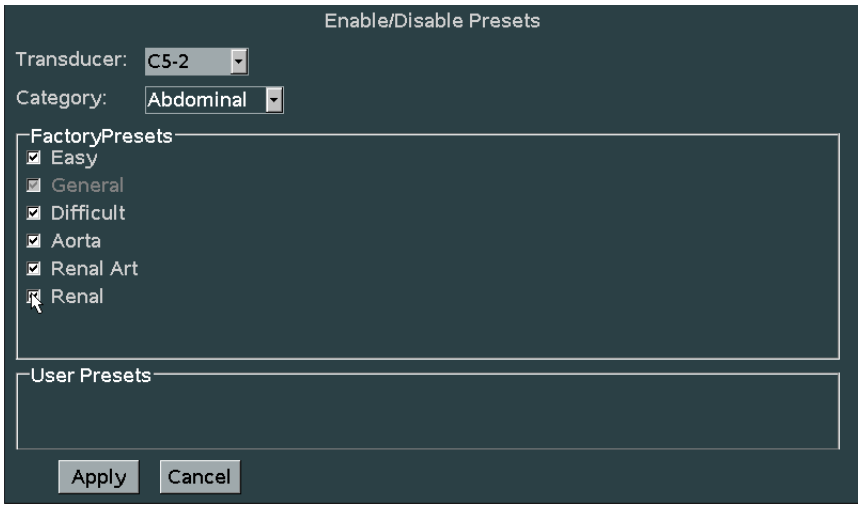


Figure 7-4. Enable/Disable Presets Screen

5. *Uncheck* the box to the left of any **Factory** or **User Preset** that you wish to **REMOVE** (disable) from the **Presets** menu. (In Figure 7-4, no **User Presets** have been configured.)
6. Highlight and select **Apply** to activate the new list. Only the checked **Presets** will display on the **Preset** list.

NOTE: You can enable/disable **Presets** for each transducer by selecting the transducer and **Exam Type** via the drop-down menus.

▶ *To Configure Softkey Display of Available Presets*

SmartCart/SmartCart *sp* workstations displays up to 6 **Exam/Preset** softkeys for the active transducer. You can customize the display of available **Exam/Preset** softkeys as described below.

1. Go to **Exam Type button | Preset Mgmt | Customize**.
2. The **Preset Customization Configuration** screen displays:

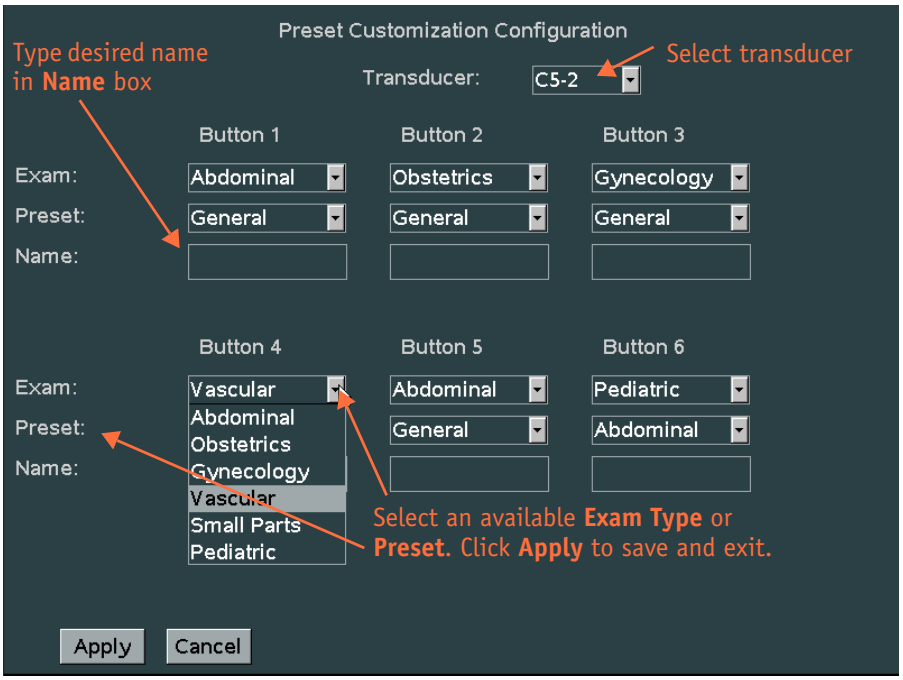


Figure 7-5. Preset Customization Configuration Screen

3. Select a transducer in the **Transducer** drop-down box.
4. Customize softkey display for this transducer by selecting **Exam** and **Preset** for one or more **Buttons** (softkeys). You can give each softkey a **Name**. Enter the desired name in the **Name** box.
5. Click **Apply** to save and exit.

▶ *To Back Up User Presets to USB Memory Stick*

See page 14-6.

▶ *To Backup System Configuration to USB Memory Stick*

See page 14-10.

Programmable Keys

Programmable keys are unassigned keys that can be configured by the user. Programmable keys per system are as follows:

System	Function Keys	Mode Keys
SmartCart	4	3
SmartCart *sp*	2	0
Scan Engine	2	

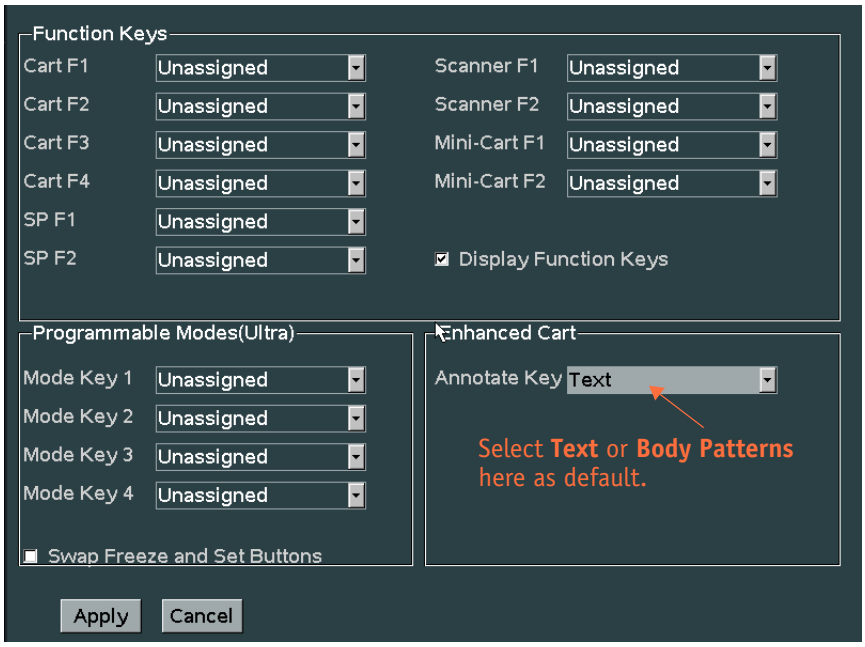


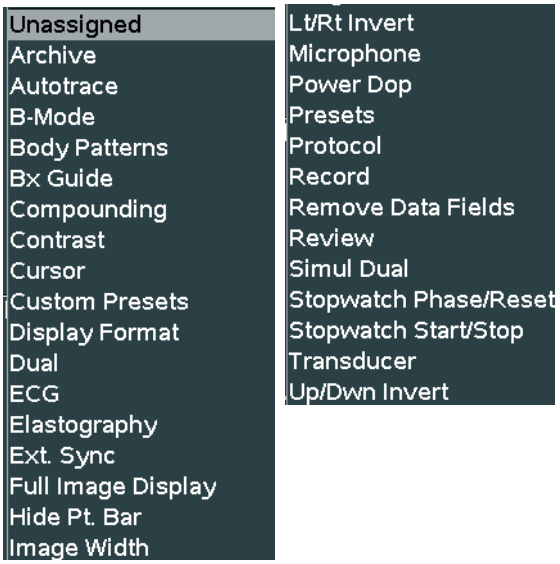
Figure 7-6. Function Key Assignments Screen

▶ *To Configure Function Keys*

1. Go to:

SmartCart/SmartCart *sp*	**Setup | System Setup | Keys**
Scan Engine	**Tools | System Setup | Keys**

2. The **Function Key Assignments** screen displays (Figure 7-6).
3. Click the drop-down box next to the desired **Function Key**. The drop-down list displays.



Not all assignment options are available for each key. Assignment options vary depending on your system and key chosen.

Figure 7-7. Function Key Assignment Options

4. Select the function you want to assign to the **Function Key**. Then click **Apply**.

NOTE: There are two rocker function keys available that can be programmed to adjust a specified imaging parameter up or down.

5. To verify the newly configured **Function Key**, press the key to ensure that the desired operation begins.

NOTE: To display the **Function Keys** on the **SmartCart/SmartCart *sp*** monitor, check the box labeled **Display Function Keys** (Figure 7-6), then click **Apply**.

NOTE: To swap the **Freeze** and **Set** buttons on the **SmartCart/SmartCart *sp***, check the box labeled **Swap Freeze and Set Buttons (SmartCart/SmartCart sp only)**.

▶ *To Configure Mode Keys (SmartCart only)*

1. Go to: **Setup button | System Setup | Keys**
2. The **Function Key Assignments** screen displays (Figure 7-6).
3. Configure **Mode Key 1 t**hrough **Mode Key 3** as described above for **Function Keys**.
4. To verify the newly configured **Mode Key**, press the key to ensure that the desired operation begins.

Live and Frozen Images

Annotations, including text, arrows, and body pattern graphics can be used with both live and frozen images. For more information, see Chapter 8 Annotations.

Live Images

All imaging parameters can be changed (see mode-specific tables in the following sections). However, except for simple depth measurements in B-Mode, M-Mode, and Color Doppler mode, and velocity measurements in PW mode, the generic measurement tools and application-specific calculation packages are not available. For more information, see Chapter 9 Measurements and Calculations.

Acoustic Zoom (Live)

The **Acoustic Zoom** function enables users to perform a variable level of magnification (**Zoom**) over a user-specified portion of an image to better view the details of a patient's anatomy. Besides magnification, **Acoustic Zoom** also increases the image frame rate.

▶ *To Operate Acoustic Zoom*

1. Acquire the desired image view and press the **Zoom** button. A **Zoom** ROI appears on the image.
2. Use the **Trackball** to resize the ROI if desired. The default is set to **Size**.
3. Press **Set** to toggle to **Position** and use the **Trackball** to move the ROI box over the area of interest.
4. Press **Zoom** again; the image area within the ROI enlarges and the image area outside the ROI box is cropped off.
5. To exit, press **Zoom** again.

Image Width (Live) (SmartCart Only)

Image Width enables users to quickly narrow the lateral margins of the image field of view [see also "Image Width Button (SmartCart only)" on page 10-12]. You can adjust the amount of cropping by using the **Trackball**. Reducing the **Image Width** also increases the image frame rate.

▶ *To Operate Image Width*

1. Acquire the desired image view and press the **Image Width** button.
2. The full image narrows by symmetrically reducing the width.
3. Use the **Trackball** to resize the amount of cropping.
4. Press **Set** to toggle the **Trackball** to **Pan** mode. The narrowed image can now be panned from side to side.
5. To exit, press the **Image Width** button again.

Frozen Images

Clip/Cine Review (Frozen)

Use **Trackball** to move forward or backward in the clip or you can use the **Set** keys as follows:

2D or Color

- **Freeze** image.
- Press left **Set** key to move back through frames.
- Press right **Set** key to move forward through frames.
- Rapidly double-click left **Set** key to go to first frame.
- Rapidly double-click right **Set** key to go to last frame.

Strip Cine (PW, CW, M-Mode)

- Capture two or more strip sweeps, then **Freeze**.
- Press left **Set** key to move earlier in strip.
- Press right **Set** key to move later in strip.
- Rapidly double-click left **Set** key to go to strip beginning.
- Rapidly double-click right **Set** key to go to strip end.

NOTE: See also "Current Exams: Review Procedures" on page 11-12.

NOTE: See Table 3-6 on page 3-19 re wrapping. *New!*

Imaging parameters (as marked by an * in the Imaging mode tables in the following sections) can be changed. The generic measurement tools and application-specific calculation packages can be used. For more information, see Chapter 9 Measurements and Calculations.

Clip/Image Store (Protocol Button - SmartCart only)

The **Protocol** button  enables users to easily configure **Clip Store** parameters in seconds or beats. The **Protocol** button configurations you set can be stored to **Exam** presets.

▶ *To Use Protocol Button*

1. Press **Protocol** button. Five softkeys are available: **Stopwatch STOP/START**; **Stopwatch RESET/PHASE**; **Clip A/Clip B**; **Beats/Seconds**; and **Hz**.
2. For **Stopwatch STOP/START**, see "Stopwatch STOP/START Softkey" on page 7-76. *New!*

3. For **Stopwatch RESET/PHASE**, see "Stopwatch RESET/PHASE Softkey" on page 7-76. *New!*

NOTE: You can set a **Function Key** to display **Stopwatch STOP/START** and **Stopwatch RESET/PHASE;** see "Programmable Keys" on page 7-9.

4. Press **Clip A/Clip B** softkey to toggle between the two options.
5. Press **Beats/Seconds** softkey to toggle between the two options. Rotate the knob to increase/decrease the number of beats or seconds.
   - You can choose up to **300 Beats** or **300 Seconds**. *New!*
   - The **Cardiac Exam Preset** default settings for **Clip A** are **2 Beats/2 Seconds**.
   - **Beats** are captured from the onset of the next **R wave** after **Store** button has been pressed.
   - **Seconds** are captured from the moment **Store** button is pressed.
   - If **Clip Store** is set to **Beats** and ECG is lost during an exam or no ECG is active, **Clip Store** defaults to 2 seconds.
   - While in **M**, **PW**, **CW**, or **TDI** modes, a still frame of the screen is stored.
6. Press **Hz** softkey to cycle through Hz options. Max capture rate with ECG = **30Hz**; Max capture rate non-ECG = **40Hz**.

Pan Zoom (Frozen)

Pan Zoom enables users to perform a variable level of magnification (**Zoom**) over a user-specified portion of a frozen image to better view the details of a patient's anatomy.

▶ *To Operate Pan Zoom*

1. Acquire the desired image view and press the **Freeze** button.
2. To begin **Pan Zoom** function:

SmartCart/SmartCart *sp*	Press the **Zoom** button.
Scan Engine	Select the **Zoom** option from the **Imaging** menu.

3. Use the **Trackball** to pan up/down, left/right within the frozen image to select the desired area for **Zoom** viewing.
4. To change the level of magnification (**Zoom**) of the frozen image segment (over the range from 1.25X to 4.00X), use the up/down function of the **Depth** button.
5. To return to live imaging in standard size (non-**Zoom**ed), press the **Freeze** button.

NOTE: To use **Clip/Cine Review** while in **Pan Zoom**, press **Set** button. Press **Set** again to return to **Pan Zoom**.

Brightness Mode (B-Mode/2D) Imaging

ZONARE ultrasound systems are initialized for B-Mode imaging at startup. B-Mode operation is the basis for all other imaging modes.

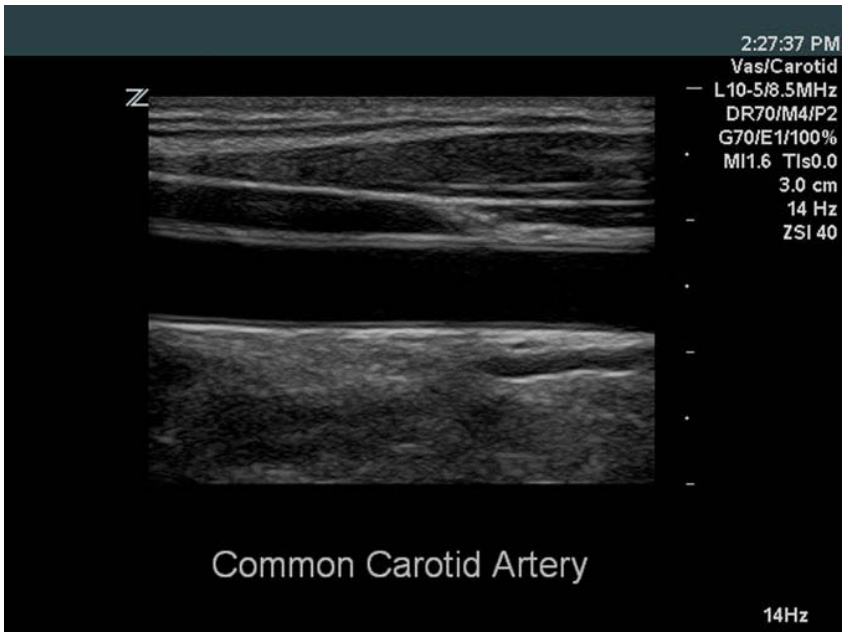


Figure 7-8. B-Mode Image Display Format

SmartCart/SmartCart *sp*

Scan Engine

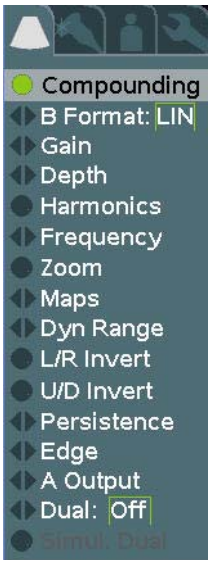


Figure 7-9. B-Mode Menu (Imaging Tab)

Working with B-Mode Imaging

- For an optimal B-Mode image, begin imaging with the settings implemented by the **Preset**. Then optimize the image if necessary. See "Presets" on page 7-6.
- To perform the required operations on the live image, see "Live and Frozen Images" on page 7-11 for operations that can be performed on a live image.
- To freeze the image, press **Freeze**.

- To perform retrospective processing on a frozen image, see "Live and Frozen Images" on page 7-11 for operations that can be performed on a frozen image.

Virtual Apex Array Format

The format of linear array transducers and some curved array transducers can be changed from linear array (its original format) to virtual apex array. This allows expansion to a wider field of view and back to normal view by the press of a control.

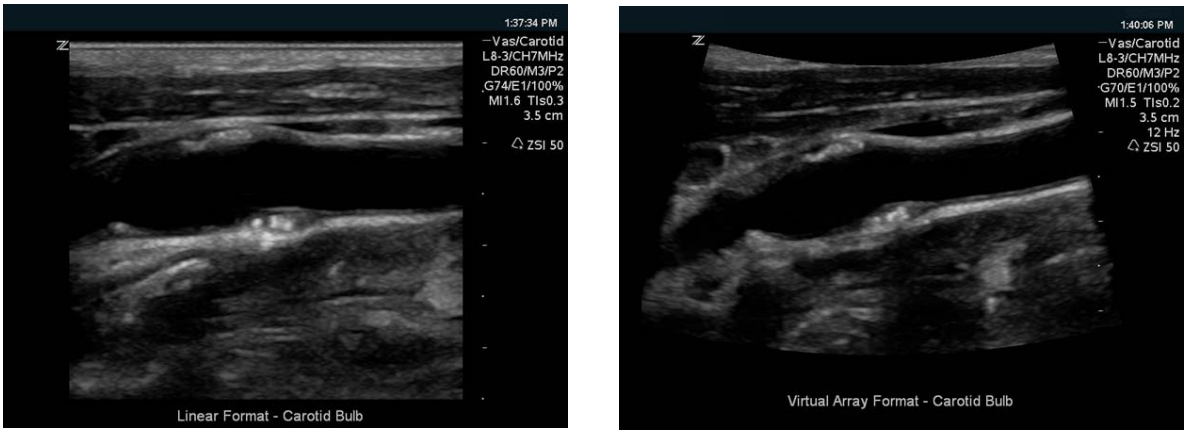


Figure 7-10. Linear Array and Virtual Apex Array Formats for Same Image

▶ *To Toggle Virtual Apex Array Format On/Off*

SmartCart/SmartCart *sp*	Press the **Format** softkey up or down. Format will switch between **Linear** and **Virtual Apex Array** formats. An icon will show format you are using (see Figure 7-12 below)
Scan Engine	Using **Menu Control**, select **B Format**; cycle left/right between **LIN** and **VA** (see Figure 7-11 below)

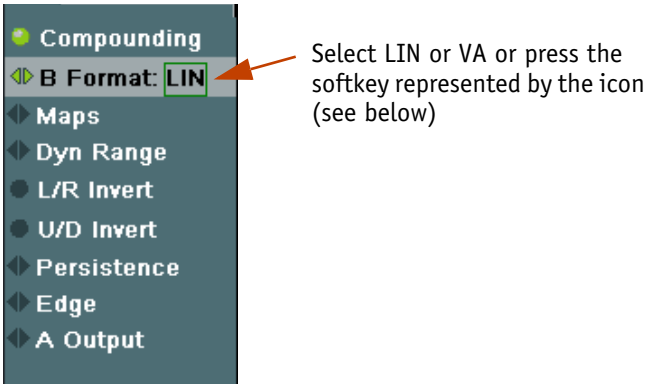
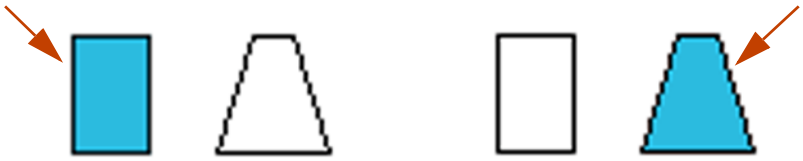


Figure 7-11. B Format: Select LIN or VA



Linear Array Format is Active Virtual Apex Array Format is Active

Figure 7-12. Linear and Virtual Apex Array Icons and Softkeys

Dual Mode

Turning on **Dual** imaging mode enables the system to display two side-by-side images (referred to as image **A** and image **B** for the purpose of this document). Only nonstrip imaging modes (i.e., 2D/B-Mode, Color Doppler, or Power Doppler) are supported for Dual image mode.

- In basic **Dual** mode, one of the two images displayed on the screen is active (live updating) while the other image is static (not updating).
- In **Simultaneous Dual** mode, both images (**A** and **B**) displayed on the screen are dynamically active (live updating). One image is selected as the active image, indicated by the white **Z** (Zonare logo).
- You can Freeze and Pan Zoom independently on either image (see below).
- Color Doppler Mode can be applied to just one side, if desired.
- User controls are applied as follows during **Simultaneous Dual** mode:
  - Preprocessing functions (A Output, C, etc.) - Active image only
  - Postprocessing functions (Gain, Persistence) - BOTH images affected

▶ *To Activate Dual Mode*

1. Activate **Dual** mode as follows:

SmartCart	Press **Dual** button.
SmartCart *sp*	Press **Menu** button; then select **Dual**.
Scan Engine	a. Use **Menu Control** to highlight and select **Dual: Off**. b. Toggle to initial **Dual** image (**A**) using **Menu Control** left/right arrows.

2. System enters **Dual** mode. Optimize orientation on patient's anatomy, user settings, and image quality for initial image displayed (Image **A**).
3. To toggle to (activate) other **Dual** image (Image **B**):

SmartCart	Press **ENTER** button.
SmartCart *sp*	Press **Enter/Select** button.

Scan Engine	a. Using **Menu Control**, ensure that **Dual** function is selected. b. Using **Menu Control** left/right arrows, toggle through to activate (**B**) **Dual** image.

4. Optimize orientation on patient's anatomy, user settings, and image quality for this second image displayed (**B**).

▶ *To Enter Dual Mode From Frozen 2D/B-Mode Image* New!

1. Freeze 2D image. Press **Dual** button.
2. System enters **Dual** mode. Image **A** (left) is frozen; Image **B** (right) is live.
3. Press **Enter** to activate Image **A** and freeze Image **B**.

▶ *To Freeze and Pan Zoom Independently on Either Image* New!

1. Select and freeze Image **A**. Press **Zoom** to magnify image. Press **Depth** to increase/decrease zoom.
2. Press **Enter** to select Image **B**; then freeze. Press **Zoom** to magnify image. Press **Depth** to increase/decrease zoom.
3. Image **A** and Image **B** show different magnification.

Simultaneous Dual Mode

▶ *To Activate Simultaneous Dual Mode*

While already in **Dual** mode:

SmartCart/SmartCart *sp*	Press the **SIMUL** softkey.
Scan Engine	a. Using **Menu Control**, scroll down to select the **Simul:Dual** selection. b. Press the **Enter button** (or use the **Menu Control** left/right arrows) to toggle ON/OFF **Simultaneous Dual** imaging mode.

▶ *To Enter Strip Modes (M or PW) Directly from Simul Dual Mode*

- To enter M-Mode, press the M-Mode button.
- To enter PW-Mode, press the PW-Mode button.

Dual Annotations

For information on **Dual** annotations, see Chapter 8 Annotations.

Optimize Feature

The **Optimize** button can be used to activate two separate functions. Both features can be activated simultaneously or separately, depending on the user settings configured on the **Imaging** configuration page.

- Overall/DGC (Auto DGC) gain adjustment
- Sound Speed Correction

NOTE: A transducer must be attached to the **Scan Engine** for the **Optimize** feature to work.

The method of pressing the **Optimize** button (single press-and-release or press-and-hold) defines one of two possible configurable sets of actions related to the **Overall/DGC** and **Sound Speed Correction** functions. The two **Optimize** button depression methods are:

- Regular — Single press-and-release of the **Optimize** button
- Extended — Press-and-hold **Optimize** key for 2 -3 seconds, then release

Optimize Button Configuration

▶ *To Configure Optimize Button*

1. Go to:

SmartCart/SmartCart *sp*	**Setup button | System Setup | Imaging**
Scan Engine	**Tools | System Setup | Imaging**

2. The **Imaging Configuration** screen displays (see below).

Figure 7-13. Imaging Configuration Screen (detail) - OPTIMIZE Button Setup

3. Check q the boxes to the left of functions you wish to be activated for each of the two possible button depression methods (**Regular** and **Extended**).
4. Check q the circle to the left of the method of **Sound Speed Correction (ZSI)** that you wish to activate when the **Optimize button** is pressed.
   - **ZSI Basic** — Less complex ZSI algorithm (faster ZSI initialization, basic level ZSI performance)
   - **ZSI Fine** — Advanced ZSI algorithm (longer ZSI initialization interval; optimum ZSI performance)
5. Highlight and click **Apply** to activate the new settings.

NOTE: To enable the auto **Re-Optimize** function (system automatically re-executes an **Optimize** operation whenever ultrasound echo changes are detected), check q the **Enable Re-opt** box on this screen.

Optimize Button Operation

▶ *To Activate Automatic Overall/DGC Gain Optimization*

SmartCart/SmartCart *sp*	a. Press the **Optimize** button to automatically balance the **Overall/DGC Gain**. The B-Mode image will adjust the brightness of the image to the **Target Gain Offset** value that was set by the factory. To change the setting, see "Optimize Button Configuration" above. b. If the B-Mode overall **Gain** is changed while **Optimize** = **ON**, the **Target Gain** value will be modified to reflect the new **Gain** setting. This new **Gain** setting will be remembered the next time **Optimize** is invoked in the current study.
Scan Engine	Same as **SmartCart**

▶ *To Activate Sound of Speed Correction*

SmartCart/SmartCart *sp*	a. Press and hold down the **Optimize** button for 2-3 seconds. The B-Mode image will pause momentarily and then automatically compensate for the sound speed in the tissue. b. The value for **SSC** is displayed as a **Sound Speed Index (SSI)** in the B-Mode data display, e.g., **SSI=40**
Scan Engine	Same as **SmartCart**

▶ *To Exit Optimize Functions*

SmartCart/SmartCart *sp*	▪ Double-click the **Optimize** button to make **Optimize** = **OFF** ▪ **Gain** will change according to the DGC slider locations ▪ SSC will revert back to the preset **Sound Speed Index Default (SSID)** value ▪ **Target Gain** will reset to the preset **Target Gain Offset** value
Scan Engine	Same as **SmartCart**

Compound Imaging

Compound imaging is a form of frequency compounding that combines two frequency components to reduce speckle noise. Compound imaging is available on all ZONARE transducers.

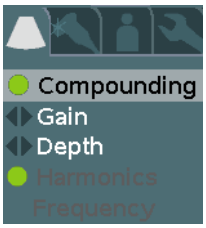


Figure 7-14. Menu Access - Compounding Function

To Activate Image Compounding (SmartCart/SmartCart sp only)

1. During B-Mode, press the **Compounding ON/OFF** softkey.
2. Alternatively, press the **Frequency** button to quickly cycle through the **Frequency** and **Compounding** choices.
   a. Look at the **Data Display** to see the **Frequency** or **Compounding** schemes.

To Activate Image Compounding (SmartCart/SmartCart sp & Scan Engine)

1. Press the **Tab** button (**Scan Engine**) or **Menu** button (**SmartCart/SmartCart *sp***), and the **Imaging** menu will appear.
2. Highlight the **Compounding** menu item.
3. Press the **Select** button to activate this function.

To Deactivate Image Compounding (SmartCart/SmartCart sp & Scan Engine)

1. After selecting (highlighting) the **Compounding** menu item, press the **Select** button again to turn off this function.

Needle Viz Preset (Linear array transducers)

New!

1. Press **Exam Type** button: Select **Small Parts** or **Vascular**
2. Select **Needle Viz** on next menu.
3. The **B Steer** softkey displays, showing **B Steer –10** (default for preset).
4. Turn **B Steer** softkey to cycle through options. **B Steer** (0°); **B Steer 10** (10° right); or **B Steer –10** (10° left).

NOTE: **L8-3** transducer **B Steer** options: **B Steer** (0°), **B Steer 15** (15° right), **B Steer –15** (15° left). See page 7-26 for more on **B Steer**.

B-Mode Controls

NOTE: To access B-Mode, see page 7-14.

Table 7-1. B-Mode Controls

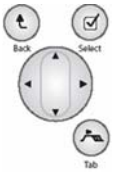
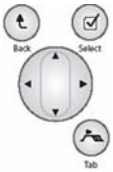
B Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Gain ∗  **SmartCart/ SmartCart *sp***  **Scan Engine**	■ Adjust Gain by rotating outer ring of **B** Mode (2D) button.	■ Adjust Gain using the **Gain** knob. **Or** ■ Highlight **Gain**. Press **Left / Right** function on **Menu Control** to increase or decrease the desired receive gain. The selected value displays in the Image Information area.
Depth  **SmartCart/ SmartCart *sp***   **Scan Engine**	■ Press **Depth** button **Up** to decrease depth; press **Down** to increase depth.	■ Press **Depth** button **Up** to decrease depth; press the **Down** to increase depth. **Or** ■ Highlight **Depth**. Press **Left / Right** function on **Menu Control** to increase or decrease the desired imaging depth. The selected value displays in the Image Information area.

Table 7-1. B-Mode Controls (Continued)

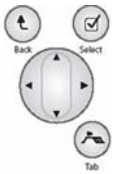
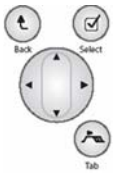
B Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Harmonics  **SmartCart**   **SmartCart *sp***  **Scan Engine**	**SmartCart** ■ Press **TH** button to toggle On/Off tissue harmonic imaging. When harmonic imaging is active, an **H** displays in the Image Information area. **SmartCart *sp*** ■ Press **Menu** button. Highlight **Harmonics** with **Trackball**. Move **Trackball** Left / Right to increase/decrease desired dynamic range.	■ Highlight **Harmonics**. Press **Select** to toggle between selecting/deselecting harmonic imaging mode. When harmonic imaging is active, an **H** displays in the Image Information area.
Frequency  **SmartCart**  **SmartCart *sp***  **Scan Engine**	**SmartCart** ■ Press **Frequency** button **Up** to increase transmit frequency; press **Down** to decrease transmit frequency. Selected value is displayed in Image Information area. **SmartCart *sp*** ■ Press the **Frequency** button to cycle through the transmit frequency choices. **NOTE:** Press **Frequency** button up or down when doing **Compound** imaging to cycle through **Frequency** and **Compounding** choices.	■ Highlight **Frequency**. Press **Left / Right** function on **Menu Control** to increase/ decrease the desired transmit frequency for the B-Mode image. The selected value displays in the Image Information area.

Table 7-1. B-Mode Controls (Continued)

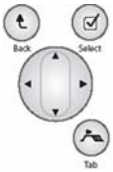
B Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Zoom  **SmartCart/ SmartCart *sp***  **Scan Engine**	■ ***Acoustic Zoom*** (During live scanning): Press **Zoom button**. The ROI (region of interest) box displays over the image. Define the ROI: Use the **Trackball**. Press the **Set** button to toggle between ROI position and ROI size. Press **Zoom** to display the enlarged ROI. Press **Zoom** to return to the normal view. ■ ***Display/Pan Zoom*** (From a Frozen Image): Press **Zoom button**. The image initially magnifies 1.25X Use **Trackball** to pan the image. Press **Depth** rocker button up to increase magnification level Press **Depth** rocker button down to decrease magnification level Press **Zoom** to return to the normal view **NOTE:** Press **Set** button to toggle between **Clip/Cine Review** and **Pan Zoom**.	■ ***Acoustic Zoom*** (During live scanning): Select **Zoom** function from the Imaging menu. The ROI (region of interest) box displays over the image. Define the ROI: Use the **Trackball**. Press the Set button to toggle between ROI position and ROI size. Select **Zoom** again to display the enlarged ROI. De-select **Zoom** to return to the normal view. ■ ***Display/Pan Zoom*** (From a Frozen Image): Select **Zoom** function from the imaging menu. The image initially magnifies 1.25X Use **Trackball** to pan the image. Press **Depth** rocker button up to increase magnification level Press **Depth** rocker button down to decrease magnification level Select **Zoom** to return to the normal view **NOTE:** Press **Set** button to toggle between **Clip/Cine Review** and **Pan Zoom**.
Maps ∗  	**SmartCart/SmartCart *sp*** ■ Press **Menu** button. Highlight **Maps** with **Trackball**. Move **Trackball** Left / Right to select desired tissue grey-scale map to be applied to B-Mode image.	
Tints *New!*  	**SmartCart/SmartCart sp** ■ Press **Menu** button. Highlight **Tints**. Move **Trackball** left/right (or press **Set** buttons) to select desired **Tint** to apply to image. There are five tints. **NOTE:** Tints can also be applied to strips in M, CW & PW Doppler modes.	

Table 7-1. B-Mode Controls (Continued)

B Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Dynamic Range∗  	**SmartCart/SmartCart *sp*** ■ Press the **Menu** button. Highlight **Dyn Range** with the **Trackball**. Move the **Trackball** Left / Right to increase or decrease the desired dynamic range.	
L/R Invert ∗  	**SmartCart/SmartCart *sp*** ■ Press the **Menu** button. Highlight **L/R Invert** with the **Trackball**. Press **Set** to invert the L/R orientation of the image. The transducer orientation marker (Zonare “Z”) moves from the left to the right of the Image area.	
U/D Invert ∗  	**SmartCart/SmartCart *sp*** ■ Press the **Menu** button. Highlight **U/D Invert** with the **Trackball**. Press **Set** to invert the U/D orientation of the image. The transducer orientation marker (Zonare “Z”) moves from the top to the bottom of the Image area.	
Persistence ∗  	**SmartCart/SmartCart *sp*** ■ Press the **Menu** button. Highlight **Persistence** with the **Trackball**. Move the **Trackball** left/right (or press left/right **Set** button) to increase or decrease the desired level of frame averaging.	
Edge ∗  	**SmartCart/SmartCart *sp*** ■ Press the **Menu** button. Highlight **Edge** with the **Trackball**. Move the **Trackball** left/right (or press left/right **Set** buttons) to increase or decrease the desired image enhancement option.	

Table 7-1. B-Mode Controls (Continued)

B Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
DGC ∗  **SmartCart**   **SmartCart *sp***  **Scan Engine**	**SmartCart** ■ Move a **DGC** slider to the right to increase gain, and to the left to decrease gain for the depth zone controlled by each slider. When DGC is being adjusted, the on-screen DGC graphic displays to the right of the image. **SmartCart *sp*** ■ Press **Menu** button. Highlight **DGC** with **Trackball**. Move **Trackball** down/up **DGC** curve and highlight desired **DGC** depth button. ■ To select multiple **DGC** buttons simultaneously, press **Enter** button. Then highlight as many **DGC** buttons as desired. They will move in unison. ■ Move the **Trackball** left/right to increase or decrease the **Gain**.	■ Press **DGC button**. The onscreen DGC graphic displays to the right of the image. The green highlight shows the active "slider." Turn **Gain** clockwise to increase gain and counter clockwise to decrease gain at the depth controlled by the active slider. Use the **Depth** rocker button to move up or down in selecting the active DGC slider for control by the Gain control knob. ■ Press **DGC** to save the settings and return to the menu.
Optimize ∗  **SmartCart/ SmartCart *sp***  **Scan Engine**	**Overall / DGC Gain** ■ Press the **Optimize** button to automatically balance the Overall/DGC gain. The B-Mode image will adjust the brightness of the image to the default Target Gain value. **Sound Speed Correction** ■ Press and hold down the **Optimize** button to automatically compensate for the sound speed in tissue. The B-Mode image will pause momentarily, then adjust for the detected sound speed. **To Exit Optimize Mode** ■ Double-click the **Optimize** button to turn Optimize functions = OFF.	**Overall / DGC Gain** ■ Press the **Optimize** button to automatically balance the Overall/DGC gain. The B-Mode image will adjust the brightness of the image to the default Target Gain value **Sound Speed Correction** ■ Press and hold down the **Optimize** button to automatically compensate for the sound speed in tissue. The B-Mode image will pause momentarily, then adjust for the detected sound speed. **To Exit Optimize Mode** ■ Double-click the **Optimize** button to turn Optimize functions = OFF.

Table 7-1. B-Mode Controls (Continued)

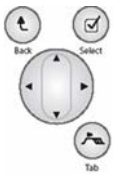
B Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Compounding∗   **SmartCart/ SmartCart *sp***  **SmartCart**	**NOTE:** All ZONARE ultrasound factory **Presets** have **Compounding** as the default. To adjust B-Mode frequencies, first exit **Compounding** as follows: ■ Highlight **Compounding** in the **Imaging** menu. Press **Select** to turn OFF the **Compound Harmonic** imaging function. Repeat this process to turn ON **Compounding**. ■ There may be more than one **Compounding Image** selection depending on the transducer. To select another **Compounding** setting, press the left/right arrows on the Menu Control. **NOTE:** On the **SmartCart**, press the **Frequency** button up or down when doing **Compound** imaging to cycle through **Frequency** and **Compounding** choices.	
B Steer *New!*	**NOTE:** For linear array transducers only ■ Turn **B Steer** softkey to select: **B Steer** (0°); **B Steer 10** (10° right); or **B Steer –10** (10° left). **Note**: L8-3 transducer B Steer options: B Steer (0°), B Steer 15 (15° right), B Steer –15 (15° left). See also "Needle Viz Preset (Linear array transducers)" on page 7-20.	
A Output  	**SmartCart/SmartCart *sp*** ■ Press the **Menu** button. Highlight **A Output** with the **Trackball**. Move the **Trackball** left/right (or press left/right **Set** buttons) to decrease or increase the desired transmit power output level. ■ The current transmit power level is displayed (as a percentage; 25%, 50%, etc.) in the Image Information area. The default value is 100%.	
Biopsy Guide  **SmartCart/ SmartCart *sp***  **Scan Engine**	■ From the QWERTY keyboard, press **Bx Guide** key to toggle through the available guide lines, and biopsy guide on/off, in live or freeze modes.	■ Highlight **Bx Guide**. Press **Select** to toggle biopsy guide on/off.

Table 7-1. B-Mode Controls (Continued)

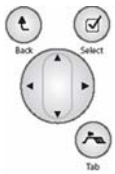
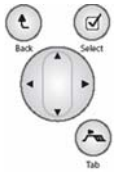
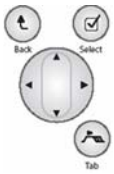
B Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Dual: OFF/ON  **SmartCart**   **SmartCart *sp***  **Scan Engine**	**NOTE:** The **Dual** imaging function allows for displaying two separate images on the screen (at the same time) for concurrent comparison/ analysis. **SmartCart** ■ Press the **Dual** mode **button** to toggle the Dual imaging function On/Off. **SmartCart *sp*** To Enter **Dual**: ■ Press the **Menu** button and use the **Trackball** to highlight **Dual**. ■ Press **Set** or move the **Trackball** to the right. To Exit **Dual**: ■ Press the **Menu** button and use the **Trackball** to highlight **Dual**. ■ Press **Set** or move the **Trackball** to the left.	■ Highlight **Dual Off (On)**. Press **Left / Right** function on **Menu Control** to turn On/Off the dual image display function. **NOTE:** In addition to turning the Dual function On or Off, the **Left / Right function** on the **Menu Control** is used for sequencing through four (A, B, A:b, a:B) different **Dual** image display states.
Dual: Toggle  **SmartCart**  **SmartCart *sp***  **Scan Engine**	**SmartCart** ■ Press **Enter** button to change the selection of the“Active”/”Selected” image (Left or Right image, as displayed on screen). **SmartCart *sp*** ■ Press **Enter/Select** button to change the selection of the **Active**/**Selected** image (Left/Right image, as displayed on screen).	■ Highlight **Dual Off (On)**. Pressing the **Left / Right** function on **Menu Control** will sequence through four (A, B, A:b, a:B) different **Dual** image display states. > A:b = Left image active / Right image static > a:B = Left image static / Right image active > A = Full sized Left image displayed > B = Full sized Right image displayed

Table 7-1. B-Mode Controls (Continued)

B Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Simul: (Dual)  **Scan Engine**	■ Press the softkey assigned **Simul** to toggle On/Off the **Simultaneous Dual** imaging update modality. **NOTE:** When **Simul Dual** is active, the two different images, potentially using different modalities (i.e. Color Doppler & Power Doppler) will be dynamically updated, simultaneously. When this function is *deselected* (standard **Dual** mode) one image will be static, while the other image is dynamically active.	■ Highlight **Simul: Dual.** Press **Select** to toggle On/Off this function. **NOTE:** When **Simul Dual** is active, the two different images, potentially using different modalities (i.e., Color Doppler & Power Doppler) will be dynamically updated, simultaneously. When this function is *deselected* (standard **Dual** mode) one image will be static, while the other image is dynamically active.
	NOTE: To enter **M-Mode** or **PW-Mode** directly from **Simul Dual**, press the **M-Mode** button or the **PW-Mode** button, respectively.	
Record  **SmartCart**	**SmartCart Only** Ejects **CD/DVD** from internal **CD/DVD** Burner ■ Press and hold down **Record** button until disk ejects.	■ N/A

Motion Mode (M-Mode) Imaging

Motion mode (M-Mode) is used to quantify the dynamic movement of tissues. M-Mode imaging begins with the acquisition of a B-Mode image.

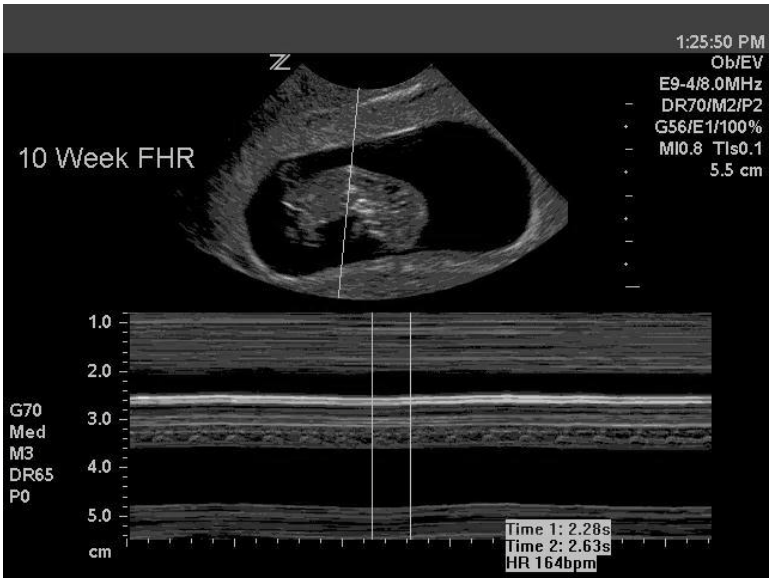
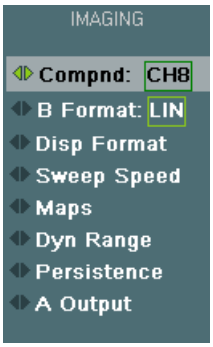


Figure 7-15. M-Mode Image Display Format

SmartCart/SmartCart *sp*



Scan Engine

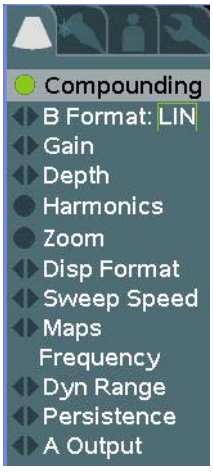


Figure 7-16. M-Mode Menu (Imaging Tab)

Working with M-Mode Imaging

1. Acquire the B-Mode image. See “Brightness Mode (B-Mode/2D) Imaging” on page 7-13.
2. Initiate M-Mode as follows:

a. Press **M** button. Press **Menu** button (**SmartCart/SmartCart *sp***) or **Menu Control** (**Scan Engine**) to view **M-Mode** menu.

Scan Engine	Alternative method: Press **Mode** to view **Mode** menu. Then select **M-Mode**.

b. The M-cursor bisects the B-Mode image. The M-Mode scroll begins.

c. M-Mode status information displays to the left of the M-Mode strip.

3. To freeze the image, see "Live and Frozen Images" on page 7-11.
4. To perform retrospective processing (optional), use the retrospective processing controls (available for a frozen image) that are denoted by ∗ in the M-Mode **Controls** table (Table 7-2).
5. To return to B-Mode (optional), press **M**.

M-Mode Controls

Table 7-2. M-Mode Controls

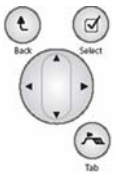
M Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Gain ∗  **SmartCart/ SmartCart *sp***   **Scan Engine**	■ Rotate outer ring of **M** Mode button to adjust **Gain**.	■ Adjust **Gain** using the **Gain** knob. **Or** ■ Highlight **Gain**. Press **Left / Right** function on **Menu Control** to increase or decrease the desired receive gain. The selected value displays in the Image Information area.

Table 7-2. M-Mode Controls (Continued)

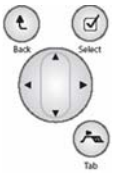
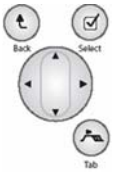
M Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Depth  **SmartCart/ SmartCart *sp***   **Scan Engine**	■ Press the **Depth** rocker button **Up** to decrease depth; press **Down** button to increase depth. The selected depth is displayed in the Image Information area.	■ On the **Depth** rocker button, press the **Up button** to decrease depth; press **Down** to increase depth. **Or** ■ Highlight **Depth**. Press **Left / Right** function on **Menu Control** to increase or decrease the B-Mode image to the desired depth. The selected depth is displayed in the Image Information area.
Zoom  **SmartCart/ SmartCart *sp***  **Scan Engine**	■ Press **Zoom** button. The ROI (region of interest) box displays over the B-Mode image. Define the ROI: Use the Trackball. Press **Set** to toggle between ROI position and ROI size. Press **Zoom** to display the enlarged ROI. Press **Zoom** to return to the normal view.	■ Highlight **Zoom**. Press the **Select** button to activate Zoom. The ROI (region of interest) box displays over the B-Mode image. The toggle icon is green when **Zoom** is active. Define the ROI: Use the **Trackball**. Press **Set** to toggle between ROI position and ROI size. Select **Zoom** to display the enlarged ROI. Select **Zoom** to return to the normal view.
Tints *New!*   	**SmartCart/SmartCart sp** ■ Press **Menu** button. Highlight **Tints**. Move **Trackball** left/right (or press **Set** buttons) to select desired **Tint** to apply to strip. There are five tints. **NOTE:** Tints can also be applied to 2D images and strips in CW & PW Doppler modes.	

Table 7-2. M-Mode Controls (Continued)

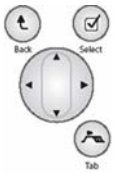
M Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Disp Format ∗  	■ Press **Menu** button. Highlight **Disp Format** (display format) with **Trackball**. Move **Trackball** to select preferred display format. Available display formats are: • M-strip (frozen image) or scroll (live image) • Split-screen (B-Mode image above and M-strip below), which has options for relative sizes of B-Mode image and M-Mode strip size **NOTE:** The format size can be saved to a **Preset**.	
Sweep Speed ∗  	■ Press **Menu** button. Highlight **Sweep Speed** with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to select preferred M-strip scroll rate (Low, Medium, High). Selected value displays to left of M-strip. **NOTE:** See "Sweep Speed" on page 10-7 for data on sweep speeds (mm/s) when ECG is active.	
Maps ∗  	■ Press **Menu** button. Highlight **Maps** with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to select desired tissue grey-scale map to be applied to M-Mode sweep.	
Frequency  **SmartCart**  **SmartCart *sp***  **Scan Engine**	■ Press **Frequency** button to cycle through the transmit frequency choices. Selected value is displayed in Image Information area.	■ Highlight **Frequency**. Press **Left / Right** function on **Menu Control** to increase/ decrease desired transmit frequency for M-Mode image. Selected value displays in Image Information area.

Table 7-2. M-Mode Controls (Continued)

M Control	SmartCart/SmartCart sp	Scan Engine
∗ Indicates this control is also available in retrospective processing.		
Dynamic Range∗ 	■ Press **Menu** button. Highlight **Dyn Range** with **Trackball**. Move **Trackball** left/right to select dynamic range setting.	
Persistence ∗ 	■ Press **Menu** button. Highlight **Persistence** with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to select preferred level of M-Mode line averaging.	
A Output 	■ Press **Menu** button. Highlight **A Output** with **Trackball**. Move **Trackball** Left to decrease or Right (or press left/right **Set** buttons) to increase desired transmit power output level. Current transmit power level is displayed (as a percentage; 25%, 50%, etc.) in Image Information area.	

Color and Power Doppler Imaging

Color Doppler imaging provides qualitative directional information about blood flow (mean velocity) within the color region of interest (color ROI).

Power Doppler imaging provides qualitative nondirectional energy information about the blood flow within the Power Doppler ROI.

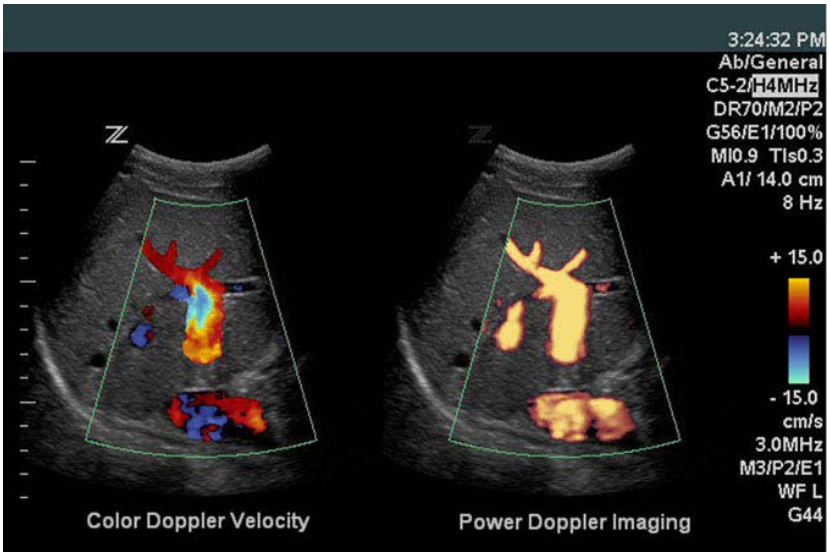


Figure 7-17. Color Mode & Power Doppler Display Format

SmartCart/SmartCart *sp*

Scan Engine

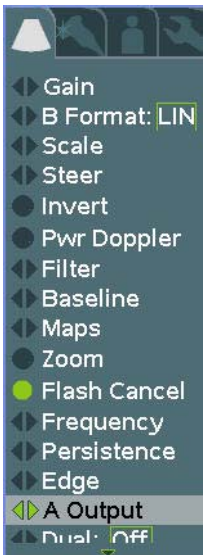


Figure 7-18. Color Doppler Menu (Imaging Tab)

Working with Color and Power Doppler Imaging

▶ *To Access Color Doppler Imaging Mode*

1. Acquire the B-Mode image (see "Brightness Mode (B-Mode/2D) Imaging" on page 7-13).
2. Press the **C** Mode button.
3. Press **Menu** button (**SmartCart/SmartCart *sp***) or **Menu Control** (**Scan Engine**) to view **Color Doppler** menu. The **Color Mode** status information and the **Color Bar** are displayed to the left of the image.

Scan Engine	Alternative method: Press **Mode** to view **Mode** menu. Select **Color Doppler**.

4. Define the color ROI:
   a. Use the **Trackball**.
   b. Press **Set** to toggle between **ROI Position** and **ROI Size**.

NOTE: The color ROI can be redefined at any time on a live image.

5. Adjust **Color Doppler Gain**:

SmartCart/SmartCart *sp*	Rotate outer rim of **C** Mode button.
Scan Engine	Rotate **Overall Gain** control (same control for **B-Mode Gain**).

6. To optimize Color Doppler image, see "Color Doppler and Power Doppler Controls" on page 7-38.
7. To freeze image, press **Freeze**. Refer to "Live and Frozen Images" on page 7-11.
8. To perform retrospective processing (optional), use the retrospective processing controls (available for a frozen image), which are denoted by ∗ in Table 7-3 on page 7-38.

▶ *To Access Power Doppler Imaging Mode*

NOTE: **Power Doppler** images can be frozen and retrospective processing can be performed on them in the same way as with **Color Doppler** images.

1. Press the **C** Mode button to activate **Color Doppler** mode.
2. Enter **Power Doppler Imaging** (PDI):

SmartCart/SmartCart *sp*	**NOTE:** Turn the right-most softkey to select **PDI**; then press the button to activate the selected mode. a. To exit **Power Doppler** mode and return to **Color Doppler** mode, turn the right-most softkey to select **CDR**; then press the button to activate. b. To exit **Color Doppler** mode, press the **C** Mode button. Or press the **B Mode** button to go to **B-Mode**.

Scan Engine	a. Press the **Pwr Dop** button on the **Touchscreen**. b. To return to **B-Mode**, press **C**.

Dual Imaging Mode

Dual imaging mode enables the ultrasound system to display two side-by-side images, referred to as image **A** (left side) and image **B** (right side) in this document. Only nonstrip imaging modes (i.e., B-Mode and Color/Power Doppler modes) are supported for **Dual** image mode.

Basic Dual Mode

In basic **Dual** mode, one of the two images displayed on the screen will be active (live updating) while the other image is static (not updating). **Dual** mode (when in Color Doppler) allows you to display a **Color Doppler** image side-by-side with a **Power Doppler** image of the same patient.

Simultaneous Dual Mode

In **Simultaneous Dual** mode, both images (**A** and **B**) displayed on the screen will be dynamically active (live updating). During **Simultaneous Dual** mode, one image will be selected as the "active" image (indicated by the brighter "**Z**" Zonare logo). User controls are applied as follows during **Simultaneous Dual** mode operation:

- Preprocessing functions (A Output, C, etc.) - ACTIVE image only
- Postprocessing functions (Baseline, Filter, Maps) - BOTH images affected

▶ *To Activate Dual Mode*

1. Enter **Dual** mode:

SmartCart	Press **Dual** button. To exit **Dual**: ■ Press **Dual** button. ■ Alternative exit: Press **D** or **M** buttons.
SmartCart *sp*	a. Press **Menu** button and use **Trackball** to highlight **Dual**. b. Press **Set** or move **Trackball** to right. To exit **Dual**: a. Press **Menu** button and use **Trackball** to highlight **Dual**. a. Press **Set** or move **Trackball** to left.
Scan Engine	a. Using **Menu Control**, scroll down to highlight **Dual: Off** selection. b. Using the **Menu Control** left/right arrows, toggle to the initial **Dual** image (**A**).

2. Optimize the orientation on the patient's anatomy, user settings, and image quality for the initial image displayed (**A**).

3. To toggle to (activate) the other **Dual** image (**B**):

SmartCart	Press **Enter** button.
SmartCart *sp*	Press **Enter**/**Select** button.
Scan Engine	a. Using **Menu Control**, select the **Dual** function. b. Using the **Menu Control** left/right arrows, toggle through to the activate the (**B**) **Dual** image.

4. Optimize the orientation on the patient's anatomy, user settings, and image quality for this second image displayed (**B**).

▶ *To Activate Simultaneous Dual Mode*

1. While already in **Dual** mode:

SmartCart/SmartCart *sp*	Press the **Simul (Simul-Dual)** softkey.
Scan Engine	a. Using the **Menu Control** left/right arrows, toggle through to **Dual: A:b**. b. Using **Menu Control**, scroll down to select **Simul:Dual** and press the **Select** button. c. To switch sides, scroll back to **Dual: A:b**. Press the arrow of the **Menu Control** wheel to **a:B**. Pressing the left/right arrows toggles between screen **A** and **B**. d. To exit, scroll to **Dual**, then press one of the **Menu Control** arrow keys to **OFF**.

Color Doppler and Power Doppler Controls

Table 7-3. Color Doppler and Power Doppler Controls

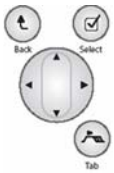
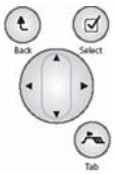
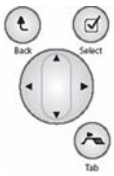
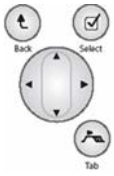
CD/PD Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing		
Gain ✱  **SmartCart/ SmartCart *sp***   **Scan Engine**	■ Adjust **Gain** using outer ring of **C Mode** button.	■ Adjust **Gain** using **Gain** knob. **Or** ■ Highlight **Gain**. Press **Left / Right** function on **Menu Control** to increase or decrease the desired receive gain. The selected value displays in the Image Information area.
Scale ✱  **Scan Engine**	■ Press **Scale** softkey Up to increase velocity scale; press Down to decrease velocity scale for color map. Selected values display at top and bottom of **Color Bar**.	■ Highlight **Scale**. Press **Left / Right** function on **Menu Control** to increase/ decrease upper and lower velocity limits of color map. Selected values display at top and bottom of **Color Bar**.
Steer ✱  **Scan Engine**	**NOTE:** For linear array transducers only. ■ Press **Steer** softkey to toggle to desired steering orientation of Color ROI (Right, Left, or Center). **NOTE:** **Steer** is available for linear array transducers only.	■ Highlight **Steer**. Press **Left / Right** function on **Menu Control** to toggle to the desired steering orientation of the Color ROI (Right, Left, or Center). **NOTE:** **Steer** is available for linear array transducers only.
Invert ✱  **Scan Engine**	■ Press **Invert** softkey to toggle orientation of color map (red/blue - towards/away blood flow)	■ Highlight **Invert**. Press **Select** button to toggle orientation of color map (red/blue - towards/away blood flow).

Table 7-3. Color Doppler and Power Doppler Controls (Continued)

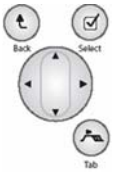
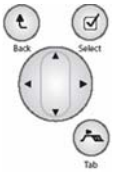
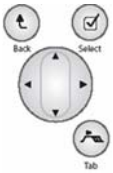
CD/PD Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing		
Pwr Doppler  **Scan Engine**	■ Press **Pwr Dop** softkey to toggle between Color Doppler and Power Doppler modes.	■ Highlight **Pwr Doppler**. Press **Select** button to toggle between Color Doppler and Power Doppler modes.
Filter ✱  **Scan Engine**	■ Press **Filter** softkey Up to increase filter; press **Down** to decrease filter. Selected value (Low, Medium, High) displays in Color Doppler Status area.	■ Highlight **Filter**. Press **Left / Right** function on **Menu Control** to increase or decrease filter. Selected value (Low, Medium, High) displays in the Color Doppler Status area.
Baseline ✱  **Scan Engine**	■ Turn **Baseline** softkey to shift Color Bar baseline. Velocity to color assignment values change as baseline shifts.	■ Highlight **Baseline**. Press **Left / Right** function on **Menu Control** to shift Color Bar baseline up or down. Velocity to color assignment values change as baseline shifts.
Maps ✱  	■ Press **Menu** button. Highlight **Maps** with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to select preferred Color map for Color Doppler or Power Doppler display.	

Table 7-3. Color Doppler and Power Doppler Controls (Continued)

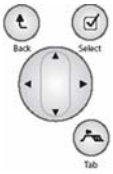
CD/PD Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing		
Zoom	There are two types of **Zoom**. **Acoustic Zoom** requires that the image be "live" or in realtime mode. **Display/Pan Zoom** is used on "frozen" images.	
Acoustic Zoom   **SmartCart/ SmartCart *sp***  **Scan Engine**	■ Press **Zoom button**. The zoom ROI (region of interest) box displays on image. Define ROI: Use **Trackball**. Press **Set** to toggle between ROI position and ROI size. Press **Zoom** to display the enlarged ROI. Press **Zoom** to return to the normal view.	■ Highlight **Zoom**. Press the **Select** button to activate Zoom. The Zoom ROI (region of interest) box displays on the image. The toggle icon is green when **Zoom** is active. Define the ROI: Use the **Trackball**. Press **Set** to toggle between ROI position and ROI size. Select **Zoom** to display the enlarged ROI. Select **Zoom** to return to the normal view. **NOTE:** When frozen, **Zoom** will activate **Display/Pan Zoom**.
Display/Pan Zoom	■ After freezing image (see "Acoustic Zoom" above) use same control to access **Zoom**. The image will magnify. If desired, adjust magnification factor with **Depth** control. Use **Trackball** to pan image up/down/left/right/diagonally. If desired, press **Set** to toggle **Trackball** between **Cine Review** and **Pan**.	
Flash Cancel ✱   	■ Press **Menu** button. Highlight **Flash Cancel** with **Trackball**. Move **Trackball** Right to toggle ON this function. Move **Trackball** Left to toggle OFF. **NOTE:** **Flash Cancel** filters flash artifact caused by low velocity/high amplitude signals produced by moving tissue structures.	

Table 7-3. Color Doppler and Power Doppler Controls (Continued)

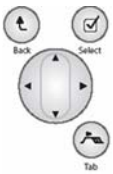
CD/PD Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing		
Frequency ✱  **SmartCart**  **SmartCart *sp***  **Scan Engine**	■ Press **Frequency** button to cycle through the transmit frequency choices.	■ Highlight **Frequency**. Press Left / Right function on **Menu Control** to increase or decrease transmit frequency for Color/ Power Doppler. Current frequency is displayed in Image Information area.
Persistence ✱   	■ Press the **Menu** button. Highlight **Persistence** with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to select preferred level of M-Mode line averaging.	
Edge ✱   	■ Press **Menu** button. Highlight **Edge** with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to desired image edge enhancement option.	
A Output   	■ Press **Menu** button. Highlight **A Output** with **Trackball**. Move **Trackball** Left to decrease transmit power output level. Move **Trackball** Right to increase transmit power output level. Current transmit power level is displayed (as a percentage; 25%, 50%, etc.) in Image Information area. **NOTE:** Minimum is a power level of 25%. Default transmit power output level is 100%.	

Table 7-3. Color Doppler and Power Doppler Controls (Continued)

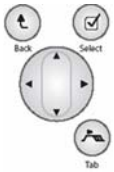
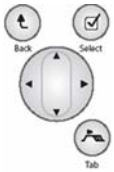
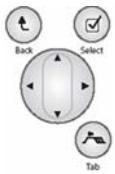
CD/PD Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing		
Dual: OFF/ON  **SmartCart**   **SmartCart *sp***  **Scan Engine**	**SmartCart** ■ Press **Dual** button to toggle **Dual** imaging function On/Off. **NOTE:** The **Dual** imaging function allows for displaying two separate images on the screen (at the same time), for concurrent comparison/analysis. **SmartCart *sp*** ■ Press **Menu** button and use **Trackball** to highlight **Dual**. ■ Press **Set** or move **Trackball** to right. To Exit **Dual**: ■ Press **Menu** button and use **Trackball** to highlight **Dual**. ■ Press **Set** or move **Trackball** to the left.	■ Highlight **Dual**. Press **Select** button to toggle On/Off this function.
Dual: Toggle  **SmartCart**  **SmartCart *sp***  **Scan Engine**	■ Press **Enter** button (**SmartCart**) or **Enter/ Select** button (**SmartCart *sp***) to change selection of **Active** / **Selected** image (Left or Right image as displayed on screen).	■ Highlight **Dual Off (On)**. Press **Left / Right** function on **Menu Control** to sequence through four (A, B, A:b, a:B) different **Dual** image display states. A:b = Left image active / Right image static a:B = Left image static / Right image active A = Full-sized Left image displayed B = Full-sized Right image displayed

Table 7-3. Color Doppler and Power Doppler Controls (Continued)

CD/PD Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing		
Simul: (Dual)  **Scan Engine**	■ Press **Simul** softkey to toggle On/Off **Simultaneous Dual** imaging update modality. **NOTE:** When **Simul Dual** is active, the two different images, potentially using different modalities (i.e. Color Doppler & Power Doppler) will be dynamically updated, simultaneously. **NOTE:** When this function is deselected (standard **Dual** mode) one image will be static, while other image is dynamically active.	■ Highlight **Simul: Dual.** Press **Select** to toggle On/Off this function. **NOTE:** When **Simul Dual** is active, the two different images, potentially using different modalities (i.e., Color Doppler & Power Doppler) will be dynamically updated, simultaneously. When this function is *deselected* (standard **Dual** mode) one image will be static, while other image is dynamically active.

Pulsed Wave (PW) Doppler Imaging

Pulse Wave (PW) Doppler is used to assess blood flow velocity.

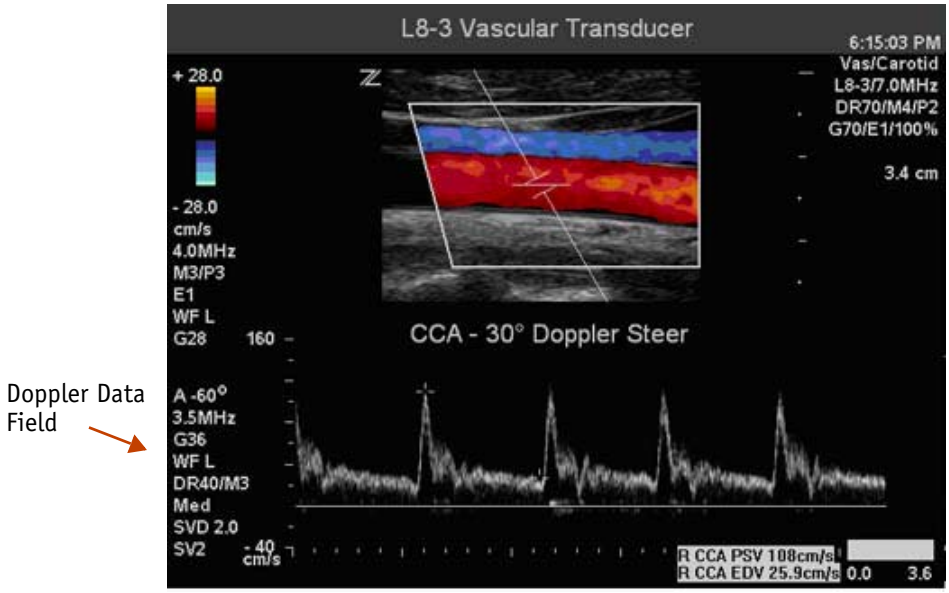


Figure 7-19. Pulsed Wave (PW) Doppler Image

NOTE: See Figure 10-16 on page 10-14 for a description of the Doppler Data Field. See also Chapter 10 Echocardiography Option for information about PW and cardiac imaging.

Working with PW Doppler Imaging

▶ *To Initiate PW Doppler Imaging*

1. Acquire the B-Mode image. See "Brightness Mode (B-Mode/2D) Imaging" on page 7-13.
2. Enter Pulse Wave (**PW**) Doppler mode:

SmartCart/SmartCart sp	Press **D** Mode button.
Scan Engine	a. Press **PW** Mode button. b. Press **Menu Control** to view **PW Doppler** menu. - Or - a. Press **Mode** to view **Mode** menu. Select **PW-mode**. b. Press **Menu Control** to view **PW Doppler** menu.

3. The screen splits into a reference image on top and the PW strip underneath. The PW scroll begins. The PW-mode status information displays to the left of the PW strip.
4. To position the PW cursor: Use the **Trackball** to move the PW cursor into the area of interest.

NOTE: To steer the PW cursor, adjust the angle correction, or optimize the PW Doppler image, see "PW Doppler Controls" on page 7-45. **Steer** is available for linear array transducers only.

5. To define the gate:

SmartCart/SmartCart *sp*	a. Press **Menu** button and use **Trackball** to highlight **Gate Size**. b. Move **Trackball** left/right to adjust size of gate.
Scan Engine	Select **Gate Size**. Use **Menu Control** left/right arrows to adjust size of gate.

6. Press **Select** or **Back** to save the setting and return to the menu.
7. To freeze the image, press **Freeze**.
8. To perform retrospective processing (optional), use the retrospective processing controls (available for a frozen image), which are denoted by * in Table 7-4.
9. To return to B-Mode (optional), press **PW**.

PW Doppler Controls

Table 7-4. PW Doppler Controls

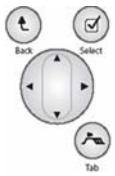
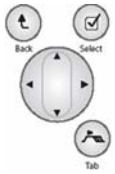
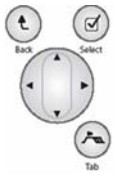
PW Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing.		
Gain ✱  **SmartCart/ SmartCart *sp***  **Scan Engine**	■ Adjust **Gain** using outer ring of **D** Mode button.	■ Adjust gain using **Gain** knob. **Or** ■ Select **Gain**. Press **Left / Right** function on **Menu Control** to increase or decrease desired gain of Doppler spectrum. Selected value displays in PW Doppler Status area.
Scale ✱  **Scan Engine**	■ Press **Scale** (velocity) softkey to increase/ decrease velocity scale in PW Doppler. Selected values display in PW Doppler Status area.	■ Highlight **Scale**. Press **Left / Right** function on **Menu Control** to change velocity scale for PW Doppler. Selected values display in PW Doppler Status area.
Baseline ✱  **Scan Engine**	■ Press **Baseline** softkey to shift Doppler spectrum baseline. Velocity values increase and decrease as baseline shifts.	■ Select **Baseline**. Press **Left / Right** function on **Menu Control** to shift Doppler spectrum baseline. Velocity values increase and decrease as baseline shifts.
Invert ✱  **Scan Engine**	■ Press **Invert** softkey to flip blood flow direction vs. strip display orientation in Doppler spectrum.	■ Highlight **Invert**. Press **Select** button to flip blood flow direction vs. strip display orientation in Doppler spectrum.

Table 7-4. PW Doppler Controls (Continued)

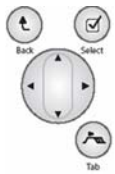
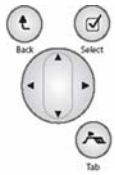
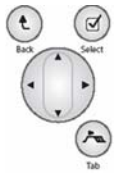
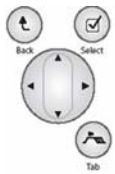
PW Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing.		
Update ✱  **Scan Engine**	■ Press **Update** softkey to toggle between live update of B-Mode image concurrent with live PW Doppler spectrum, or frozen B-Mode image with live Doppler spectrum. ■ When using *frozen* B-Mode image with *live* Doppler, press **Set** to toggle between pausing the 2D image display and the scrolling PW strip.	■ Highlight **Update**. Press **Select** button to toggle between live update of B-Mode image concurrent with live PW Doppler spectrum, or frozen B-Mode image with live Doppler spectrum. ■ When using *frozen* B-Mode image with *live* Doppler, press **Set** to toggle between pausing the 2D image display and the scrolling PW strip.
Angle ✱  **Scan Engine**	■ Press **Angle** softkey to adjust angle in 60° increments (-60°, 0, +60°). 1° increments: Rotate **Angle** control clockwise to increase the angle; turn counter clockwise to decrease angle. Selected value displays in PW Doppler Status area.	■ Highlight **Angle**. Quick 60: Press **Select** to adjust angle in 60° large increments (-60°, 0, +60°). Fine 1: Press **Left / Right** function on **Menu Control** to adjust angle in 1° increments. Selected value displays in PW Doppler Status area.
Steer ✱  **Scan Engine**	**NOTE:** Steer is available for linear array transducers only. ■ Press **Steer** softkey to toggle to steering orientation of Doppler cursor (Right, Left, or Center). L8-3 Transducer: Two steering angles are available, (30 ° and 20 °). From Doppler menu, highlight **PW angle**. Press **Left** / **Right** function on **Menu Control** to toggle between 30 ° and 20 °. **NOTE:** Steer is available for linear array transducers only.	■ Highlight **Steer**. Press **Left / Right** function on **Menu Control** to toggle to desired steering orientation of Doppler cursor (Right, Left, or Center). L8-3 Transducer: Two steering angles are available, (30 ° and 20 °). From Doppler menu, highlight **PW angle**. Press **Left** / **Right** function on Menu Control to toggle between 30 ° and 20 °.
Filter ✱  **Scan Engine**	■ Press **Filter** softkey to increase/decrease filter. Selected value (Low, Medium, High) displays in PW Doppler Status area.	■ Highlight **Filter**. Press **Left / Right** function on **Menu Control** to increase or decrease filter. Selected value (Low, Medium, High) displays in PW Doppler Status area.

Table 7-4. PW Doppler Controls (Continued)

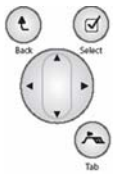
PW Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing.		
Tints *New!*  	**SmartCart/SmartCart sp** ■ Press **Menu** button. Highlight **Tints**. Move **Trackball** left/right (or press **Set** buttons) to select desired **Tint** to apply to strip. There are five tints. **NOTE:** Tints can also be applied to 2D images and strips in M and CW Doppler modes.	
Gate Size   **SmartCart/ SmartCart *sp***  **Scan Engine**	■ Press **Menu** button. Highlight **Gate Size** with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to increase or decrease desired range gate size.	■ Highlight **Gate Size**. Press **Left / Right** function on **Menu Control** to increase or decrease desired range gate size.
Dynamic Range ✱   **SmartCart/ SmartCart *sp***	■ Press **Menu** button. Highlight **Dyn Range** with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to adjust dynamic range setting.	

Table 7-4. PW Doppler Controls (Continued)

PW Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing.		
Sweep Speed ✱   **SmartCart/ SmartCart *sp***	**NOTE:** See "Sweep Speed" on page 10-7 for data on sweep speeds (mm/s) when ECG is active. ■ Press **Menu** button. Highlight **Sweep Speed** with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to choose sweep rate selection (Low, Medium, High). Selected value displays to left of PW-strip.	
Disp Format✱   **SmartCart/ SmartCart *sp***	**NOTE:** The **Display Format** size can be stored to a **Preset**. ■ Press **Menu** button. Highlight **Disp Format** (display format) with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to choose preferred display format. Available display formats: PW-strip (frozen image) or scroll (live image) Split-screen (B-Mode image above and PW-strip below), which has options for relative sizes of B-Mode image and PW-mode strip size	
Maps ✱   **SmartCart/ SmartCart *sp***	■ Press **Menu** button. Highlight **Maps** with **Trackball**. Move **Trackball** left/right (or press left/right **Set** buttons) to choose preferred grey-scale maps (M1, M2, M3, M4) to be used in spectral Doppler.	

Table 7-4. PW Doppler Controls (Continued)

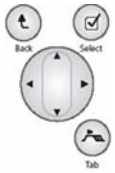
PW Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing.		
Zoom   **SmartCart/ SmartCart *sp***  **Scan Engine**	■ Press **Zoom button**. The ROI (region of interest) box displays around PW gate in image. Define the ROI: Use **Trackball**. Press **Set** to toggle between ROI position and ROI size. Press **Zoom** to display enlarged ROI. Press **Zoom** to return to normal view.	■ Select **Zoom**. Press **Select** button to enable **Zoom** function. The ROI (region of interest) box displays around PW gate in image. Toggle icon is green when **Zoom** is active. Define the ROI: Use **Trackball**. Press **Set** to toggle between ROI position and ROI size. Select **Zoom** to display enlarged ROI. Select **Zoom** to return to normal view.
A Output   **SmartCart/ SmartCart *sp***	■ Press **Menu** button. Highlight **A Output** with **Trackball**. Move **Trackball** Left to decrease transmit power output level. Move **Trackball** Right to increase transmit power output level. Current transmit power level is displayed (as a percentage; 25%, 50%, etc.) in Image Information area.	

Table 7-4. PW Doppler Controls (Continued)

PW Control	SmartCart/SmartCart sp	Scan Engine
✱ Indicates that this control is also available in retrospective processing.		
Auto-Dop Trace  **SmartCart/ SmartCart *sp***	■ Double-click **Measure** button or press assigned **Function/Mode** to activate **Auto-Dop Trace**. ■ Single-click **Measure** button to remove tracing from PW spectrum and to bring it back on. Single click does not deactivate **Auto-Dop Trace**. To perform manual measurements with **Auto-Dop Trace**: ■ Double-click **Measure** button. Measurement calipers appear, which are controlled by **Trackball**. Use Measurements and Calcs with usual steps and methods. ■ If desired, double-click **Measure** button to reactivate **Auto-Dop Trace**. **NOTE:** You can program a **Function** or **Mode** key to activate **Auto-Dop Trace** [**Autotrace**]. See page 7-9.	
CD Processing  	■ Press **Menu** button. Highlight **CD Processing.** Press **Select** to exit PW mode controls and display Color Doppler Processing controls.	

Duplex Mode

In **Duplex** mode (B-Mode and PW-mode running simultaneously) an available **Update** option pauses either the 2D image display or the scrolling PW strip.

▶ *To Turn ON the Update Option*

1. To turn on:

SmartCart/SmartCart *sp*	Press **Update** softkey.
Scan Engine	Scroll down to **Update** selection on Doppler menu and **Select**.

2. Use the **Set** button to toggle between pausing the 2D image display and the scrolling PW strip.

▶ *To Turn OFF the Update Option*

1. To return to **Simultaneous Mode**:

SmartCart/SmartCart *sp*	Press **Update** softkey a second time.
Scan Engine	Deselect **Update** selection on Doppler menu.

Triplex Mode

Triplex mode allows the user to visualize B-Mode, Color or Power Doppler, and PW Doppler modes simultaneously.

- As with Duplex mode, an available **Update** option pauses either the 2D image display (B and Color) or the scrolling PW strip.
- The **Update** ON/OFF control is the same as for Duplex mode.

Auto-Dop Trace

The **Auto-Dop Trace** feature provides automatic tracing of waveforms on a **PW Doppler** strip.

IMPORTANT: Only a basic overview of **Auto-Dop Trace** is provided in this chapter. For detailed information on setup and operation, see "Auto-Dop Trace" on page 9-44 of this manual.

▶ *To Activate Auto-Dop Trace*

1. While live scanning in any imaging mode, including **PW Doppler**, press **Function**/**Mode** key assigned to **Autotrace** (see page 9-46).

   OR

   If in **PW Doppler** mode, you can double-click the **Measure** button.

2. The system enters **PW Doppler Autotrace** mode and displays the **Autotrace Measure** menu (Figure 7-20). Autotrace icon appears next to **PW** in **Doppler Data Field** (Figure 7-21; see also Figure 10-15, "Location of Doppler Data Field," on page 10-13).

NOTE: If you selected **calculations** on **Auto-Dop Trace Configuration** screen (page 9-45) as the default, the **Autotrace Calc** menu displays instead of **Measure** menu.

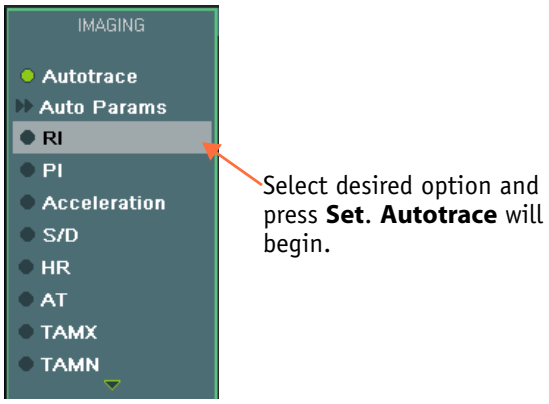


Figure 7-20. AutoTrace Measure Menu

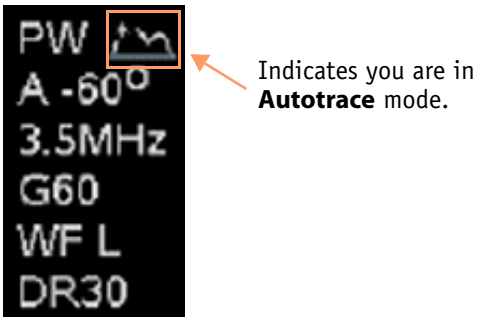


Figure 7-21. PW Autotrace Icon - Doppler Data Field

3. Select the desired measurement (e.g., **RI**) and press **Set** to initiate the **Trace**.
4. To select a different measurement or calc, press **Measure** or **Calc** button to display menu. Make your selection and press **Set**.

▶ *To Deactivate Auto-Dop Trace*

Three methods:

- Press **Function/Mode** key assigned to **Autotrace** (see page 9-46).
- Double-click **Measure** button.
- Display **Measure** or **Calc** menu (Figure 7-20) and click **Autotrace** option.

Continuous Wave (CW) Doppler Imaging

Continuous Wave (CW) Doppler imaging is available only on **SmartCart** systems equipped with the Echocardiology Option and the **P4-1c** transducer.

Auxiliary CW Doppler also operates only on **SmartCart** systems equipped with the Echocardiology Option.

NOTE: See Figure 10-18 on page 10-15 for a description of the Doppler Data Field. See also Chapter 10 Echocardiography Option for information about CW and Aux CW and cardiac imaging.

▶ *To Activate CW Doppler Imaging*

1. Connect **P4-1c** transducer to MTP.
2. Acquire B-Mode image; then press **D** button to activate **PW**.
3. Turn right-most softkey to select **CW** (options are **CW**, **PW**, and **TDI** [tissue doppler imaging]); then press button to activate **CW Doppler** imaging.

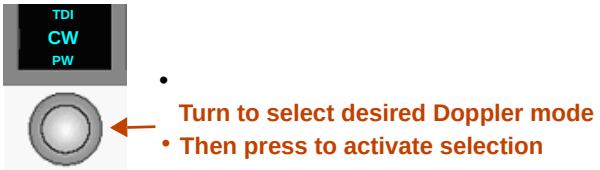


Figure 7-22. Doppler Mode Softkey (far right on softkey panel)

4. While in **CW** imaging, the **2D** image is in **Update** mode. Press the **Set** button to update the **2D** image and reposition the **CW** cursor.

NOTE: **Duplex** and **Triplex** modes are not available while in **CW** mode.

NOTE: You can also activate **CW** imaging by programming one of the **Mode** keys on the user interface. Go to **Setup button | System Setup | Keys | Mode 1-4** to program the selected **Mode** key.

▶ *To Activate Aux CW Doppler Imaging*

1. Connect **A2CW** or **A5CW** transducer to **Aux CW** port on front of the **Cart**.
2. Press **Transducer** button.
3. Press **A2CW** or **A5CW** softkey to activate **Aux CW** imaging.
4. To go back to imaging with **P4-1c transducer**, press **Transducer** button again and choose **P4-1c** softkey.

NOTE: You can also activate **Aux CW** imaging by programming one of the **Mode** keys on the user interface (see page 7-11).

CW Doppler Controls

Applicable only to **SmartCart** systems with **Echocardiology** option. See Chapter 10 Echocardiography Option.

Table 7-5. CW Doppler Controls

CW Control		SmartCart
* Indicates this control is also available in retrospective processing.		
Gain 	*	■ Adjust **Gain** using outer ring of **D** Mode button.
Scale	*	■ Press **Scale** (velocity) softkey to increase/decrease velocity scale in **PW Doppler**. Selected values display in **CW Doppler Status** area. ■ **Scale** can be increased/decreased from a frozen image while in **CW** mode.
Baseline	*	■ Press **Baseline** softkey to shift Doppler spectrum baseline. Velocity values increase and decrease as the baseline shifts.
Invert	*	■ Press **Invert** softkey to flip blood flow direction vs. strip display orientation in Doppler spectrum.
Filter	*	■ Press **Filter** softkey to increase/decrease filter. Selected value (Low, Medium, High) displays in PW Doppler Status area.

Table 7-5. CW Doppler Controls (Continued)

CW Control	SmartCart
* Indicates this control is also available in retrospective processing.	
Tints *New!*  	**SmartCart/SmartCart sp** ■ Press **Menu** button. Highlight **Tints**. Move **Trackball** left/right (or press **Set** buttons) to select desired **Tint** to apply to strip. There are five tints. **NOTE:** Tints can also be applied to 2D images and strips in M and PW Doppler modes.
Dynamic Range *   **SmartCart/ SmartCart *sp***	■ Press **Menu** button. Highlight **Dyn Range** with **Trackball**. Move **Trackball** Left / Right to adjust dynamic range setting.
Sweep Speed *   **SmartCart/ SmartCart *sp***	■ Press **Menu** button. Highlight **Sweep Speed**. The speed of the PW-strip scroll changes. ■ Move **Trackball** Left / Right to choose sweep rate selection (Low, Medium, High). Selected value displays to left of PW-strip. **NOTE:** See “Sweep Speed” on page 10-7 for data on sweep speeds (mm/s) when ECG is active.

Table 7-5. CW Doppler Controls (Continued)

CW Control	SmartCart
* Indicates this control is also available in retrospective processing.	
Maps *   **SmartCart/ SmartCart *sp***	■ Press **Menu** button. Highlight **Maps**. Move **Trackball** Left / Right to choose preferred grey-scale maps (M1, M2, M3, M4) to be used in spectral Doppler.
A Output   **SmartCart/ SmartCart *sp***	■ Press **Menu** button. Highlight **A Output**. Move **Trackball** Left / Right to increase or decrease transmit power output level selected. Current transmit power level is displayed (as a percentage; 25%, 50%, etc.) in Image Information area

3D & 4D (Real-Time 3D) *New!* Imaging

3D/4D imaging is available only when connected to a Multi-Transducer Port (MTP) on **SmartCart/SmartCart *sp*** systems. A 3D/4D transducer; e.g., **C8-33D** or **E9-33D** *[coming in Q2 2011]* is required. 3D/4D imaging is available only in B-Mode/2D.

The 3D/4D function provides 3 postprocessing modes: **Surface**, **MPR**, and **Tomo**. In addition, the user can access **Calc** packages and perform generic measurements on rendered images. 3D/4D images are transferrable to a PACS via DICOM (see "Setup" below). The user can also store 3D/4D volume data for later post-processing/manipulation (see"Setup" below and "3D/4D Volume Data" on page 11-11).

▶ *Setup*

1. Program a **Mode** key (1-4) for **3D** (see page 7-11).
2. Go to: **Setup | System Setup | Archive | Store/Print** to display **Image Store/ Print Buttons** screen (page 11-6).
3. Program a **Store** button for **3D Volume** saving. Click on checkbox labeled **3D Volume Data**. Click **Apply**.

NOTE: See page 11-11 for more information about storing **3D Volume Data**.

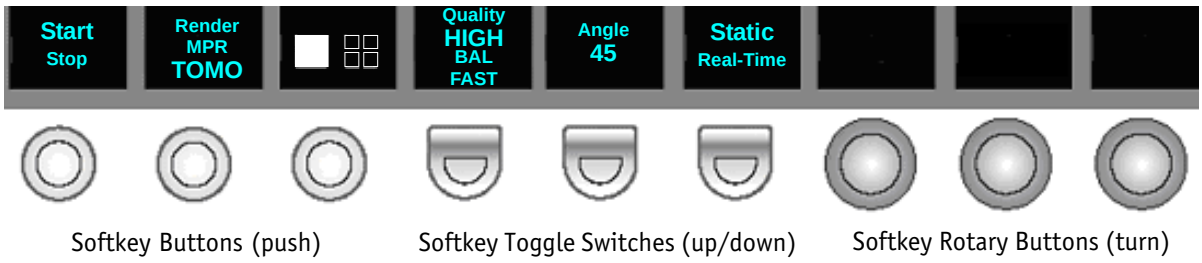


Figure 7-23. 3D/4D Preprocessing Softkey Display

Enter 3D Mode

1. Connect **3D** transducer (**C8-33D** or **E9-33D**) to MTP. System will calibrate and self-test transducer motor.
2. Acquire and optimize 2D/B-Mode image.
3. Press **Mode** key you programmed for **3D.** You are now in **3D Setup** mode.

Enter 4D Mode

1. Select **Real-Time** (4D) using **Static/Real-Time** softkey (Figure 7-23). You are now in **4D Setup** mode.
2. Adjust image and position **ROI**.
3. If desired, maximize volumes per second (**VPS**):
   a. Select **FAST** using **Quality** softkey.
   b. Choose a fundamental **Frequency**, e.g., **8.0 MHZ/6.0 MHZ**, using **Frequency** button.
   c. Reduce elevation angle to **45** degrees using **Angle** softkey.
4. Press **Freeze** or **Start/Stop** softkey to initiate volume acquisition (transducer lens will start sweeping back and forth and image will be in real-time).
5. Press **Freeze** to stop **4D** imaging. Press **Freeze** again to resume **4D** imaging.
6. To return to the **ROI**, press **Mode** key you programmed for **3D**.
7. To return to **3D** (mode, select **Static** using **Static/Real-Time** softkey.

EXAMPLE: Fetal Face Surface Rendering

1. Acquire and optimize a B-Mode/2D image of the fetal facial profile in a mid-sagittal plane, face up.

NOTE: A good B-Mode/2D image is important for a high-quality **3D/4D** image.

2. Try to scan showing fluid in front of the fetal face.
3. Press **Mode** key you programmed for **3D** (above).
4. The system enters the **3D Setup** state for 3D imaging. The 3D status field displays on the right-side of the imaging window.

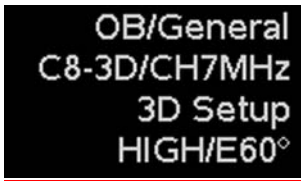


Figure 7-24. 3D Setup Mode Status Field

5. To adjust acquisition quality (**QA** in the status field), press **Quality** softkey to cycle through options: **HIGH**, **BALANCED**, and **FAST**.

NOTE: The default is **HIGH**, which results in highest resolution but slowest acquisition time. Choose **BALANCE** or **FAST** if faster acquisition times are desired.

6. To adjust elevation sweep angle (**E** in status field), press **Angle** softkey; each press changes sweep angle, which is distance across sweep path. The sweep angle choices are **75°**; **60°**; **45°**; **30°**; **20°**. Default is **60°**.

7. Place **ROI** in position using **Trackball** and **Set** button. Position **ROI** so that the cut line (yellow) is in front of fetal face with as much amniotic fluid in between face and cut line.

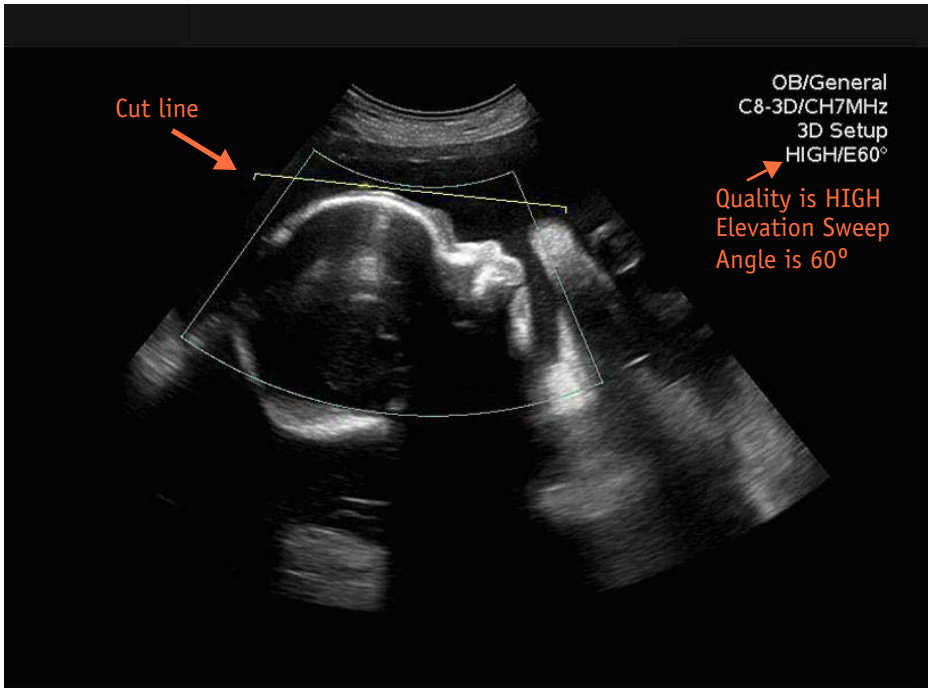


Figure 7-25. 3D ROI with Cut Line

8. Press **Freeze** button. This initiates image acquisition. A progress bar indicates status of acquisition.

NOTE: You can also initiate acquisition by pressing far-left softkey labeled **Start/Stop**.

NOTE: To abort acquisition, press **Freeze** or **Start/Stop** key to return to **3D Setup** mode.

9. When done, system enters **3D/4D Postprocessing** mode. For **OB Presets**, the default 3D/4D postprocessing mode is **3D Surface** render mode (**Render**).

NOTE: There are 3 postprocessing modes: **Surface**, **MPR** (multi-planar reconstruction), and **Tomo** (Tomogram).

Postprocessing Modes

Render Mode

The imaging screen displays the surface volume image in a large format with the three orthogonal image planes in a small format. The volume image (**V**) is the active window by default. Figure 7-26 shows the three orthogonal planes (**A**, **B**, **C**) and the larger volume image (**V**).

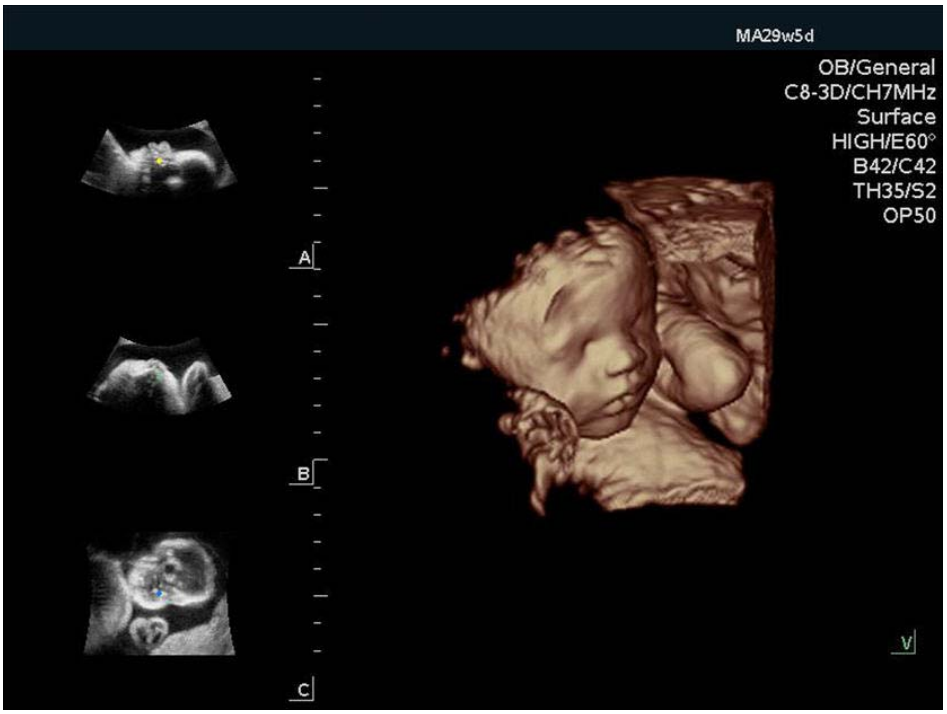


Figure 7-26. 3D Render Mode (Surface)

10. If desired, use **Trackball** to rotate volume image as if it were contained within a sphere.
11. To optimize volume (e.g., remove unwanted anatomy), press **Edit ROI** softkey and adjust clipping box. The **Set** button can be used to toggle between various clipbox manipulations. The **A** view supports an additional curved cutline on the top facing cutline.
12. Turn **X**,**Y**, **Z Rotate Axis** softkey to rotate selected image view.
13. To change axis, press softkey to cycle to your choice. Alternatively, you can rotate the axis using the **Gain** knobs of the following **Major Mode** buttons:
    - M-Mode button rotates X axis
    - Doppler Mode button rotates Y axis
    - Color Mode button rotates Z axis

14. To adjust brightness, turn **B-Mode** button or **Brightness** softkey.
15. To increase/decrease the magnification factor, toggle **Depth** button.

MPR Mode

MPR mode displays orthogonal planes (**A**, **B** & **C**) vertically; larger image is blow up of active image (Figure 7-27).

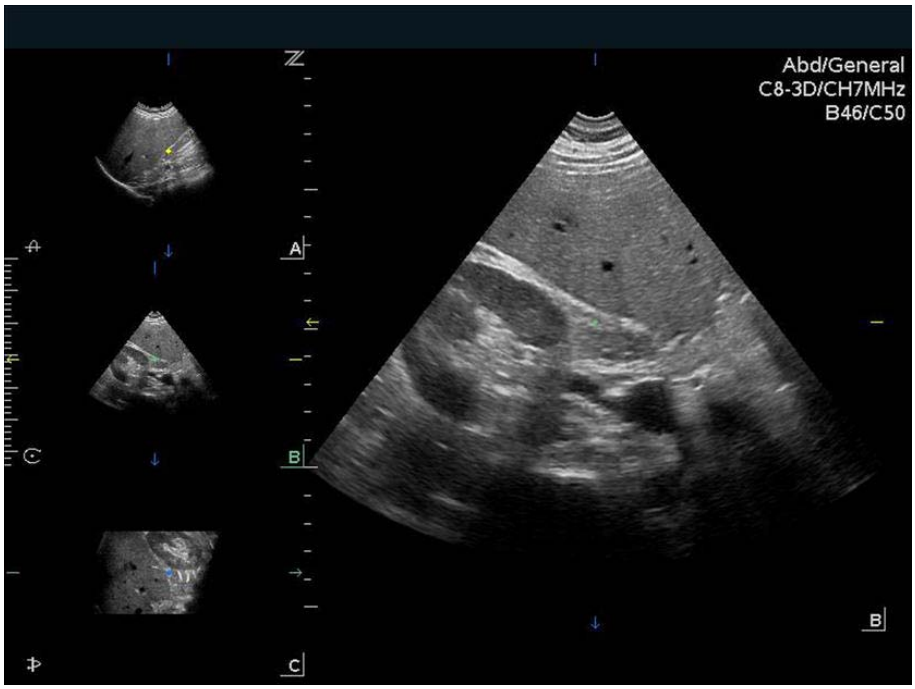


Figure 7-27. MPR Mode Display

Features include:

- Ability to cycle (forward & backwards) through different windows - **A**, **B**, & **C** planes
- Ability to measure off primary image using system **Measurement** and **OB Calcs** options
- **Thick Slice*** feature under **Menu/Tab** secondary controls

***Thick Slice Mode**: Integrates information along the z-axis to provide better contrast resolution. Maximum intensity and minimum intensity modes are supported.

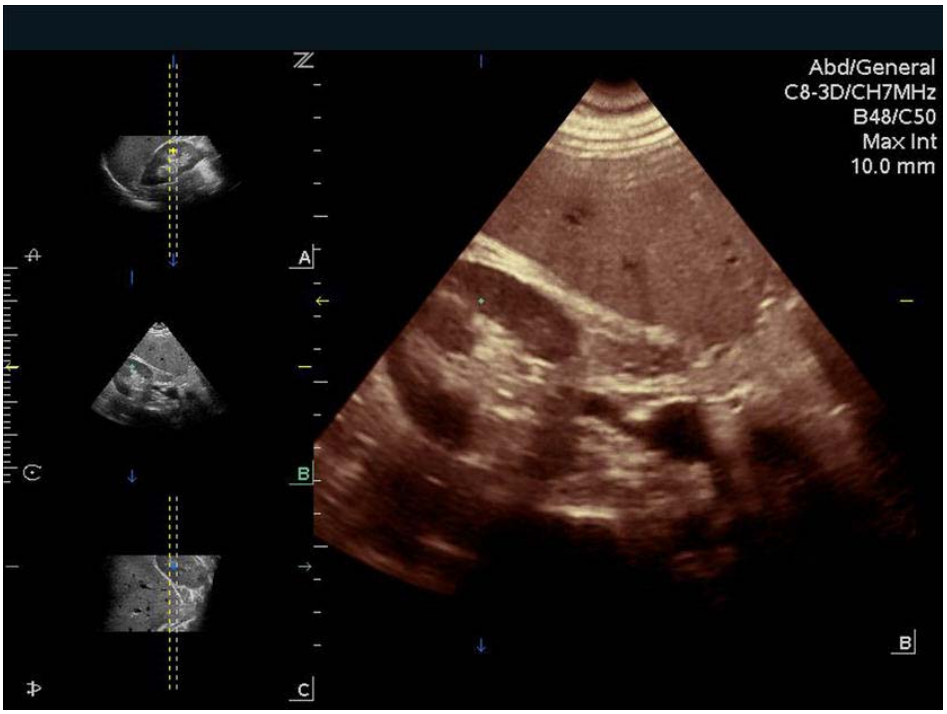


Figure 7-28. MPR Mode - Thick Slice

Tomo Mode

In **Tomo** mode, 9 images are displayed (9-up) with one image as reference for slices (Figure 7-29).

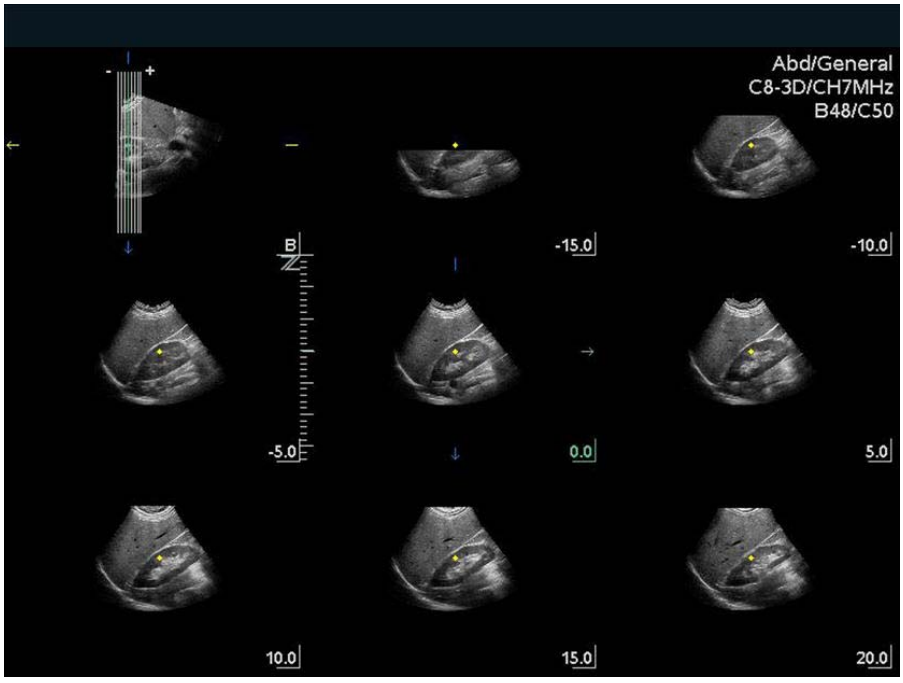


Figure 7-29. Tomo Mode Display

Features include the following abilities:

- Change line spacing between slices in mm and position of the set of lines using the **Trackball**
- Select reference image (one only) using softkey
- Toggle between **One-up** and **9-up**
- Perform measurements on **One-up** image (Figure 7-30)
- Toggle slice lines' orientation from vertical to horizontal via softkey

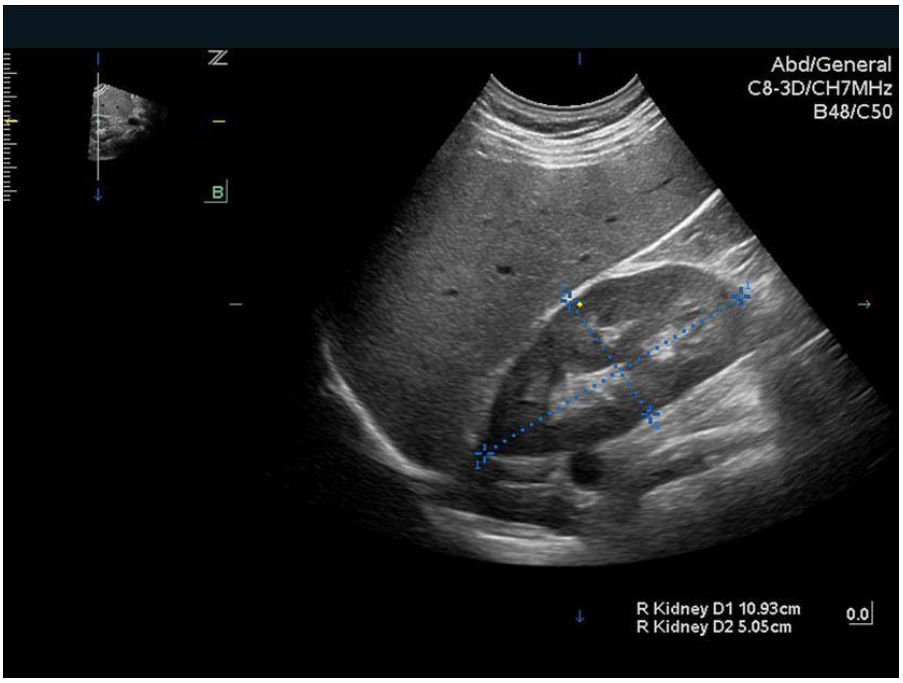


Figure 7-30. Tomo Mode - One-Up Display with Measurements

3D/4D Imaging Controls

Applicable only when connected to a Multi-Transducer Port (MTP) on **SmartCart/ SmartCart *sp*** systems.

Table 7-6. 3D/4D Controls - Volume Acquisition Processing

Control	SmartCart/SmartCart *sp*
Preprocessing	
3D Mode User-assigned **Mode** Key or **Function** key	■ Press to place the **3D ROI** on the image ■ Press **Set** to toggle between **Position** and **Size**
Preprocessing - Softkeys (*see Figure 7-23* on page 7-56)	
Start / Stop Softkey Label: **Start**	■ Press to invoke the start of a **3D Volume** ■ Pressing again during acquisition will stop it ■ Press the **Freeze** button to do the same thing

Table 7-6. 3D/4D Controls - Volume Acquisition Processing (Continued)

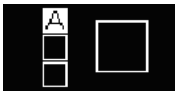
Control	SmartCart/SmartCart *sp*
Render Mode Softkey Label: **Render / MPR / Tomo**	■ Use to select the type of **3D Volume** desired: **Render [surface] / MPR / Tomo** ■ Default is **Render**
One-up / 4-up Toggle Softkey Label: 	■ Press to display **Volume** as a single, large image ■ Press again to return to 4-up (**A**, **B**, **C** planes and **Volume**)
Acquisition Quality Softkey Label: **Quality**	■ Press to select the **Quality** factor of the **Volume** set: **HIGH / BAL**anced **/ FAST** ■ Default is **HIGH**
Elevation Sweep Angle Softkey Label: **Angle**	■ Press to select the length of the sweep: **75 / 60 / 45 / 30 / 20** ■ Default is **60** degrees
3D/4D Mode	■ Press to select **Static** (3D) or **Real-Time** (4D) mode
Postprocessing - Softkeys	
Edit ROI (edit box appears) Softkey Label: **Edit ROI**	Only the **A** plane image has an adjustable curved cutline ■ Press to activate edit box for the selected plane ■ Press **Set** to cycle box functionality: **Position / Size / Cutline**
Render Mode Softkey Label: **Render / MPR / Tomo**	■ Use to select the desired rendering mode ■ Default is **Render**
One-up / 4-up Toggle Softkey Label: 	■ Press to display **Volume** as a single, large image ■ Press again to return to 4-up (**A**, **B**, **C** planes and **Volume**)
Slice Selection Softkey Label: 	■ Press to select a slice or volume: **A / B / C / V** ■ Default slice is **A**
Cubic Dimension (6 sides) Softkey Label: 	■ Press to select the viewing side for the active slice or volume ■ Default is **Top** view

Table 7-6. 3D/4D Controls - Volume Acquisition Processing (Continued)

Control	SmartCart/SmartCart *sp*
Volume Rotation Softkey Label: 	■ Press to rotate the volume to one of 4 discrete degrees: **0 / 90 / 180 / 270** ■ Default is **270** degrees
Volume Movement Softkey Label: 	■ Turn to move through the volume set: **XYZ**
Rotation (3 axes plus rotation) Default Softkey: 	■ Turn to rotate the selected plane or volume ■ Press to switch the axes. Default is **Volume** with **Z-axis** ■ Softkey options:  X-axis Y-axis Z-axis ■ Can alternatively use these **Major Mode** buttons on the **Control Panel**: **M** = **X-axis** / **D** = **Y-axis** / **C** = **Z-axis**
Threshold / Opacity / Brightness Softkey Label: **Threshold / Opacity / Brightness**	Selectable control with rotary action to adjust control parameters ■ Turn softkey to increase or decrease the value of each parameter ■ Press softkey to switch parameters ■ Default is **Brightness** ■ Can also use the **B-Mode** button to adjust **Brightness**
Secondary Postprocessing - Controls Located Under Tab Button/Menu Button	
Reset	■ Select to return volume back to original state
Mode	■ Press arrows to select an option: **Surface / Max Int / X-Ray / Min Int** ■ Chosen option displays on **Data Display**
Render Quality	■ Changes the resolution quality of the rendered image ■ Press arrows to make selection: **FAST / BALANCED / HIGH / MAX** ■ Default is **HIGH** ■ Chosen option displays on **Data Display**
Tint	■ Press arrows to select among 4 tints:1 gray / 3 colorized

Table 7-6. 3D/4D Controls - Volume Acquisition Processing (Continued)

Control	SmartCart/SmartCart *sp*
Render Smoothing	■ Press arrows to select the amount of smoothing desired: **0 / 1 / 2 / 3 / 4 / 5** ■ Least = **0** ■ Default is **3** ■ Chosen option displays on **Data Display**
Invert	■ Toggles **On / Off** ■ Inverts volume image to black on white

Elastography

Elastography (or *tissue elasticity imaging*) is an imaging modality that detects relative differences in tissue stiffness. This technique is derived from *tissue palpation*, which is performed during traditional physical examinations to detect tissues of different relative stiffness or *strain*. The magnitude of estimated strain is depicted in the form of a color or grayscale display. Differences in estimated relative strain between tissues may be demonstrated within the field of view via different colors assigned to those tissues based on the estimated strain measurement.

WARNING: Tissue elasticity is an estimation of the relative strain and at this time is not a quantifiable parameter.

Elastography is an optional capability available on ZONARE L8-3, L10-5, L14-5sp, and L14-5w transducers. It may be activated by pressing a programmable mode button configured for **Elastography** on the **SmartCart/SmartCart *sp*** or via **Menu Control** on the undocked **Scan Engine**.

Configure Mode/Function Key

If a **SmartCart/SmartCart *sp*** programmable **Mode** or **Function** button is not preconfigured for **Elastography** imaging, you can configure a button as follows:

1. Go to: **Setup button | System Setup | Keys**
2. Choose the desired **Mode** or **Function** button and select **Elastography** from its pull-down menu.
3. Then select **Apply** at the bottom of the **Keys** page to exit and return to live imaging. The button is now configured for **Elastography**. (See also "Programmable Keys" on page 7-9.)

Display Formats

The default display format for **Elastography** mode is **Dual**. The **B-Mode** image displays on the right and the **Elastography** image displays on the left.

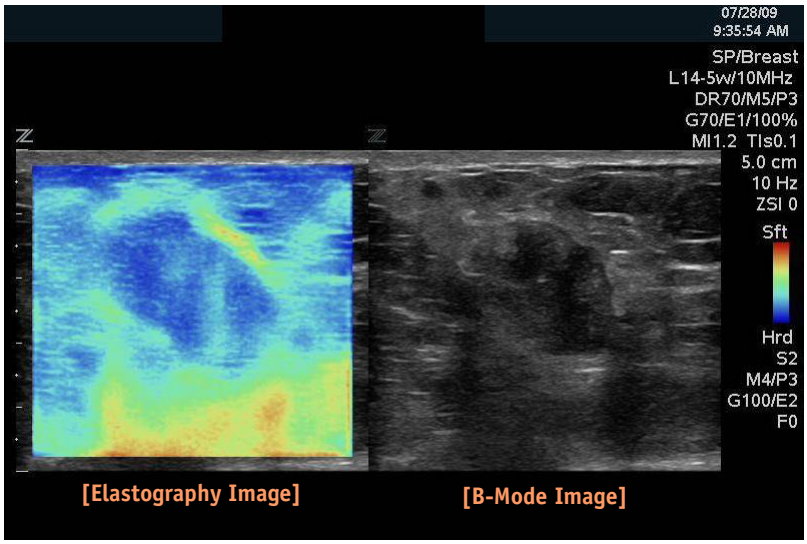


Figure 7-31. Elastography Default Image Display - Dual

To exit **Dual** display and view only the **Elastography** image:

SmartCart	Press **Dual** button.
SmartCart *sp*	Press **Menu** button and use **Trackball** to highlight and select **Dual.**
Scan Engine	Using **Menu Control**, scroll down to highlight and select **Dual: Off** selection.

To exit **Elastography** mode:

All Systems	Change imaging mode to **B**, **CD/PD**, **PW**, or **M-Mode**.

Strain Acquisition

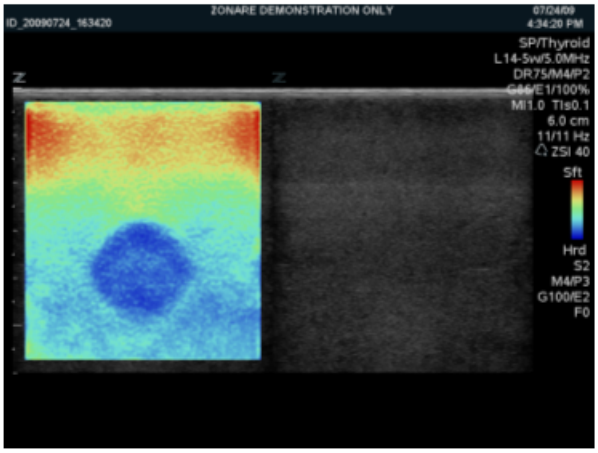
Elastography mode provides three types of strain acquisition: Relative (normalized) strain, absolute strain, and cross-correlation assessment.

Relative (Normalized) Strain

- Default Elastography Mode
- Normalized by the mean strain for more reproducible acquisition
- Mean Strain is centered on scale
- Equal Sensitivity to Hard & Soft

Example: Scale = S2
Green* = 1x Mean Strain
Blue* = 2x Hard
Red* = 2x Soft

* Red, Green, & Blue assumes using Map 4 (M4)

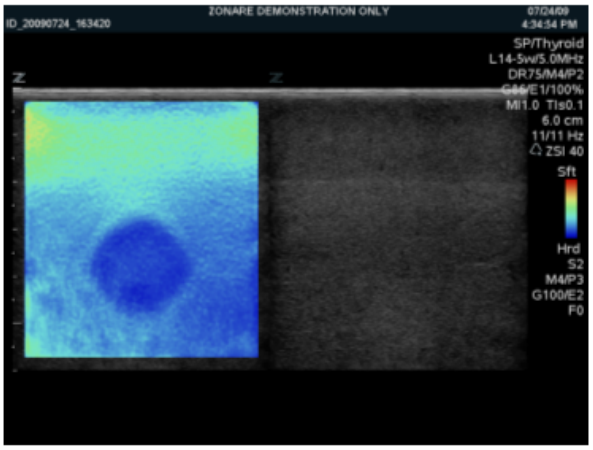


Absolute Strain

- Alternative Elastography Mode
- Strain is displayed without normalization
- More skill required to generate equal sensitivity to hard & soft targets

Example: S2 = 0 - 2% Strain
1.0% = middle of Scale (Green*)
2% = 2x Soft (Red*)
0.1% = 10x Hard (Blue*)

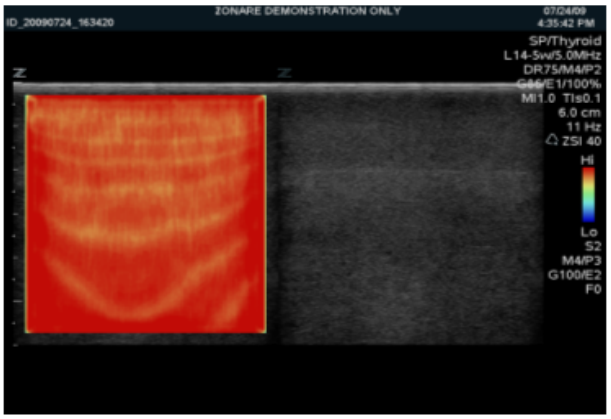
* Red, Green, & Blue assumes using Map 4 (M4)



Cross-Correlation Assessment

Cross Correlation

- Quality Assessment of Acquisition
- Help to determine if target anatomy contains frame-to-frame correlated information (Is information reliable?)
- Red* = ▲ Correlation (Reliable)
- Blue* = ▼ Correlation (Unreliable)



Example:
A true cyst will appear as “Soft” as there are no internal reflections to obtain strain. Cross Correlation data will display low correlation (Blue*) in the cyst indicating an unreliable strain estimation.

* Red & Blue assumes using Map 4 (M4)

Elastography User Controls

Elastography user controls are accessed via the Control Panel (all systems), softkey displays (**SmartCart/SmartCart sp**), and **Imaging** menu options (all systems). These are described in Table 7-7 on page 7-68.

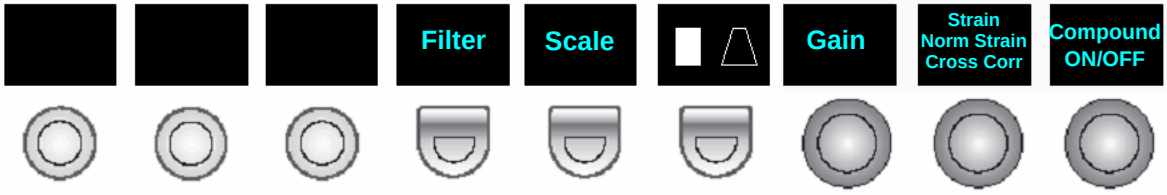


Figure 7-32. Elastography Softkeys - SmartCart/SmartCart *sp*

* Indicates this control is also available in retrospective processing.

Table 7-7. Elastography User Controls

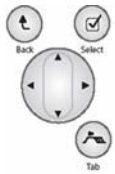
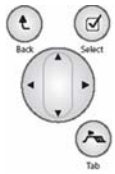
Control	SmartCart & SmartCart *sp*	Scan Engine
Dual: OFF/ON *  **SmartCart**   **SmartCart *sp***  **Scan Engine**	**NOTE:** **B-Mode** image displays on right and **Elastography** image displays on left for concurrent comparison/analysis. **SmartCart** ■ Press **Dual** button to toggle **Dual** imaging function **ON/OFF**. **SmartCart *sp*** ■ Press **Menu** button and use **Trackball** to highlight and select **Dual**.	■ On **Imaging** menu, highlight **Dual**. Press **Select** button to toggle **ON/OFF**.
Frequency  **SmartCart**  **SmartCart sp**  **Scan Engine**	■ Press **Frequency** button to increase/ decrease **Frequency**	■ Display **Imaging** menu and increase/ decrease **Frequency**

Table 7-7. Elastography User Controls (Continued)

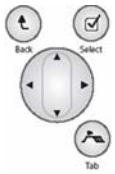
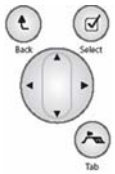
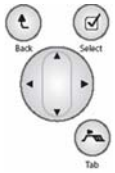
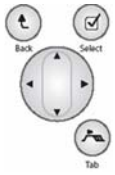
Control	SmartCart & SmartCart *sp*	Scan Engine
Compounding  **Scan Engine**	■ Press **Compounding** softkey to toggle **Compounding** ON/OFF.	■ Display **Imaging** menu and toggle **Compounding ON/OFF**
Strain/Norm Strain/ Cross Corr  **Scan Engine**	■ Rotate **Cross Corr** softkey to select desired strain acquisition format; then press knob to activate selection.	■ Display **Imaging** menu and select desired strain acquisition format.
Gain ✱  **Scan Engine**	■ Rotate **Gain** softkey to control the level of estimated strain range displayed.	■ Rotate **Gain** button to adjust **Gain**.
VA/LIN  **Scan Engine**	■ Press **VA/LIN** softkey to switch between **LIN** and **VA**.	■ Display **Imaging** menu and toggle **VA/ LIN**.
Scale  **Scan Engine**	■ Press **Scale** softkey to select the range (**S2 - S20**) of hard/soft structures in the image. **NOTE:** For tissues with large differences in strain, use a higher **Scale**. For tissues with small differences in strain, use a lower **Scale**.	■ Display **Imaging** menu and select range (**S2 - S20**) of hard/soft structures in image.

Table 7-7. Elastography User Controls (Continued)

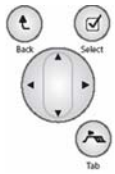
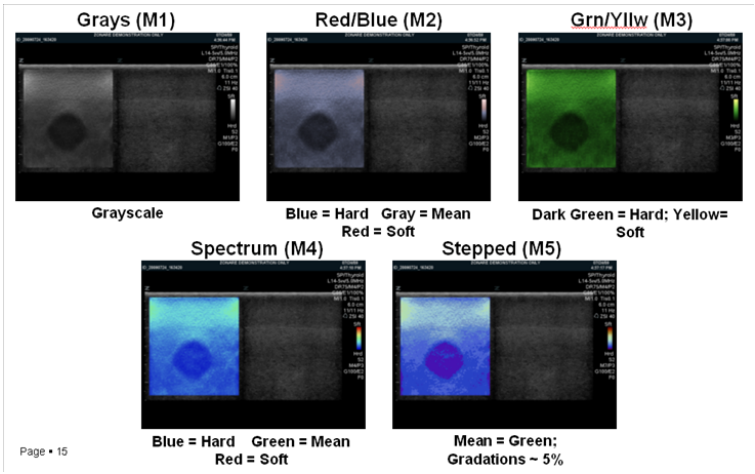
Control	SmartCart & SmartCart *sp*	Scan Engine
Filter ✱  **Scan Engine**	■ Press **Filter** softkey to select **F0**, **F1**, or **F2**. Increasing **Filter** improves estimated strain acquisition at expense of detail resolution and temporal continuity.	■ On **Imaging** menu, select desired **Filter** setting, **F0**, **F1**, or **F2**.
Elastography Imaging Menu: All Systems		
Maps ✱   **SmartCart/ SmartCart *sp***	■ Press **Menu** button and select desired **Map**: **M1**, **M2**, **M3**, **M4**, **M5**.  	
Persistence ✱   **SmartCart/ SmartCart *sp***	■ Press **Menu** button and select desired **Persistence** setting: **P0**, **P1**, **P2,** or **P3**. **NOTE: Persistence** allows for more or less temporal averaging to improve quality of display.	

Figure 7-33. Elastography Maps

Table 7-7. Elastography User Controls (Continued)

Control		SmartCart & SmartCart *sp*	Scan Engine
Edge   **SmartCart/ SmartCart *sp***	*	■ Press **Menu** button and select desired **Edge** setting: **E0**, **E1**, **E2**, or **E3**. **NOTE: Edge** allows for more or less spatial smoothing of display.	

Elastography Measurements

▶ *To Access Measurements for Elastography*

1. Freeze the desired **Elastography** image.
2. Press **Measure** button. The **Measurement** options will display on the **Imaging** menu.

Figure 7-34. Elastography Measurement Options

The following measurements are possible while using **Elastography** mode:

Distance Allows for linear measurement of the two-dimensional image. The **Distance** measurement displays the span between two calipers on the image.

For instructions to do **Distance** measurements, see "Distance" on page 9-15. In **Elastography** mode, the **Distance** measurements show simultaneously on both images (**B-Mode** and **Elastography**).

Area (trace) Enables area measurement (cm^2) and comparison of strain areas on the **Dual** images (**B-Mode** and **Elastography**) displayed. The trace is free-form. The ratio of the measured **B-Mode** area to the measured **Elastography** area is displayed in lower right of screen.

Area (ellipse) This option is exactly like **Area (trace)** except the trace is always an ellipse.

▶ *To Do an Area (trace or ellipse)*

1. Display the **Measurements** menu (see "To Access Measurements for Elastography" on page 7-71).
2. Highlight and select **Area (trace)** or **Area (ellipse)**.
3. Use **Trackball** to draw a trace/ellipse on the **B-Mode** image. Draw the trace/ellipse on the perimeter of the area of interest. The trace/ellipse will also appear on the **Elastography** image. Press **Enter** button.

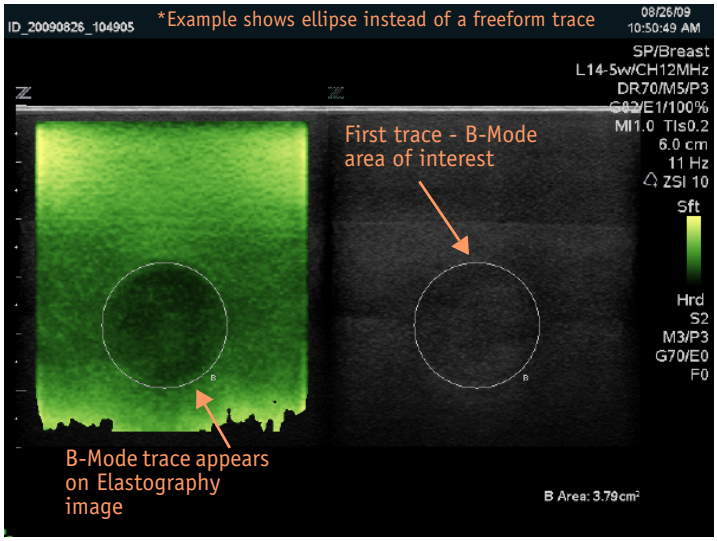


Figure 7-35. Area Ratio: First Trace/Ellipse - B-Mode

4. Use **Trackball** to draw a trace/ellipse on the **Elastography** image. The trace/ellipse will also appear on the **B-Mode** image. Press **Enter** button.

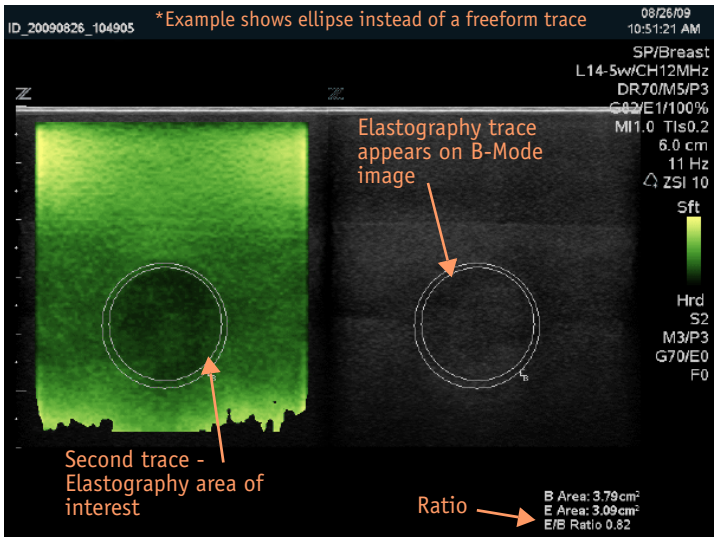


Figure 7-36. Area Ratio: Second Trace/Ellipse - Elastography

5. The area ratio is displayed at bottom right of the screen.

Retrospective Processing

Elastography may be enabled/disabled during live, frozen, or cine imaging, or when reviewing **IQ Scan** B-Mode images.

Ocular Preset

WARNING: To avoid injury to the patient, use only the Ocular Preset when performing imaging through the eye. The FDA has established lower acoustic energy limits for ophthalmic use. The system will not exceed these limits only if the Ocular Preset is selected. See the Safety Manual for information about the lower acoustic energy limits established for ophthalmic use.

▶ *To Select Ocular Preset*

1. Connect and activate transducer enabled for **Ocular** imaging: e.g., **L10-5** or **L14-5sp**.
2. Press **Exam** button. Select **Small Parts** exam type if not already selected. Then select **Ocular** preset.

Figure 7-37. Ocular Preset

3. The system enters **SP/Ocular** mode. You can begin ophthalmic scanning.

MI Acoustic Energy Output

Ocular Preset has low MI acoustic energy output for safe ophthalmic use. The system, while in **SP/Ocular** mode, will not exceed **MI 0.18**.

L10-5 Transducer: The maximum (and default) is **MI 0.18** (**100%** acoustic output, see Figure 7-38). Other options are **MI 0.16** (**75%**) and **MI 0.12** (**50%**). To select acoustic output **MI**: Press **Menu** button, then select **A Output**.

L14-5sp Transducer: Acoustic output **MI** is ***not*** user-selectable for this transducer. The default is **MI 0.16** (**100%**) and cannot be changed in **SP/Ocular** mode when scanning with **L14-5sp** transducer.

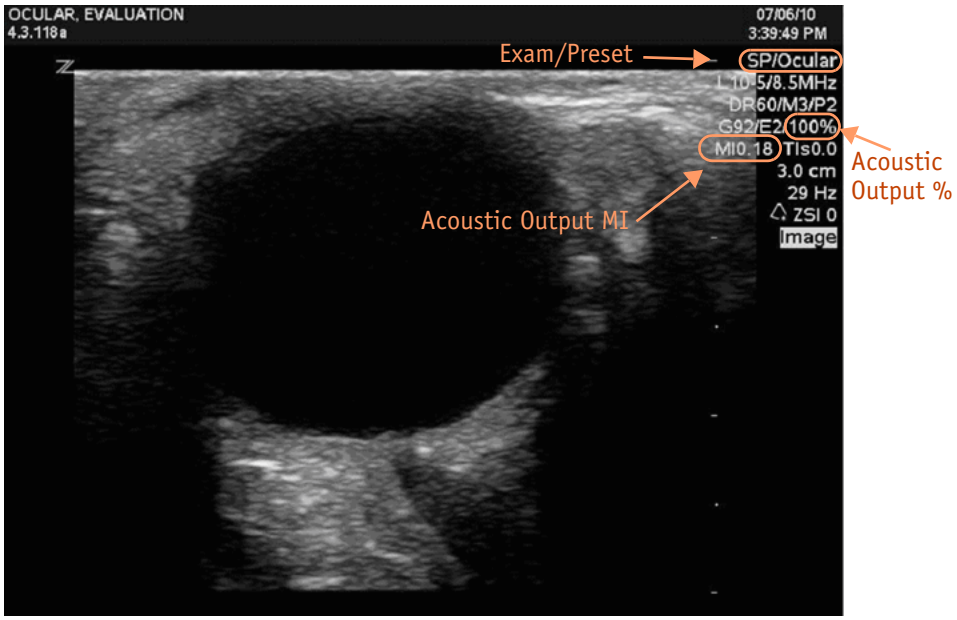


Figure 7-38. Ocular Imaging Screen

Contrast Imaging *New!*

NOTE: For **SmartCart**/**SmartCart *sp*** systems only.

Contrast Imaging is a harmonic detection mode specifically designed to enhance ultrasound contrast agent signals. Similar to 2D (B-Mode), a suite of additional optimization controls are provided to further enhance contrast agent imaging performance.

CAUTION: Cardiac rhythm disturbances during perfusion studies using gas ultrasound contrast agents have been observed in the diagnostic range of MI values. See the specific package insert for the contrast agent being used for details.

▶ *To Activate Contrast Imaging*

1. Go to **Setup | System Setup | Keys** and program a **Mode** or **Function** key for **Contrast**. Click **Apply**.

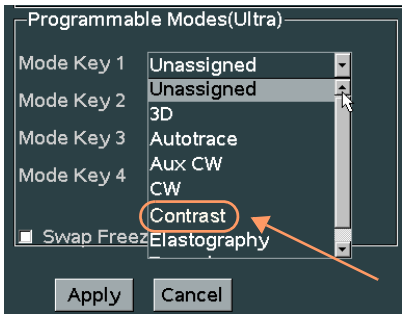


Figure 7-39. Key Assignment Screen (detail): Contrast Selection

NOTE: Once a **Mode** key is defined, it will remain so unless the system configuration is reset to factory default settings.

2. Connect and activate a transducer enabled for Contrast Imaging: **P4-1c** (**Cardiac**) or **C4-1** (**Abdominal**).
3. Select an appropriate **Preset** for the application.
4. While imaging the desired anatomy, press **Mode/Function** key you programmed for **Contrast**.
   - For **P4-1c**, system enters **Contrast** mode & displays single image.
   - For **C4-1**, system enters **Simul Dual** mode with **Contrast** detection image on left and non-contrast reference image on right.
5. Once in **Contrast** mode, system displays **Contrast** softkey controls:

Figure 7-40. Contrast Imaging Softkeys

NOTE: Rotate **Gain** softkey to control **Contrast** image brightness. Rotate **2D/B** button to control reference image brightness.

Contrast Imaging User Controls

Contrast imaging controls are accessed via the Control Panel (all systems), softkey displays (**SmartCart/SmartCart *sp***), and **Imaging** menu options (all systems). They are described in Table 7-8.

Table 7-8. Contrast Imaging User Controls

Control	SmartCart & SmartCart *sp*
Softkeys	
Simul Softkey (C4-1 transducer only)	Controls whether **Dual Simultaneous** or **Dual (**non-simultaneous) mode is operational. By default, **Dual Simultaneous** mode is enabled. ■ Press **Simul** to transition to **Dual** mode, displaying only the **Contrast** detection image. ■ Press **Enter** button to toggle between right and left imaging panes. ■ Press **Simul** again to return to **Dual Simultaneous** mode.

Table 7-8. Contrast Imaging User Controls (Continued)

Control	SmartCart & SmartCart *sp*
Stopwatch STOP/START Softkey *New!*	■ Press **START** to start timer from **0:00:00** (hours:minutes:seconds) or from the last stopped time (if was not reset). Accuracy is within 1 second. ■ Press **STOP** to stop elapsed (and active phase times, if using phases). Elapsed time (and phase times) will remain displayed onscreen. **NOTE:** See also "Clip/Image Store (Protocol Button - SmartCart only)" on page 7-12.
Stopwatch RESET/PHASE Softkey *New!*	■ **RESET** is available only in Stopwatch **STOP** state: Returns Stopwatch to **0:00:00** state Resets/clears all **Phase** timers, if present Removes onscreen Stopwatch display ■ **PHASE** is available only in Stopwatch **START** state. Four Phase times are supported. Displays duration of elapsed time as follows: Phase 1: From start of Stopwatch Phase 1+n (2,3,4): From prior Phase **NOTE:** Cine Elapsed Time (CET): Upon freezing the image, a second elapsed time will be displayed, the Cine Elapsed Time (CET). CET indicates the elapsed time for a particular cine frame or strip location. CET does not affect cine operation. Stopwatch control functionality is not be affected by displaying CET. Stopwatch control functionality is not affected by cine scroll or cine play operations. CET is displayed to the right of onscreen elapsed timer display. Two CETs are displayed when displayed in nonsimultaneous **Dual** mode. **NOTE:** See also "Clip/Image Store (Protocol Button - SmartCart only)" on page 7-12.
Image Format Softkey (C4-1 transducer only)	■ Press to change format. See "Virtual Apex Array Format" on page 7-15.
Frame Rate Softkey	Reduces the imaging frame rate and allows for increased contrast agent concentration between imaging frames. ■ Press **Frame Rate** softkey up/down to select a frame rate that is lower than the realtime frame rate. **NOTE:** The **Frame Rate** will not be increased above the initial realtime rate.
Power Softkey	Controls the Acoustic Output Power; the **A Output** selection on the **Imaging** menu does the same thing. Raising/lowering the Acoustic Output Power affects contrast agent detection. ■ Press **Power** softkey up/down to increase/decrease the **Contrast Imaging** acoustic output power.
Gain Softkey	Controls the **Contrast** image **Gain** only while in **Dual** or **Contrast**-only imaging modes: ■ Rotate the **Gain** softkey to select the desired **Contrast** image brightness. **NOTE:** While in mixed modes, like **Color Doppler** and **Spectral Doppler**, rotate the **2D/B-Mode** button to control **Contrast Gain**.
Compounding On/Off Softkey	■ Press this softkey to turn **Contrast**-specific **Compounding** on/off.

Table 7-8. Contrast Imaging User Controls (Continued)

Control	SmartCart & SmartCart *sp*
Control Panel Controls	
Depth  SmartCart/SmartCart *sp* 	■ Press **Depth** button **Up** to decrease depth; press **Down** to increase depth.
Harmonics  SmartCart  SmartCart *sp*	SmartCart ■ Press **TH** button to toggle On/Off tissue harmonic imaging. When harmonic imaging is active, an **H** displays in the Image Information area. SmartCart *sp* ■ Press **Frequency** button to cycle through the transmit frequency choices. **NOTE:** Press **Frequency** button up or down when doing **Compound** imaging to cycle through **Frequency** and **Compounding** choices.
Frequency  SmartCart  SmartCart *sp*	SmartCart ■ Press **Frequency** button **Up** to increase transmit frequency; press **Down** to decrease transmit frequency. Selected value is displayed in Image Information area. SmartCart *sp* ■ Press **Frequency** button to cycle through the transmit frequency choices. **NOTE:** Press **Frequency** button up or down when doing **Compound** imaging to cycle through **Frequency** and **Compounding** choices.
Zoom  SmartCart/SmartCart *sp*	■ ***Acoustic Zoom*** (During live scanning): Press **Zoom button**. The ROI (region of interest) box displays over the image. Define the ROI: Use the **Trackball**. Press the **Set** button to toggle between ROI position and ROI size. Press **Zoom** to display the enlarged ROI. Press **Zoom** to return to the normal view. ■ ***Display/Pan Zoom*** (From a Frozen Image): Press **Zoom button**. The image initially magnifies 1.25X Use **Trackball** to pan the image. Press **Depth** rocker button up to increase magnification level Press **Depth** rocker button down to decrease magnification level Press **Zoom** to return to the normal view **NOTE:** Press **Set** button to toggle between **Clip/Cine Review** and **Pan Zoom**.

Table 7-8. Contrast Imaging User Controls (Continued)

Control	SmartCart & SmartCart *sp*
Dual: OFF/ON  **SmartCart**   **SmartCart *sp***	**NOTE:** **B-Mode** image displays on right and **Contrast** image displays on left for concurrent comparison/analysis. **SmartCart** ■ Press **Dual** button to toggle **Dual** imaging **ON/OFF**. **SmartCart *sp*** ■ Press **Menu** button and use **Trackball** to highlight and select **Dual**.
Dynamic Range  	■ Press the **Menu** button. Highlight **Dyn Range** with the **Trackball**. Move the **Trackball** Left / Right (or press left/right **Set** buttons) to increase or decrease the desired dynamic range.
Edge  	■ Press the **Menu** button. Highlight **Edge** with the **Trackball**. Move the **Trackball** left/right (or press left/right **Set** buttons) to increase or decrease the desired image enhancement option.
Persistence  	■ Press the **Menu** button. Highlight **Persistence** with the **Trackball**. Move the **Trackball** left/right (or press left/right **Set** button) to increase or decrease the desired level of frame averaging.

Table 7-8. Contrast Imaging User Controls (Continued)

Control	SmartCart & SmartCart *sp*
Maps  	■ Press **Menu** button. Highlight **Maps** with **Trackball**. Move **Trackball** Left / Right to select desired tissue grey-scale map to be applied to image.
L/R Invert  	■ Press the **Menu** button. Highlight **L/R Invert** with the **Trackball**. Press **Set** to invert the L/R orientation of the image. The transducer orientation marker (Zonare “Z”) moves from the left to the right of the Image area.
U/D Invert  	■ Press the **Menu** button. Highlight **U/D Invert** with the **Trackball**. Press **Set** to invert the U/D orientation of the image. The transducer orientation marker (Zonare “Z”) moves from the top to the bottom of the Image area.
DGC  **SmartCart**   **SmartCart *sp***	**SmartCart** ■ Move a **DGC** slider to the right to increase gain, and to the left to decrease gain for the depth zone controlled by each slider. When DGC is being adjusted, the on-screen DGC graphic displays to the right of the image. **SmartCart *sp*** ■ Press the **Menu** button. Highlight **DGC** with the **Trackball**. Move the **Trackball** down/up the **DGC** curve and highlight the desired **DGC** depth button. ■ To select multiple **DGC** buttons simultaneously, press **Enter** button. Then highlight as many **DGC** buttons as desired. They will move in unison. ■ Move the **Trackball** left/right to increase or decrease the **Gain**.

Table 7-8. Contrast Imaging User Controls (Continued)

Control	SmartCart & SmartCart *sp*
Optimize  SmartCart/SmartCart *sp*	**Overall / DGC Gain** ■ Press the **Optimize** button to automatically balance the Overall/DGC gain. The B-Mode image will adjust the brightness of the image to the default Target Gain value. **Sound Speed Correction** ■ Press and hold down the **Optimize** button to automatically compensate for the sound speed in tissue. The B-Mode image will pause momentarily, then adjust for the detected sound speed. **To Exit Optimize Mode** ■ Double-click the **Optimize** button to turn Optimize functions = OFF.
Compounding   SmartCart/SmartCart *sp*  SmartCart	**NOTE:** All ZONARE ultrasound factory **Presets** have **Compounding** as the default. To adjust B-Mode frequencies, first exit **Compounding** as follows: ■ Highlight **Compounding** in the **Imaging** menu. Press **Select** to turn OFF the **Compound Harmonic** imaging function. Repeat this process to turn ON **Compounding**. ■ There may be more than one **Compounding Image** selection depending on the transducer. To select another **Compounding** setting, press the left/right arrows on the Menu Control. **NOTE:** On the **SmartCart**, press the **Frequency** button up or down when doing **Compound** imaging to cycle through **Frequency** and **Compounding** choices.
A Output   	■ Press the **Menu** button. Highlight **A Output** with the **Trackball**. Move the **Trackball** left/right (or press left/right **Set** buttons) to decrease or increase the desired transmit power output level. ■ The current transmit power level is displayed (as a percentage; 25%, 50%, etc.) in the Image Information area. The default value is 100%.
Tints   	■ Press **Menu** button. Highlight **Tints** with **Trackball**. Move **Trackball** Left / Right to select desired **Tint** to be applied to image. **NOTE:** Tints may be applied separately to **Dual** images.

8

Annotations

The user can enter text annotation, body pattern graphics, and arrow graphics on live images, frozen images, stored images during in-progress exam review (open exam), and stored images from restarted exams.

Annotations and graphics can be stored with:

- The frozen image in the open exam
- Stored images during in-progress exam review
- Stored images from restarted exams

Annotations and graphics can be intermixed and placed on the image in any order.

Annotation Types

Three types of text annotation and two types of graphics can be placed on the image.

Free-Form Text

Free-form text can be placed anywhere on the screen except for the image title bar and the menu area. Free-form text can be entered from the **SmartCart/ SmartCart *sp*** keyboard or from the **Scan Engine** virtual keyboard (**VKB**). See "Virtual Keyboard (VKB)" on page 5-2.

Programmed Orientation Text (POT)

A variety of different programmed orientation text (POT) values can be placed on the image:

- Right/Left
- Proximal/Mid/Distal
- Longitudinal/Transverse/Sagittal/Coronal

POTs can be placed anywhere on the screen except for the image title bar and menu area.

List Text Entries

List1, **List2**, and **List3** menus are application-specific terms defined by the user. List entries can be placed anywhere on the screen except for the image title bar and menu area.

Arrow Graphic

The arrow is free moving and can be placed anywhere on the screen except for the image title bar and the menu area. As many as 15 arrows may be placed on the image.

Body Pattern Graphics

One **Body Pattern** graphic can be placed from an **Exam**-specific **Body Patterns** menu. The selected graphic is displayed in the lower-left quadrant of the image area. After the **Body Pattern** graphic is placed, use **Trackball** and **Set** button or the positioning and rotation softkeys to position and rotate the graphic.

NOTE: See "Body Pattern Graphics" on page 17-9 for a complete list of the available **Body Pattern** graphics and associated **Exam Types**.

List Keys/Annotation Configuration

▶ *To Configure List Keys*

1. Go to:

SmartCart/SmartCart *sp*	**Setup button| System Setup | Annotations**
Scan Engine	**Tools | System Setup | Annotations**

2. The **Annotation Preset Configuration** screen displays (Figure 8-1).
3. Select the options you want and click **Apply** to save.

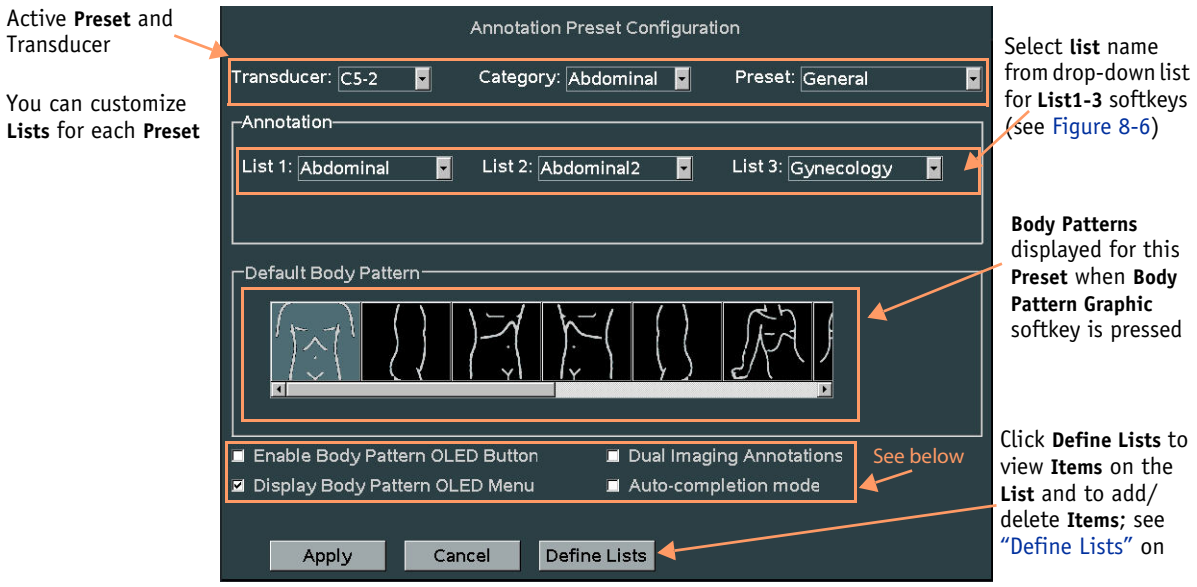


Figure 8-1. Annotation Preset Configuration Screen

Checkboxes

Checkbox	Description
Enable Body Pattern OLED Button	Check this box to enable the **Body Pattern** softkey (2nd from far right). Press the softkey to cycle through the **Body Patterns** available for the active **Preset**. Enabled in B- and M-Modes only.
Display Body Pattern OLED Menu	Check this box to view a special **Body Pattern** softkey display that has been user-configured for the **Preset**. Press the **Body Pattern** softkey (above) to show this display.
Dual Imaging Annotations	Check this box to enable entry and manipulation of **Text**, **POT**, **Lists**, **Body Patterns**, and **Arrows** independently on each pane of a **Dual** display. Press the **Enter** button on the Control Panel to toggle panes.
Auto-Completion Mode	Check this box to enable auto-completion of **TEXT** entries after pressing the **TEXT** key. After typing the first letter of **TEXT**, the system will automatically display a possible match. To accept the match and complete the **TEXT** entry, press the **Enter** key on the QWERTY keyboard.

Define Lists

Click the **Define Lists** softkey on the **Annotation Preset Configuration** screen to display the **Annotation List Definition** screen.

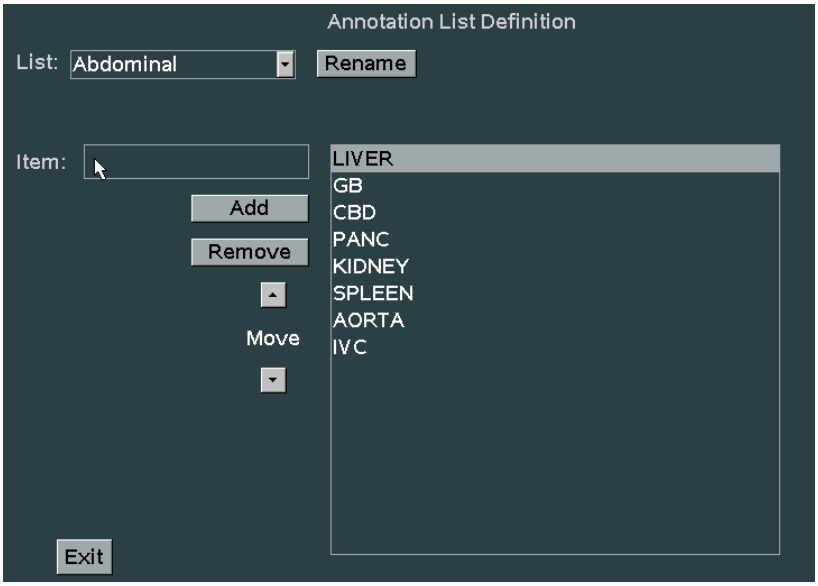


Figure 8-2. Annotation List Definition Screen

▶ *To Add Item to a List*

1. Click on the desired **List** name in the **List** dropdown box.

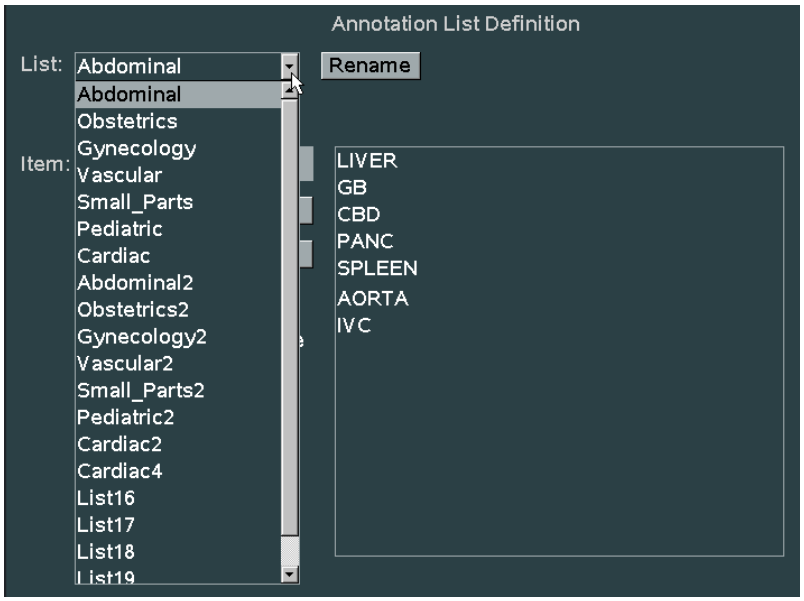


Figure 8-3. List Dropdown Box

2. Type the name of the **Item** you want to add in the box (the example below shows **KIDNEY**). Then click the **Add** softkey. **KIDNEY** is now an item on this **List**.

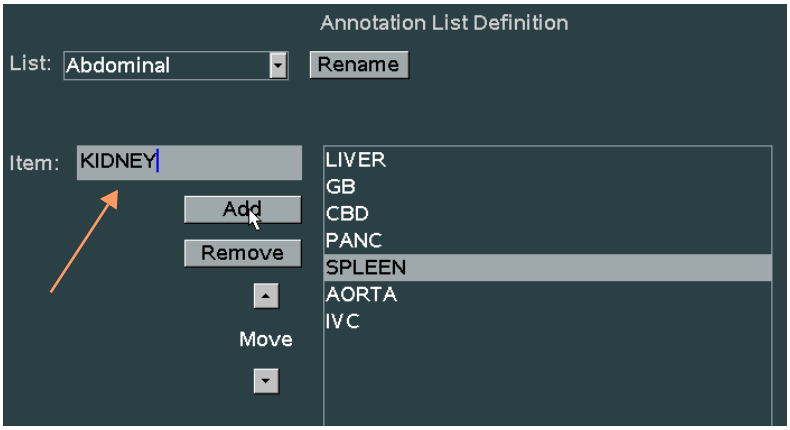


Figure 8-4. New Item Added to a List

▶ *To Remove Item from a List*

1. Highlight the Item you want to delete.
2. Click the **Remove** softkey. The **Item** is removed from the **List**.

To Move Item Up or Down in List

1. Highlight the **Item** you want to move.
2. Click the **Move** up or down arrow to move the **Item**. Each click moves the **Item** one place up or down.

To Rename a List

1. In the **List** dropdown box (Figure 8-3), select the **List** name you want to change.
2. Then click the **Rename** softkey.
3. Type the new name in the box (the example below shows **CARDIAC1**). Then click **Apply**. The **List** has now been renamed.

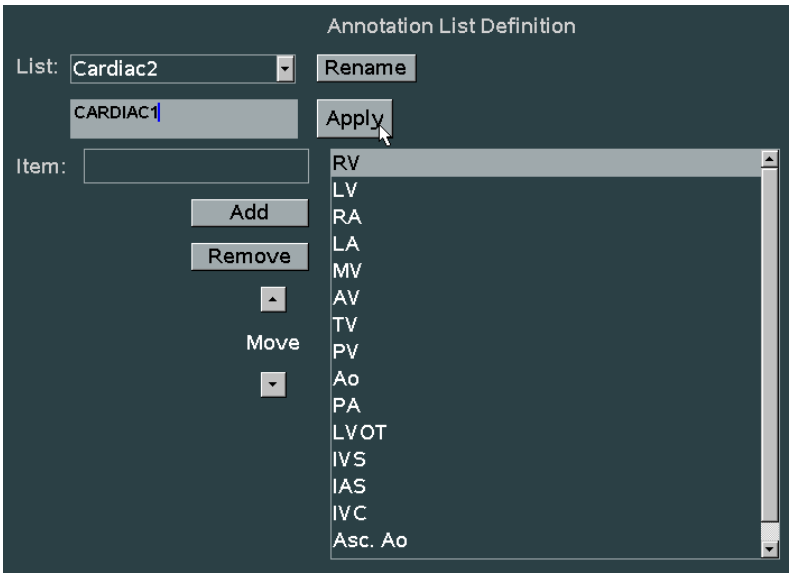


Figure 8-5. New Name for a List

Working with Annotations - All Systems

- A single text annotation is limited by the number of lines that will fit before reaching the bottom of the imaging area.
  - Characters are never chopped off at the right edge of the screen. When the cursor reaches the right edge of the screen, the System automatically performs a carriage return and aligns the cursor with the left-most character of the free text string.
  - If entering another character results in text extending beyond the bottom of the screen, any subsequent keyboard character keystrokes are ignored.
  - Use the **Backspace** key to delete the character to the left of the cursor and shift the characters to the right of the cursor one character to the left.

- When the cursor moves to a new position after the user enters text, the previous text string is considered complete and text entry will begin at the new cursor location.
  - If the cursor is moved back into the string and text entry continues, text will be in the **Overwrite** mode.

POTS and Lists

- There can be up to three **POT** entries (one for each key) and three **List** entries (one for each key) in a block of text.
  - Only one instance of a particular **POT** key may exist in a block. For example, **Right** and **Left** from the **Rt/Lt POT** key cannot exist in the same block.
  - If the cursor position is changed within the block of text and a **POT** or **List** key is pressed, the **POT** or **List** item will not be added at the new cursor position; they will be changed at their current location.
- Regardless of the ordering of the entries, if a **POT** string was entered, subsequent presses of a **POT** key or selection of a **POT** menu item cycles the **POT** values even if other **POT** and list entries have been placed there after it.
  - For example, if **POT** and **List** entries have been made such that the display shows that the **COR LEFT PROX LIST1** and the **Rt/Lt** key is pressed, the display now shows **COR RIGHT PROX LIST1**. If the **Prox/Mid/Dist** key is pressed, the display shows **COR RIGHT MID LIST1**.
  - If the cursor position is changed after **POT** or **List** values were entered and a new block of text is started, subsequent presses of the **POT** or **List** keys will enter those items in the new text block.
  - If a **POT** or **List** value is added in a line of text, the **POT** or **List** value is entered with a space after it.

Delete Word and Delete Text

- When the user presses **Del Word** on the **SmartCart/SmartCart *sp*** QWERTY keyboard or selects **Del Word** from the **Scan Engine** menu, the word (text, **POT**, or **List**) to the left of the cursor will be deleted.
- If the cursor is placed within a word and the user presses **Del Word**, the word the cursor is within will be deleted.

Insert Mode and Overwrite Mode

When there is typed text, the user can either **Insert** or **Overwrite**. **Overwrite** is the default mode.

Insert Mode

1. Place the **Text** cursor between the desired characters to start **Insert Mode**.
2. Press the **Set** button. The text cursor will turn yellow. The message **Insert Mode** also displays. When typing, the characters to the right of the cursor will move to the right.
3. If the cursor is moved to another location within the block of text, the System will default back to **Overwrite Mode**.

Overwrite Mode

1. Place the **Text** cursor between the desired characters to start **Overwrite Mode**.
2. When typing, the characters to the right of the cursor will be replaced by the new characters.

Block Text Manipulation

Block text can be moved to another location:

1. Using the **Set** button, double-click within the block of text. The block will now be highlighted in yellow.
2. Use **Trackball** to move text to the desired location.
3. Single-click the **Set** button to anchor the text.

Annotation Procedures - SmartCart/SmartCart *sp*

Annotation Button (SmartCart only)

Press the **Annotation** button to display the softkeys (see Figure 8-6 on page 8-8) for the selected **Exam/Preset** and transducer.

▶ *To Place Annotations*

1. Press the **Text** key or **Spacebar** on the keyboard. The green text cursor appears at the default **Home** position.
2. Use the **Trackball** to move the text cursor to another position. Annotations can now be entered at the cursor position.
3. Press the **Home** key on the keyboard to move the text cursor to the **Home** position at any time.
4. To redefine the **Home** position, use the **Trackball** to move the text cursor to the desired **Home** position.
   - Press **Shift + Set Home** on the keyboard. This position is now defined as the new **Home** position, and the text cursor then moves to that position when the **Home** key is pressed.

▶ *To Enter Free-Form Text*

1. Press the **Text** key or **Spacebar** on the keyboard to display the text cursor.
2. Use the **Trackball** to move the text cursor to the desired position.
3. Use the keyboard to enter the desired text. Enter a character to place that character at the cursor location, and then move the cursor one character to the right. The keyboard defaults to uppercase.
4. Use the **Trackball** to move the text cursor to another position, and then continue entering text.

▶ *To Enter Programmed Orientation Text (POT)*

Programmed orientation text can be entered either from the POT keys on the QWERTY keyboard or the POT softkeys on the Control Panel.

To Enter POT from Qwerty Keyboard:

1. Press the **Text** key or **Spacebar** on the keyboard to display the text cursor.
2. Use the **Trackball** to move the text cursor to the desired position.
3. Press one of the **POT** keys on the keyboard. The first **POT** value will display, and then the text cursor moves to the right of the displayed value.

NOTE: The **POT** keys are cycling keys. Press a **POT** key to replace the currently displayed value with the next value.

4. Continue pressing a **POT** key until the desired value is displayed.
5. Press another **POT** key to place its value to the right of the first **POT** entry.

To Enter POT From POT Softkeys:

1. Press the **Text** key or **Spacebar** on the keyboard to display the text cursor.
2. Use the **Trackball** to move the text cursor to the desired position.
3. Press one of the **POT** softkeys. The first **POT** value will display, and the text cursor moves to the right of the displayed value.

NOTE: The **POT** softkeys are cycling keys. Press a **POT** softkey to replace the currently displayed value with the next value.

4. Continue pressing a **POT** softkey until the desired value is displayed.
5. Press another **POT** softkey to place its value to the right of the first **POT** entry.

NOTE: **POT** values can be entered without first pressing the **Text** key. When a **POT** key is pressed and no text cursor is displayed, the **POT** is entered at the **Home** position or at the last text cursor position if **Text** was previously invoked. The text cursor displays to the right of the **POT** value. The **Annotation** and **Body Pattern** softkeys also display.

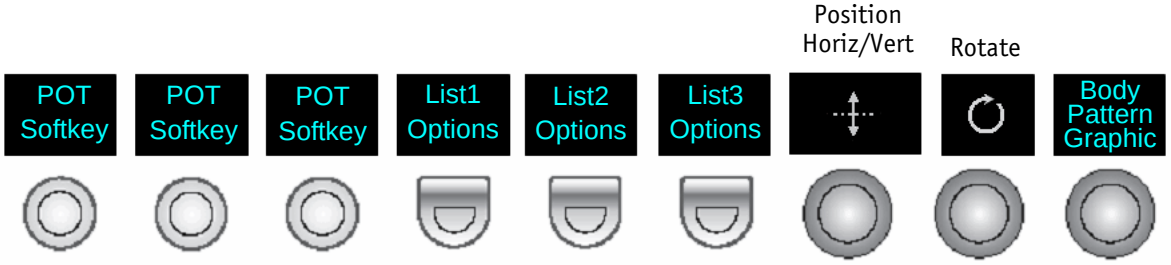


Figure 8-6. Annotation Softkey Display (Generic)

▶ *To Enter List Text*

List text can be entered either from the **List1** and **List2** keys on the QWERTY keyboard or the **List1**, **List2**, and **List3** softkeys on the Control Panel.

NOTE: To configure **List** keys, see "List Keys/Annotation Configuration" on page 8-2.

▶ *To Enter List Text From QWERTY Keyboard*

1. Press the **Text** key or **Spacebar** on the keyboard to display the text cursor.
2. Use the **Trackball** to move the text cursor to the desired position.

3. Press the **List1** key on the keyboard. The first list value displays, and the text cursor then moves to the right of the displayed value.

NOTE: The **List** keys are cycling keys, each press replacing the currently displayed value with the next value.

4. Continue pressing the **List1** key until the desired value is displayed.
5. Press the **List2** key. The first list value displays and the text cursor then moves to the right of the displayed value.
6. Continue pressing the **List2** key until the desired value is displayed.

▶ *To Enter List Text From List Softkeys*

1. Press the **Text** key or **Spacebar** on the keyboard to display the text cursor.
2. Use the **Trackball** to move the text cursor to the desired position.
3. Press one of the **List** softkeys on the user interface. The first **List** value will display, and then the text cursor moves to the right of the displayed value.

NOTE: The **List** keys (L**ist1**, **List2**, **List3**) are cycling keys. Press a **List** softkey to replace the currently displayed value with the next value.

4. Continue pressing a **List** softkey until the desired value is displayed.
5. Press another **List** softkey to place its value to the right of the first **List** entry.

NOTE: **List1** and **List2** values can be entered without first pressing the **Text** key. When the **List1** or **List2** key is pressed and no text cursor is displayed, the **List1** or **List2** value is entered at the **Home** position or at the last text cursor position if **Text** had been previously invoked. The text cursor displays to the right of the **List1** or **List2** value. The **Annotation** and **Body Pattern** softkeys also display (Figure 8-6 on page 8-8).

▶ *To Delete All Text, POT Values, List Values, and Arrow Graphics*

SmartCart/SmartCart sp	Press **Shift+Del Text** on the keyboard
Scan Engine	Select **Del Text** from the menu

- Neither **Del Text** nor **Shift+Del Text** delete any **Body Pattern** graphics.
- Press **Shift+Del Text** or **Del Text** when the text cursor is not displayed to delete all text, **POT** values, **List** values, and arrow graphics and the text cursor does not display.

▶ *To Exit Annotations*

When the user exits **Annotations** mode, the text cursor is removed and the Annotation and Body Pattern softkeys are no longer available. To exit **Annotations** mode:

1. Press the **Text** key on the keyboard.
2. Freeze the image.

3. Unfreeze the image. The System remembers the last cursor position, and then the cursor defaults to the previous position when annotation mode is entered the next time.

Annotation Procedures - Scan Engine

To Place Annotations

1. From the **Tools** menu or the **Freeze** menu, use **Menu Control** to scroll to the **Annotate** menu item, and then press the **Select** button.
2. On the **Annotate** menu, highlight **Text** and press **Select**. The green text cursor appears at the default **Home** position and the virtual keyboard (VKB) displays.
3. Use the **Trackball** to move the text cursor to another position. Annotations can now be entered at the cursor position.
4. Using **Menu Control**, highlight **Home**; then press **Select** to move the text cursor to the **Home** position at any time.
5. To redefine the **Home** position, use the **Trackball** to move the text cursor to the desired **Home** position.
6. Using **Menu Control**, highlight **Set Home**; then press **Select**. This position is now defined as the new **Home** position, and then the text cursor moves to that position when the **Home** menu item is selected.

To Enter Free-Form Text

1. From the **Tools** menu or the **Freeze** menu, use **Menu Control** to scroll to the **Annotate** menu item, and then press the **Select** button to display the **Annotate** menu.
2. To enter free text, highlight **Text**; then press **Select** to activate the **VKB**.
3. Use the **Trackball** to move the text cursor to another position. Annotations can now be entered at the cursor position.
4. Use the stylus on the **VKB** to enter the desired text.
5. Enter a character to place that character at the cursor location, and then move the cursor one character to the right. The **VKB** defaults to uppercase.
6. Use the **Trackball** to move the text cursor to another position, and then continue entering text.

To Enter Programmed Orientation Text (POT)

1. From the **Tools** menu or the **Freeze** menu, use **Menu** Control to scroll to the **Annotate** menu item, and then press the **Select** button to display the **Annotate** menu.
2. Use the **Trackball** to move the text cursor to the desired position.
3. Use **Menu Control** to scroll to one of the **POT** menu items, and then press the **Select**. The first **POT** value displays, and the text cursor then moves to the right of the displayed value.

NOTE: The **POT** keys are cycling keys. Press a **POT** key to recycle the currently displayed value with the next value.

4. Continue selecting a **POT** key until the desired value is displayed.
5. Select another **POT** key to place its value to the right of the first **POT** entry.

NOTE: The user can enter **POT** values without first pressing the **Text** key. When a **POT** key is pressed and no text cursor is displayed, the **POT** is entered at the **Home** position or at the last text cursor position if text was previously invoked. The text cursor displays to the right of the **POT** value. The **VKB** also displays.

▶ *To Enter List Text*

1. From the **Tools** menu or the **Freeze** menu, use **Menu Control** to scroll to the **Annotate** menu item, and then press the **Select** key to display the **Annotate** menu.
2. Use the **Trackball** to move the text cursor to the desired position.
3. Use **Menu Control** to scroll to **List1** and press the **Select** key. The first list value displays, and the text cursor then moves to the right of the displayed value.

NOTE: The **List** key is a cycling key. Press each key to recycle the currently displayed value with the next value.

4. Continue selecting the **List1** key until the desired value is displayed.
5. Select **List2** or **List3** to place the first value in **List2** or **List3** to the right of the last text entry.

NOTE: **List1**, **List2**, and **List3** values can be entered without first pressing the **Text** key. When the **List1**, **List2,** or **List3** menu items are selected and no text cursor is displayed, the **List1**, **List2,** or **List3** value is entered at the **Home** position or at the last text cursor position if **Text** had been previously invoked. The text cursor displays to the right of the **List1**, **List2,** or **List3** value. The **VKB** also displays. See "List Keys/Annotation Configuration" on page 8-2 for information on configuring **Lists**.

▶ *To Exit Annotations*

When the user exits **Annotations** mode, the text cursor is removed. To exit **Annotations** mode:

1. Press the **Back** key.
2. Scroll to the **Text** menu item and press **Select**.
3. Freeze the image.
4. Unfreeze the image. The System remembers the last cursor position, and then the cursor defaults to the previous position when **Annotation** mode is entered the next time.

Graphics Procedures - SmartCart/SmartCart *sp*

See "Body Pattern Graphics" on page 17-9 for a complete list of the available **Body Pattern** graphics and associated **Exam Types**. See "List Keys/Annotation Configuration" on page 8-2 for information on configuring **Body Pattern** graphics.

▶ *To Activate Display of Body Patterns*

Press the **Body Pattern** key on the **SmartCart/SmartCart *sp*** QWERTY keyboard. An initial default **Body Pattern** specific to the **Exam** type in use will appear at the bottom of the display. The Annotation and Body Pattern softkeys will also display.

NOTE: The **Body Pattern** key on QWERTY keyboard is a toggle ON/OFF function.

▶ *To Change Body Patterns*

Rotate the **Body Pattern** softkey left or right to sequence through the available body patterns until the desired pattern is displayed.

▶ *To Position Transducer Graphic*

In addition to the selected body pattern, a transducer (transducer) graphic will be displayed in green within the body marker. The message **Probe graphic positioning** also displays. The probe graphic may be positioned and rotated by using either the Trackball or the positioning and rotation softkeys.

▶ *To Position Probe Graphic Using the Trackball*

1. Use the **Trackball** to position the probe graphic.
2. When the probe graphic is positioned correctly, press the **Set** button. The probe graphic position locks and a message **Probe graphic rotating** displays.
3. Use the **Trackball** to rotate the probe graphic.
4. When the probe graphic is correctly rotated, press the **Enter**, **Back**, **Tab**, or **Freeze** button. This locks the probe graphic and exits **Body Patterns**. The probe graphic now displays in white and no messages display.

▶ *To Position Probe Graphic Using the Softkeys*

1. Rotate the **Position** softkey left/right (see Figure 8-6) to position the probe graphic. Press the softkey to change from lateral positioning to vertical positioning.
2. Rotate the **Rotate** softkey left/right (see Figure 8-6) until the probe graphic is correctly rotated.
3. When the probe graphic is correctly rotated, press the **Enter**, **Back**, **Tab**, or **Freeze** button. This locks the probe graphic and exits **Body Pattern**s. The probe graphic now displays in white and no messages display.

▶ *To Remove Body Patterns From Display*

Press the **Body Pattern** key a second time.

▶ *To Use Arrows*

Arrows can be used during live or frozen imaging. As many as 15 arrows can be displayed at one time.

1. Press the  key on the keyboard. A green arrow displays in the center of the imaging area. The message **Arrow graphic positioning** also displays.
2. Use the **Trackball** to position the arrow. If  is pressed while an arrow is green, that arrow is removed. Pressing  does not remove any arrows that have previously been locked in position.
3. Press the **Set** button to enable arrow rotation about its point. The message **Arrow graphic rotation** also displays.
4. Use the **Trackball** to rotate the arrow. Pressing **Set** will toggle between arrow positioning and arrow rotation.
5. To lock the arrow in position and display another arrow, double-click the **Set** button.
6. To remove all arrow graphics in Live mode, press **Shift+Del Text** key.
7. In **Freeze** mode, exiting **Freeze** will remove all arrow graphics.

▶ *To Clear All Annotations, Arrows, and Body Markers*

All annotations, arrows, and body markers are cleared when any of the following events occur:

- Changing exam types
- Powering off the System
- Ending an exam

Graphics Procedures - Scan Engine

See “Body Pattern Graphics” on page 17-9 for a complete list of the available **Body Pattern** graphics and associated **Exam Types**. See “List Keys/Annotation Configuration” on page 8-2 for information on configuring **Body Pattern** graphics.

▶ *To Activate Display of Body Patterns*

1. From the **Tools** menu or the **Freeze** menu, use **Menu Control** to scroll to the **Body Patterns** menu item, and then press the **Select** button.
2. An initial default **Body Pattern** specific to the **Exam Type** in use will appear at the bottom of the display.

▶ *To Change Body Patterns*

1. From the **Tools** menu or the **Freeze** menu, use **Menu Control** to scroll to the **Body Patterns** menu item, and then press the **Select** button.
2. Ensure the **Pattern** menu item is selected in the **Body Patterns** menu.
3. Use the **Menu Control** left/right arrows to sequence through the available body patterns until the desired pattern is displayed.

▶ *To Position Probe Graphic*

In addition to the selected body pattern, a probe (transducer) graphic will be displayed in green within the body marker. The message **Probe graphic positioning** also displays.

1. Use the **Trackball** to position the probe graphic.
2. When the probe graphic is positioned correctly, press the **Set** button. The probe graphic position locks and a message **Probe graphic rotating** displays.
3. Use the **Trackball** to rotate the probe graphic.
4. When the probe graphic is correctly rotated, press the **Back**, **Tab**, or **Freeze** button. This locks the probe graphic and exits **Body Patterns**. The probe graphic now displays in white and no messages display.

▶ *To Remove Body Patterns From Display*

1. Use the **Menu Control** left/right arrows to scroll to **Body Patterns** and press the **Select** button.
2. Use **Menu Control** to scroll to menu item listed as **Blank**.
3. To remove the **Body Pattern** graphic, press the **Select** button.

▶ *To Use Arrows*

Arrows can be used during live or frozen imaging. As many as 15 arrows can be displayed at one time.

1. From the **Tools** menu or the **Freeze** menu, use **Menu Control** to scroll to the **Annotate** selection.
2. Use **Menu Control** to scroll to the **Arrows** menu item, and then press the **Select** button. A green arrow displays in the center of the imaging area and the message **Arrow graphic positioning** also displays.
3. Use the **Trackball** to position the arrow.
4. Press the **Set** button to enable arrow rotation about its point. The message **Arrow graphic rotation** also displays.
5. Use the **Trackball** to rotate the arrow. Pressing **Set** will toggle between arrow positioning and arrow rotation.
6. To lock the arrow in position and display another arrow, double-click the **Set** button.
7. To delete the most recently locked arrow, use **Menu Control** to scroll to the **Delete Arrow** menu item and press **Select**.
8. Exit **Freeze** to remove all arrow graphics.

▶ *To Clear All Annotations and Arrows*

Scroll to the **Del Text** menu item and press the **Select** button to remove all text and arrows.

▶ *To Clear All Annotations, Arrows, And Body Markers*

All annotations, arrows, and body markers are cleared when any of the following events occur:

- Changing exam types
- Powering off the System
- Ending an exam

Dual Imaging Annotations - All Systems

Text, **POTS**, **Lists**, **Body Patterns**, and **Arrows** may be entered on each pane of a **Dual** image.

▶ *To Enable Dual Imaging Annotations*

1. Go to **Setup button | System Setup | Annotations**, and press **Select**.
2. On the **Annotation Preset Configuration** screen (Figure 8-1 on page 8-2), check the box next to **Dual Imaging Annotations** and click **Apply**.

Using Annotations During Dual Imaging

Text, **POTS**, **Lists**, **Body Patterns**, and **Arrows** in **Dual Imaging** behave as described earlier in this chapter with the following exceptions:

- If the left pane is active and a **Body Pattern** is selected, it will be displayed below the left image. If the right pane is active and a **Body Pattern** is selected, it will be displayed below the right image. A **Body Pattern** may be displayed below each image.
- **POTS** or **Lists** entered on each pane are mutually exclusive. For example, if **LONG** is entered when the right pane is selected, it can also be entered when the left pane is selected: the **POT** will not display the next **POT** item, **TRANS**, and it will not overwrite **LONG** that was entered when the right pane was active.
- Arrows will be invoked from the center of the imaging area, whether the right or left pane is active.
- **Text**, **POTS**, **Lists**, and **Arrows** can be placed anywhere on either **Dual** image, no matter which pane is active.
- When **Dual Imaging** is exited, annotations entered on the left pane will be displayed on the non-**Dual** image. Annotations entered on the right pane will not be displayed when **Dual Imaging** is exited.
- When **Dual imaging** is re-entered, annotations for both the right and left panes will be displayed.
- Annotations and **Body Patterns** can be deleted as described earlier in this chapter but only for the active pane.
  - To delete annotations entered when the left pane was active, the left pane must be selected.
  - To delete annotations entered when the right pane was active, the right pane must be selected.

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9

Measurements and Calculations

NOTE: For **Cardiac** calculations and imaging, see Chapter 10 Echocardiography Option.

With the **SmartCart/SmartCart *sp*** the user can perform a full range of measurements and calculations on live, frozen, and stored images from an open exam and on stored images from an archived exam.

Each imaging mode supports a specific mode-dependent **Generic** measurement package. Only the measurements available for the active imaging mode are listed in the current **Measurement** menu.

A **Calc** Package can only be invoked when the user selects the associated **Exam/Preset** type. If no **Calc** Package is associated with selected **Exam/Preset** type, the System will ignore attempt to invoke **Calc** Package.

Measurement and **Calc** packages can be customized to allow for variations in demographic and workflow requirements.

Exam Types and Measurement Menus

The imaging mode determines the types of available **Generic** measurements.

Figure 9-1. Generic Measurements by Mode

B-Mode	M-Mode	PW-Mode	
B Depth*	M Depth*	Velocity*	Acceleration
B Distance	M Distance	Velocity Pairs	S/D
Circ/Area	HR	RI	A/B
% Stenosis		PI	HR
Volume			

*A single caliper measures **Depth** when in B/M/Color modes and measures **Velocity** when in PW mode.

Tools for Measurements and Calculations

Freeze

The image must be ***frozen*** before most measurements and calculations can be performed on it.

- To freeze an image, press **Freeze** button.

Measure and Calcs Menus

- User can directly access **Measure** menu by pressing **Measure** button.
- User can directly access exam **Calc** measurements by pressing **Calc** button.

Figure 9-2. Generic Measure Menu (example); Calcs Menu (OB example)

Measurements and calculations that are available during an examination are *mode specific* and are listed in the **Measure** or **Calc** menu.

- To select the appropriate item:

SmartCart/SmartCart *sp*	Use **Trackball** to highlight and select; this automatically initializes measurement and places a cursor on imaging screen
Scan Engine	Use **Menu Control** up/down arrows, which automatically initializes measurement and places a cursor on imaging screen

- The menu will automatically reposition to the opposite side of the imaging display when it is 'touched' by the active measurement tool. This is to allow full access to the available display region for measurements.
- The user can also manually toggle the menu location by using the keyboard **L** and **R** keys (left and right menu positioning, respectively).
- **Show previous measurement:** The display of multiple measurements (current and previous) is supported as a setup option. If the **Show previous measurement** option is **On (**see Figure 9-5), the graphics and **Data Display Box** (see page 9-3) for both the current and previous measurement – Calculation Package or generic – will remain on the Display. Otherwise, only one measurement at a time is displayable.
- **Maintain Calcs upon Freeze: Calc** state (active or inactive) persistence across **Freeze**/un-**Freeze** cycling is supported as a setup option. If the **Maintain Calcs**

upon Freeze option is **On** (see Figure 9-5) and a Calculation Package is active when an un-**Freeze** occurs, the Calculation Package will automatically be reactivated the next time **Freeze** is entered as long as the Operator has not changed modes in the interim. Otherwise, it is necessary to manually reactivate the Calculation Package the next time **Freeze** is entered.

Fetus A, B, C, D, E

The OB calc package can be used to collect data on up to five fetuses, labeled **Fetus A, B, C**, etc.

- The **Worksheet** automatically reflects the number of fetuses recorded in the **Patient Information** form.
- Measurement data is recorded separately in the **Worksheet** for each selected fetus.

Right/Left

The **Right/Left** option is offered in the **Measure** menu for **Vascular, GYN,** and **Abdomen**. Toggle to record bilateral measurements.

CCA and ICA

The **Measure** menu for the **Vascular Exam** type includes **CCA** and **ICA** functions.

- These have associated value cycle menu icons with the following values: proximal (**Prx**), middle (**Mid**), and distal (**Dist**).
- These functions enable measurement of the different sections of each vessel.

Diastolic/ Systolic

The **Measure** menu for the **Vascular Exam** type includes the **Diastolic/Systolic** function, which enables measurement of different phases of the cardiac cycle.

E/A

The **Measure** menu for the **Fetal Echo Exam** type includes the **E/A** function, which enables measurement of the passive filling of the left ventricle (**E**) and the atrial kick (**A**).

Calipers

The System provides several types of calipers.

- The user can place a single caliper on a live image or multiple calipers on a frozen image from an open or archived exam.
- The caliper associated with the first item in the exam-specific **Measure** menu is automatically activated when the **Measure** menu is displayed.
- Calipers display in **GREEN** when they are active, and in **BLUE** when set. Images can be saved with calipers in place.
- The **Data Display Box** (see below) shows dynamic measurements and calculations data for the active caliper(s).

Data Display Box (DDB)

The **Data Display Box** (**DDB**) displays at the bottom right of the screen. It is visible in all imaging modes when the user is performing a measurement, whether the image is live or frozen.

- During live imaging in **B**, **M**, or **Color** modes, the **DDB** displays the depth from the transducer face to the position of the cursor.
- In **PW** mode, the caliper shows the velocity at the caliper position on the PW Strip.
- On frozen images, the **DDB** displays data related to the measurements and calculations in progress.

When working with **Calc** Packages, the data in the **DDB** is stored when the measurements have been completed (locked down). To complete measurements, press the **Enter** button (**SmartCart**), **Enter/Select** button (**SmartCart *sp***), **Select** button (**Scan Engine**), or **Store/Print**.

Measurements made when working with calculation packages are highlighted in reverse in the **DDB** to indicate results have been recorded on the associated Worksheet/Report.

Calculation Packages

Calc packages have been developed for the following **Exam** types:

- Abdominal
- Cardiac
- Obstetrics
- Gynecology
- Vascular
- Pediatric

Figure 9-3. Examples of Calc Menus

NOTE: A Cardiac Calculation Package is available. See "Echocardiography Option" on page 10-1 for more information.

NOTE: If the **Exam** type selected does not have a Calculation Package available pressing the **Calc** button will have no effect (no **Calc** menu will display).

The **Exam** type determines the **Calc** Package that is available. The combination of the **Presets** selection and imaging mode determines which of the supported **Calc** Package measurements will be available and displayed in the **Calculations** menu.

Customizing Calc Packages

The **General** measurement configuration package and the **Calculation** configuration package are accessed through the **Calcs** menu.

1. To access the selections, go to:

SmartCart/SmartCart *sp*	**Setup | System Setup | Calcs**
Scan Engine	**Tools | System Setup | Calcs**

SmartCart/SmartCart *sp*

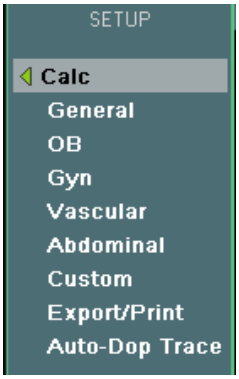


Figure 9-4. Calcs Menu

2. The **General** selection displays the **General Configuration** screen.

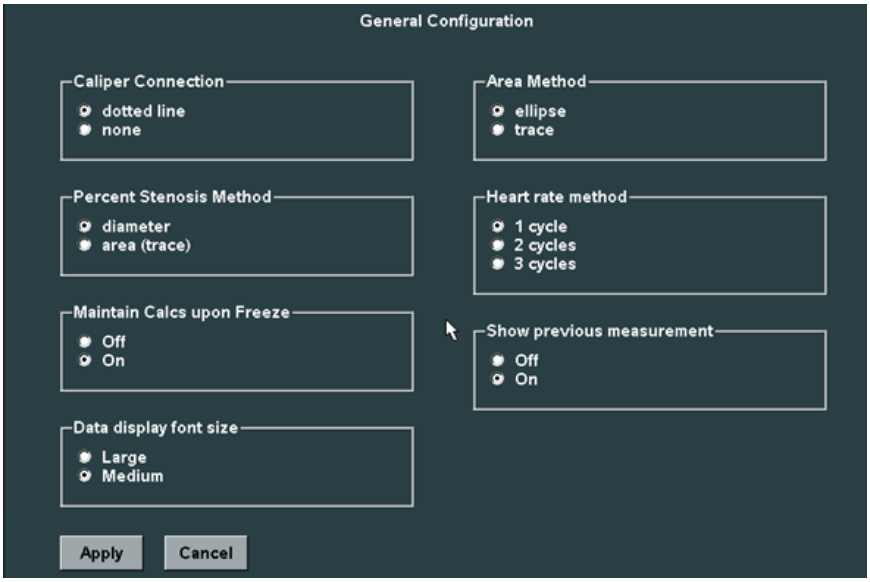


Figure 9-5. Calcs – General Configuration Screen

The user can customize:

- Caliper connection
- Percent stenosis method
- Area method
- Heart rate method
- Maintain Calcs upon Freeze
- Show previous measurement
- Data display font size

These settings apply to the **Generic** measurement package as well as to the Calculation Packages, to the extent that they do not conflict with any specific tool behaviors for a **Calc** package.

Worksheets and Reports

NOTE: For information on other **Worksheets**/**Reports** available on the system, see "User Customizable Worksheets" on page 9-7 and "DICOM Structured Reports" on page 13-14.

Each **Calc** Package includes associated **Worksheet** and **Report** pages. All completed measurement and calculation results are automatically populated to the **Worksheet/Report** for the selected **Calc** Package.

- A **Worksheet** is a spreadsheet that displays all the measurement and calculation results entered into a **Calc** Package, including multiple results for each measurement.
  - Depending on the **Calc** Package, the **Worksheet** can be edited to customize aspects of the display, select alternate equations, and edit measurement data.
- The **Report** is the summary of the measurement and calculation results entered into a **Calc** Package.
  - The **Report** displays an abbreviated form of the content derived from the **Worksheet**.
  - The **Report** is not directly editable; the user makes any desired changes to the **Worksheet**.
  - Changes made in the **Worksheet** will be reflected in the **Report** when next viewed or printed.
- All measurement and calculation results entered in a **Calc** Package are saved when an image is stored (at least one image store is required). In addition, any calculation results taken after the last image store will be saved when the exam is ended.
- The **Report** for an exam that has been ended can be selected and reviewed using **Archive Review**.
- The user can obtain hardcopy output for any of the **Worksheet** and/or **Report** displays by printing to a video printer connected to the System or to a network printer using the DICOM print function.
- For **Calc** Packages that support direct **Report** printing (currently only **OB** & **GYN**), a hardcopy of the associated **Report** can be printed on a PostScript Level 3-compatible printer connected via USB or a network (see "Printing OB & GYN Reports" on page 9-13).

Data Fields

The **Worksheet** has five types of data fields:

- **Free Text Data Field**: The free text data field accepts alphanumeric characters entered via the keyboard or the Touchscreen. Each such field has a maximum character count. Text wraps until the maximum character count is reached.
- **Numeric Data Field**: The numeric data field accepts only numeric characters and the decimal point entered via the **DDB**, the keyboard, or the VKB. Any other entry is ignored. In addition, superfluous precision after the decimal place is not allowed.

- **Date Data Field**: The date data field accepts only a date in the format selected in system setup.
- **Highly Restricted Data Field**: This highly restricted data field accepts only certain characters; for example, the **BPP** data field accepts only **0** (zero) or **2**. All other characters are ignored.
- **Checkbox**: This checkbox toggles between two states: activated (checked) and deactivated (unchecked). To activate or deactivate a checkbox, highlight the field by moving the cursor into it with the Trackball, and then press **Set**. (Or on the QWERTY keyboard, use the **Tab** key to move to the checkbox and press the **Enter** button (the "return arrow" button).

Editing Worksheets

Worksheet result data fields are editable. The user can edit or delete existing results and enter new results into any data fields.

- To navigate the **Worksheet** displays, use either the **Tab** key on the keyboard (or the **VKB** on the undocked **Scan Engine**) or use the **Trackball/Cursor** followed by the **Set** button to select a data field.
- Once an editable field is selected, the user can enter or change data.

Selecting Worksheet and Report Displays

When the **Scan Engine** is docked on the **SmartCart/SmartCart *sp***, all **Worksheet** pages include a softkey labeled **Report**.

- When the user selects this **Report** button, the display toggles (switches) to the first page of the **Report** display.

Correspondingly, all **Report** pages include a softkey labeled **Worksheet**.

- If the user selects the **Worksheet** softkey on the **Report**, the display toggles to the corresponding page of the **Worksheet** display.

NOTE: When the **Scan Engine** is undocked, selecting the cycling option in the **Calculations** menu performs the same function as the **Worksheet** and **Report** softkey when the **Scan Engine** is docked on the **SmartCart/SmartCart sp**.

User Customizable Worksheets *New!*

NOTE: See also "DICOM Structured Reports" on page 13-14.

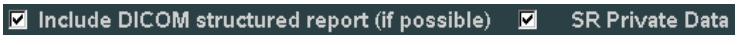
User customizable worksheets/reports (**User Worksheets**) enable users to augment standard exam worksheet/report data with site-specific exam data fields.

User Worksheet templates are defined and then imported into the ZONARE system as XML-format files. These **Worksheets** are assigned to **Presets**, integrated with **Calc** worksheets and reports, and included in exported structured report files for later display on third-party commercial software.

Setup

If using **User Worksheets**, configure the system as follows *before* using the worksheets.

1. Go to Figure 11-10, "Archive Exam Export Options Screen," on page 11-24, and check boxes for **Include DICOM structured report (if possible)** *and* **SR Private Data** under **DICOM Export Options** heading.



Click **Apply**.

2. Go to Figure 13-12, "DICOM Network Storage Destination Screen," on page 13-10, and configure a **Storage Destination** for custom reports (Figure 9-6). Be sure to also check boxes for **SR Document** *and* **SR Private Data** under **Object Type** heading. ☑ SR Document ☑ SR Private Data Click **Apply**.

NOTE: You can configure your [**Default Archive**] as the **Storage Destination** as long as you check boxes for **SR Document** *and* **SR Private Data** as described in step above.

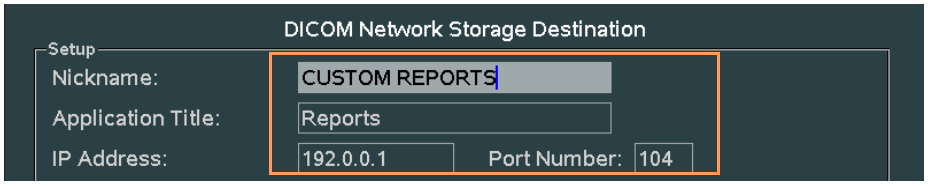


Figure 9-6. Example: Custom Reports Storage Destination

3. Go to Figure 11-4, "Image Store/Print Buttons Screen," on page 11-6 and select the storage destination for **Custom Worksheets/Reports** in the **Reports** drop-down box (e.g., **CUSTOM REPORTS** in Figure 9-7). Click **Apply**.

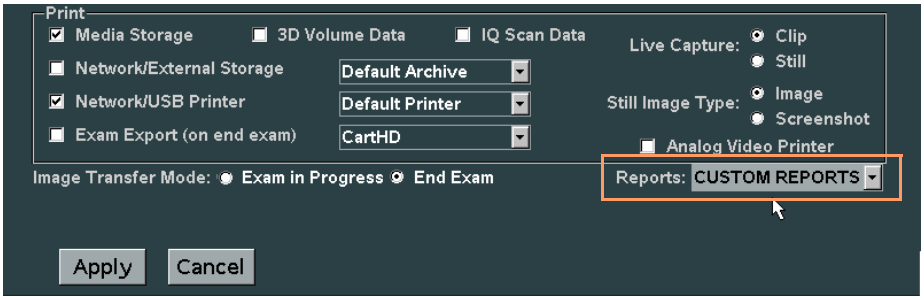


Figure 9-7. Select Storage Destination in Reports Box

Assigning User Worksheets to Presets

▶ *To Assign User Worksheets to Exam Presets*

NOTE: Only one **User Worksheet** can be assigned to a **Preset**.

1. Go to **Setup | System Setup | Calcs | User Worksheets**.
2. The **Custom Report Pages** screen displays.

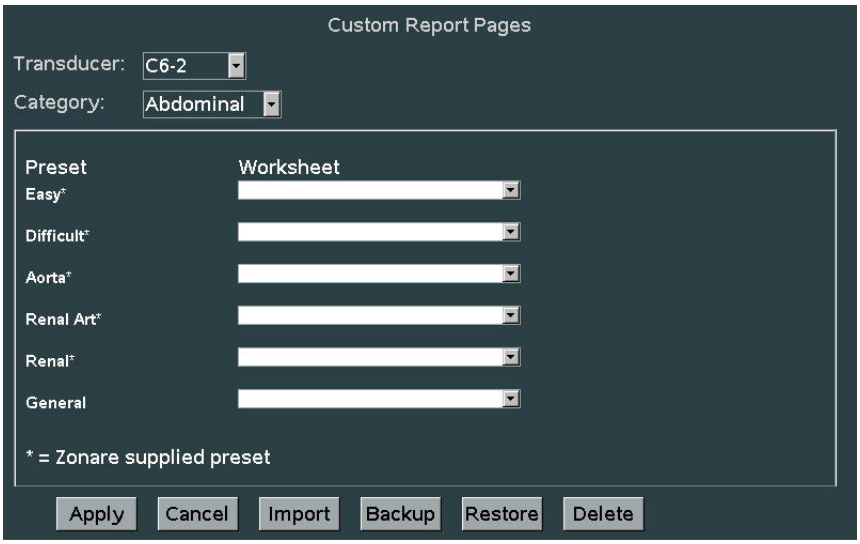


Figure 9-8. Custom Report Pages Screen

3. Insert USB stick containing custom **User Worksheet** templates (filename: **MasterWorksheet.wst**) into USB port on the system.
4. Message will display: **No worksheets available. Use Import/Restore to get the worksheets**.
5. Click the **Import** softkey on the **Custom Report Pages** screen. Message will display: **Proceed with updates?** Click **Yes**. The custom **User Worksheet** templates will load.
6. Select transducer from **Transducer** drop-down list (e.g., **P4-1c**).
7. Select **Exam** type from **Category** drop-down list (e.g., **Cardiac**).

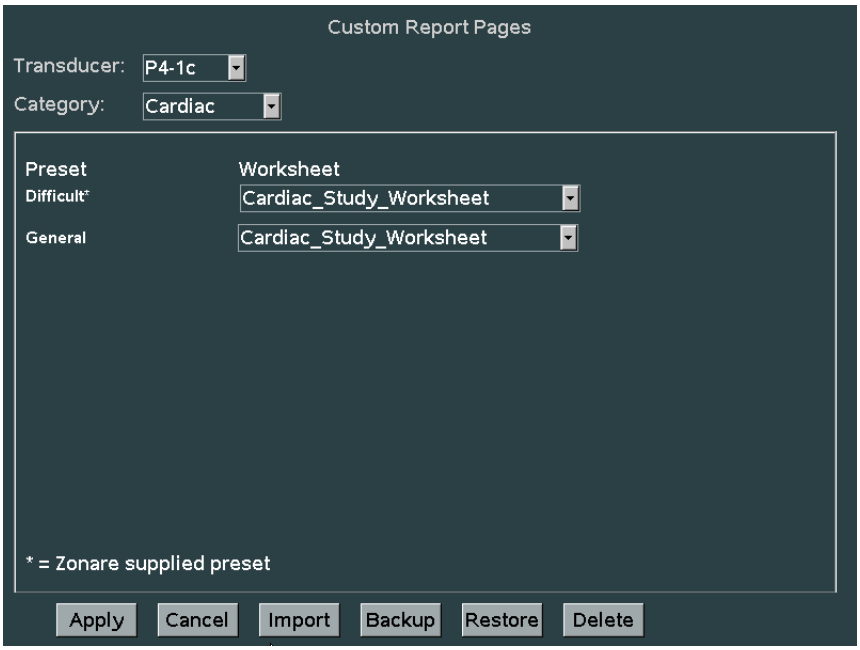


Figure 9-9. User Worksheets Assigned to Cardiac Presets (Example)

8. Assign **User Worksheet** for desired **Preset** from **Worksheet** drop-down list. This list displays all **User Worksheets** available on the system.
9. Click **Apply** to assign selected **User Worksheet** to **Preset(s)**. When message **Proceed with preset updates** appears, select **YES**.
10. To view standard ZONARE **Worksheets** and new **User Worksheets** during an exam (e.g., **Cardio/General** or **Cardio/Difficult**), press **Report** button on Control Panel.
    - Standard ZONARE **Worksheets** for **Exam/Preset** display first, followed by newly added **User Worksheets**. For example, there are 9 standard ZONARE **Cardio/General Worksheets**. With newly added **User Worksheets**, there is a total of 14 **Worksheets** for **Cardio/General**. The newly added **User Worksheets** display after standard ZONARE **Worksheets**.

Table 9-1. Custom Report Pages Screen: Softkeys

Softkey	Description
Apply	Press to assign selected **User Worksheet**(s) to **Preset**(s). **NOTE:** Assigning a **Worksheet** to a factory **Preset** creates a new user preset with the same name or modification of user preset by the same name. When a new user preset with the same name as the factory preset is created, the factory preset is no longer visible for selection. If the factory preset was the category default, the user preset shall now be the category default. The assignment information is located in the **Calc** component area for the user preset.
Cancel	Press to cancel any **Worksheet** assignments specified for the **Presets**.
Import	Press to check for a USB drive with **MasterWorksheet.wst** file. This file contains templates for one or more **Worksheets**. **Import** option creates separate worksheet files for each template. **Worksheet** files created are ZONARE-formatted and stored in the **CustomWorksheetTemplates** subdirectory on the main system drive.
Backup	Press to archive all files in the **CustomWorksheetTemplates** subdirectory to a USB drive.
Restore	Press to display all ZONARE-formatted **Worksheets** in USB drive's **CustomWorksheetTemplates** subdirectory. User can restore all or individual worksheets to system main drive under same directory name. User may choose to overwrite files with same names that already exist on system hard drive.
Delete	Press to display all ZONARE-formatted worksheets in system hard drive subdirectory **CustomWorksheetTemplates**. User can select all or individual **Worksheets** to delete.

Ending & Restoring Exams

- Assigned **User Worksheet** is loaded when associated **Preset** is activated.
- When an exam using **Presets** with associated **User Worksheet** types is ended, a copy of the **User Worksheet** template files for the associated **Worksheet** types is saved in the exam folder for the ended exam.

- Data entered in **User Worksheets** is saved with exam's **Calc** data. Data is restored when an exam is opened for review or restarted. Restored data is included in custom worksheets and reports.

Import & Export

- Users can export one or more **User Worksheet** templates in XML format to a USB stick. This file format can be used for import to another ZONARE system.
- When an archived exam is *exported* to media, the exported exam folder includes all custom worksheet templates in the archived exam folder.
- When an exam is *imported* from media, the imported exam folder includes all custom worksheet templates from the exam folder on the imported media.
- When an exam is saved via **Exam Export**, all custom worksheet templates from exam are saved in the exam folder on the **Exam Export** destination media.

Backup, Restore, Rebuild & Clean Install

- **User Worksheet** master folder is included in backup and restore of system files. Assignments of **User Worksheet** types for **Presets** is included with backup and restore of **Preset** files.
- When patient database is rebuilt, **User Worksheet** templates in exam folders are retained in exam folder. They are excluded from database rebuild process.
- A clean install *does not* clear the **User Worksheet** template directory.

Printing Reports

▶ ***To Configure Report Printing***

1. Go to:

SmartCart/SmartCart *sp*	**Setup button | System Setup | Calcs | Export/Print**
Scan Engine	**Tools | System Setup | Calcs | Export/Print**

2. The **Printer/Export Configuration** screen displays:

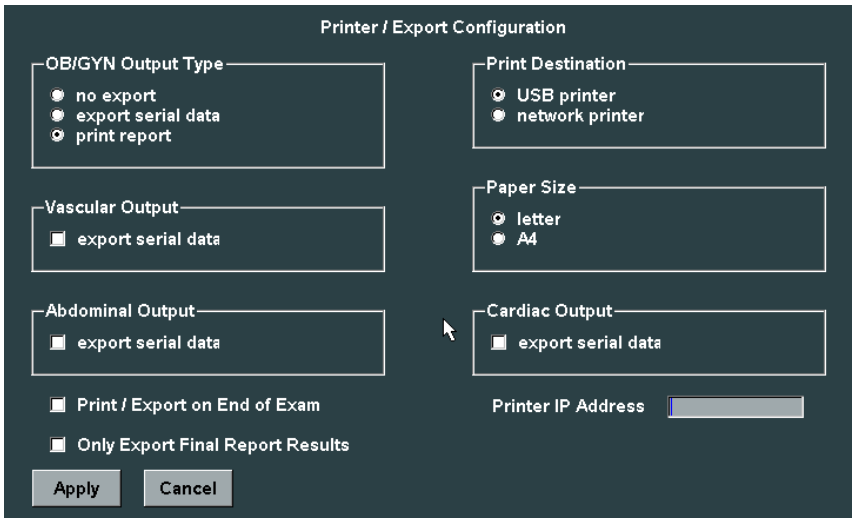


Figure 9-10. Printer/Export Configuration Screen

3. Make your selections (table below) and click **Apply**.

Table 9-2. Calcs Printer/Export Parameters

Parameter	Setting
OB/GYN Output Type* • no export • export serial data • print report	• Select to prevent Report/Worksheet export • Select to export Report/Worksheet data to a serial device connected to the system (see "Exporting Report Data to Serial Device" on page 9-14). • Select to print Report*
Vascular Output** • export serial data	• Select to export Report/Worksheet data to a serial device connected to the system (see "Exporting Report Data to Serial Device" on page 9-14).
Abdominal Output** • export serial data	• Select to export Report/Worksheet data to a serial device connected to the system (see "Exporting Report Data to Serial Device" on page 9-14).
Cardiac Output** • export serial data	• Select to export Report/Worksheet data to a serial device connected to the system (see "Exporting Report Data to Serial Device" on page 9-14).
Print Destination • USB printer • network printer	• Select if local printer • Select if network printer

Table 9-2. Calcs Printer/Export Parameters (Continued)

Parameter	Setting
Paper Size • Letter • A4	 • Select for letter-size paper • Select for A4-size paper
Print/Export on End of Exam	■ Select to transfer Report/Worksheet data at end of exam
Only Export Final Report Results	■ Select to export final Report only; not Worksheets
Printer IP Address	■ Select network printer in drop-down box

* You can print **OB/GYN** reports *directly* to a qualified printer; see "Printing OB & GYN Reports" below.

** If you select ⊙ **export serial data**, a **Report** button displays on the **Report** page.

Printing OB & GYN Reports

You can print **OB & GYN** Calc reports (**OB & GYN** trending graphs and calculation results tables) to a network printer that supports **PostScript Level 3** and must include a local networked Ethernet port. See also "Postscript Level 3 Network-Capable Color Printer" on page 12-7.

NOTE: See also "OB Calculation Package" on page 9-26.

▶ *To Set Up OB/GYN Report Direct Printing*

1. Select the following parameters on the **Printer/Export Configuration** screen (Figure 9-10).

Parameter	Setting
OB/GYN Output Type	Select ⊙ **print report**
Print Destination	Select ⊙ **network printer**
Paper Size	Select ⊙ **letter**
Printer IP Address	Select from drop-down list
Print/Export on End of Exam	Check box as desired for print behavior

2. Click **Apply** to save settings.

NOTE: To enable networked printing of **OB/GYN** reports, an **IP Address** for the ZONARE system must be configured on the **Network Configuration** screen (see Figure 13-1 on page 13-2 for more information).

▶ *To Print Reports*

1. Perform the desired **OB/GYN** calculations and measurements on the scan.
2. To print the **Report**, select **Print** at the bottom of the **Report** page.

NOTE: If printing was configured for **Print/Export at End of Exam**, the **Report** will automatically print at the end the current exam.

Exporting Report Data to Serial Device

Users can export **Report** data from **OB/GYN, Abdominal, Vascular,** and **Cardiac** report packages (via the USB port of the **SmartCart/SmartCart *sp*** or **Scan Engine**) for use by third-party off-line software.

- A USB-to-serial port adapter (not provided by ZONARE) must be inserted into one of the **SmartCart/SmartCart sp**'s USB ports to enable connectivity to the RS-232 serial port on a third-party workstation.
- To export data, it is necessary to set up **Serial Port** and **Print/Export** parameters.

▶ *To Setup Serial Port*

1. Tab to **Serial Port Settings** screen (Figure 9-11):

SmartCart/SmartCart *sp*	**Setup | System Setup | Archive | Serial Port**
Scan Engine	**Tools | System Setup | Archive | Serial Port**

2. On the **Serial Port Settings** screen, select **USB**.

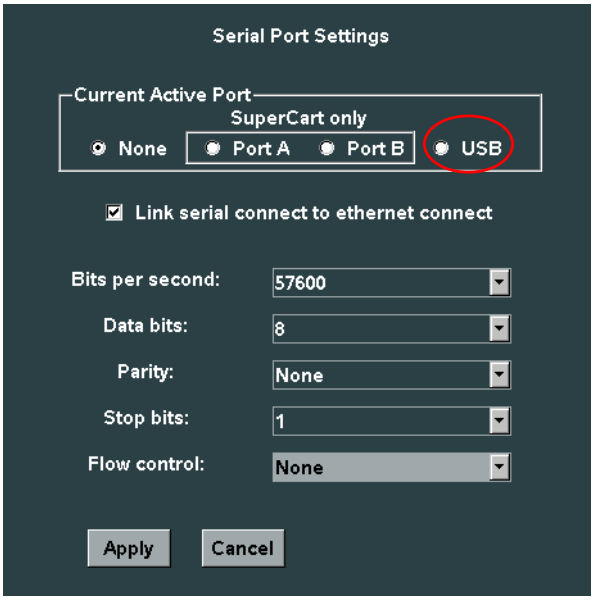


Figure 9-11. Serial Port Settings Screen

▶ *To Set Up Export/Import*

1. Access the **Printer/Export Configuration** screen (Figure 9-10) by going to:

SmartCart/SmartCart *sp*	**Setup | System Setup | Calcs | Export/Print**
Scan Engine	**Tools | System Setup | Calcs | Export/Print**

2. On the screen, select ⊙ **export serial data** for **OB/GYN, Abdominal, Vascular,** and **Cardiac Output**. Also select **Print/Export on End of Exam**, if desired.

▶ *To Export Data*

1. Make sure the targeted **Export** system is connected to one of the external USB ports of the System.
2. Perform the desired calculations and measurements on the scan.
3. To **Export** the data, select **Export** at the bottom of the **Report** page.

NOTE: If the **Export** was configured for **Print/Export on End of Exam**, data will be automatically exported at the end of the current exam.

Generic Measurement Procedures

B-Mode

Depth

Depth measures the distance from the transducer face to the location of the caliper in the image. The **Depth** measurement result is displayed in the **DDB** and updated continuously as the user positions the caliper within the image.

▶ *To Measure Depth*

Live Image

1. Display a live B-Mode image.
2. Press **Measure** button.
3. Use **Trackball** to position caliper to desired location within image display. A **Depth** result displays in **DDB** and updates as user positions caliper within the image.
4. Press **Measure** button to remove single caliper and exit **Generic Measurements**.

Frozen Image

1. Freeze a B-Mode image.
2. Press **Measure** button.
3. Use **Trackball** to highlight and select **Distance**. Then proceed to Steps 3 and 4 above.

Distance

The **Distance** measurement displays the span between the two B-Mode calipers in the image.

- Up to four (4) **Distance** measurements can be displayed on a single image simultaneously.
- The **Distance** measurement results are displayed in the **DDB.**
- The active measurement result updates continuously as the user positions the active caliper within the image.

▶ *To Measure Distance*

1. Freeze the B-Mode display.
2. Press the **Measure** button.

NOTE: The first item in the **Measure** menu is auto-selected when the user selects **Measure.**

3. Use **Trackball** to position caliper to desired location within image display. The **DDB** updates **Depth** result as user positions caliper within image.
4. Press **Set** button to fix first **Distance** caliper and activate second **Distance** caliper.
5. Use **Trackball** to position caliper to desired location.
6. Press **Enter** (**SmartCart**), **Enter**/**Select** (**SmartCart *sp***), or **Select** (**Scan Engine**) to lock calipers in position. The **DDB** updates distance result as user positions caliper within image.

   OR

   Press **Set** button again. This toggles active caliper selection between first and second **Distance** calipers, allowing positional corrections to be made to both caliper instances. Press **Enter** (**SmartCart**), **Enter**/**Select** (**SmartCart *sp***), or **Select** (**Scan Engine**) to lock calipers in position.
7. To activate additional distance measurements:

SmartCart/SmartCart sp	Press **Measure** button again
Scan Engine	Press **Select** button twice

8. Pressing **Measure** button while an uncompleted **Distance** measurement is being displayed completes the measurement and starts another (up to maximum of four) **Distance** measurement.
9. Press **Measure** button to remove **Distance** tools and exit **Measure** mode.

Circ/Area (Ellipse)

Circ/Area measures circumference and area delineated by an ellipse drawn in image.

- The DDB displays ellipse circumference and area results and continuously updates results as **Ellipse** shape (as defined by caliper positions and outline) is changed within image.
- Ellipse must be selected for **Area** method. Go to:

SmartCart/ SmartCart *sp*	**Setup button | System Setup | Calcs | General** and select **Ellipse** option under **Area** method
Scan Engine	**Tools | System Setup | Calcs | General** and select **Ellipse** option under **Area** method

▶ *To Measure Ellipse Circumference/Area*

1. Freeze the B-Mode display.
2. Press **Measure** button.
3. Highlight and select **Circ/Area**.

4. Use **Trackball** to position caliper to desired location within image. The **DDB** displays **Depth** and updates result as user positions caliper within image.
5. Press **Set** button to fix first caliper and activate second caliper, displaying a circle connecting two calipers.
6. Use **Trackball** to position caliper to desired location within image. The **DDB** displays circumference and area of circle, and system updates results as user positions caliper within image.
7. Press **Set** button to fix second caliper and select **Ellipse** outline.
8. Use **Trackball** to change eccentricity of outline within fixed caliper positions.

NOTE: Pressing **Set** button again toggles active selection between first caliper, second caliper, and outline, allowing corrections to be made to both size and shape of **Ellipse**.

9. Press **Measure** button to remove **Ellipse** tools and exit **Measure** mode.

Circ/Area (Trace)

Circ/Area measures the circumference and area delineated by a **Trace** outline drawn in the image.

SmartCart/SmartCart *sp*	Can simultaneously display up to two **Traces** on a single image

- The **Trace** circumference and area results are displayed in the **DDB** when the **Trace** outline is closed.
- Trace must be selected for the Area method. Go to:

SmartCart/SmartCart *sp*	**Setup button | System Setup | Calcs | General**
Scan Engine	**Tools | System Setup | Calcs | General**

- Select **Trace** button under **Area** method.

▶ *To Measure Trace Circumference/Area*

1. Freeze the display with a B-Mode image.
2. Press **Measure** button.
3. Highlight and select **Circ/Area**.
4. Use **Trackball** to position caliper to desired location within image display.

SmartCart/SmartCart *sp*	Displays **Depth** result (in the **DDB**) and result is updated as user positions caliper within image

5. Press the **Set** button to fix first **Trace** caliper and activate second **Trace** caliper.
6. Draw **Trace** outline using **Trackball**. As **Trackball** is moved, a trail of small dots are left behind to create outline of desired area.
7. Press **Set** button to fix second **Trace** caliper and complete **Trace** outline.

NOTE: Any gap in the outline between first and second **Trace** calipers will be automatically closed by a straight connecting line when second **Trace** caliper position is fixed.

8. To undo any portions of the trace:

SmartCart	Press **Delete** button; each press removes last small dot
SmartCart *sp*	Press **Back/Delete** button; each press removes last small dot
Scan Engine	Press **Back** button; each press removes last small dot

9. To activate additional **Trace** circumference/area measurements (up to a maximum of two), press **Select** button to invoke another **Trace** measurement instance.
10. Press **Measure** button to remove the **Trace** tools and exit **Generic Measurements**.

Volume (cm^3)

▶ *To Measure Volume*

1. Acquire long axis image first.
2. Freeze 2D image; then press **Measure** button.
3. Use **Trackball** and **Set** button to select **Volume**.
4. Use **Trackball** to position first caliper for caliper set 1. Press **Set**.
5. Use **Trackball** to position next caliper.
6. Press **Enter** (**Enter/Select** on ***sp***).
7. Repeat Steps 4 and 5 for caliper set 2. Press **Store** button.
8. Unfreeze image. Acquire short axis view.
9. Freeze image; then press **Measure**.
10. Use **Trackball** to position first caliper for caliper set 3. Press **Set**.
11. Use **Trackball** to position next caliper. Press **Store**. Volume calculation displays on screen.

M-Mode

Depth

In M-Mode, **Depth** measures the vertical distance from the top of the strip (transducer face) to the position of the cursor/caliper in the M-Mode strip. The **DDB** displays the **Depth** measurement result and continuously updates the result as the user positions the cursor/caliper within the image.

▶ *To Measure Depth*

Live Image

1. Display a live M-Mode strip image.
2. Press **Measure** button.
3. Use **Trackball** to position cursor (vertical line) and caliper (horizontal line on cursor) to desired location within strip display. The **DDB** displays **Depth** result as user positions cursor/caliper within strip image.
4. Press **Measure** button to remove **Depth** caliper and return to live imaging.

Frozen Image

1. Freeze an M-Mode strip image.
2. Press **Measure** button.
3. Highlight and select **Distance**. Use **Trackball** to position cursor (vertical line) and caliper (horizontal line on cursor) to desired location within strip display. The **DDB** displays **Depth** result as user positions cursor/caliper within strip image.
4. Unfreeze image to clear M-Mode **Depth** caliper and return to live imaging.

Distance

Distance measures vertical distance between two calipers on a single cursor line in M-Mode strip.

SmartCart/SmartCart *sp*	Can simultaneously display up to four **Distance** measurements on an M-Mode strip image

- The **DDB** displays **Distance** measurement result and System continuously updates result as user positions cursor/caliper within M-Mode strip image.

▶ *To Measure Distance*

1. Freeze the display with an M-Mode strip image.
2. Press **Measure** button.
3. Use **Trackball** to position cursor (vertical line) and caliper (horizontal line on cursor) to desired location within M-Mode strip display. The **DDB** updates depth result as user positions cursor/caliper within image.
4. Press **Set** button to fix first **Distance** cursor/caliper and activate second **Distance** caliper.

NOTE: The first **Distance** cursor/caliper is fixed at its current position in the M-Mode strip when the user presses the **Set** button, and a second caliper (horizontal line) is activated on the fixed cursor.

5. Use the **Trackball** to position the caliper to the desired location along the fixed cursor. The **DDB** updates **Distance** result as user positions caliper within image.

NOTE: Pressing **Set** button again toggles active caliper selection between first and second **Distance** calipers, allowing positional corrections to be made to both caliper instances along fixed cursor.

6. To activate additional distance measurements (up to a maximum of four), press **Enter** button (**Enter/Select** button on SmartCart *sp*) twice - once to complete the current measurement instance and a second time to invoke another **Distance** measurement instance.
7. Press **Measure** button to remove **Distance** tools and exit **Measure** mode.

PW Doppler Mode

Velocity

Velocity is measured (relative to selected **Scale** and **Baseline** position) at the caliper's position in the PW Doppler strip.

SmartCart/SmartCart *sp*	Can simultaneously display up to four **Distance** measurements on a PW Doppler strip image

- The System displays the **Velocity** measurement result in the **DDB** and continuously updates the result as the user positions the caliper within the PW Doppler strip image.

▶ *To Measure Velocity*

1. Acquire a live or frozen PW Doppler strip image.
2. Press **Measure** button.
3. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display. The **DDB** updates the velocity result as the user positions the caliper within the strip image.
4. To activate additional **Velocity** measurements (up to a maximum of four), press the **Enter** button (**Enter/Select** button on SmartCart *sp*) twice - once to complete the current measurement instance and a second time to invoke another **Velocity** measurement instance.
5. Press the **Measure** button to remove the **Velocity** tools and exit **Measure** mode.

Resistivity Index

Resistive Index (**RI**) is defined as abs **[(Max – Min)/Max]**, where **Max** and **Min** are determined by comparing the absolute velocities obtained by two concurrent PW **Velocity** calipers positioned within the context of the same PW Doppler strip.

SmartCart/SmartCart *sp*	Continuously displays both **Velocity** results and their associated **RI** results in the **DDB** when the user positions either caliper within the PW Doppler strip

- Only a single instance of this tool can exist at any one time.
- In the **DDB**, **Max** velocity is identified as **PSV** (Peak Systolic Velocity) and **Min** velocity is identified as **EDV** (End Diastolic Velocity).

To Measure Resistive Index (RI)

1. Freeze the display with a PW Doppler strip image.
2. Press the **Measure** button.
3. Highlight and select **RI**.
4. The **PSV** caliper will be displayed.
5. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display. At this time, the **DDB** only displays the **PSV** velocity result and updates the result as the user positions the caliper is positioned.
6. Press the **Set** button to fix the **PSV** velocity caliper and display the **EDV** velocity caliper.

NOTE: The **RI** result is calculated and displayed once both velocity calipers have been activated.

7. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display. The **DDB** only displays the **EDV** velocity result and updates the **RI** calculation result as the user positions the caliper within the strip image.

NOTE: If the absolute value of the **EDV** velocity result is greater than the current **PSV** result, the **EDV** and **PSV** result displays are swapped and the caliper becomes a **PSV** caliper. The converse is also true when the absolute value of the **PSV** velocity result is less than the current **EDV** result.

NOTE: Pressing the **Set** button again toggles the active caliper selection between the first and second velocity calipers, allowing positional corrections to be made to both caliper instances within the strip image.

8. To successively erase trace dots:

SmartCart	Press **Delete** button
SmartCart *sp*	Press **Back/Delete** button
Scan Engine	Press **Back** button

9. Press the **Measure** button to remove the **RI** tools and exit **Measure** mode.

Pulsatility Index

The Pulsatility Index (**PI**) is defined as **(Max – Min)/TA Max**, where **Max** and **Min** are determined by comparing the absolute velocities obtained by two concurrent PW **Velocity** calipers positioned within the context of the same PW Doppler strip.

SmartCart/SmartCart *sp*	Displays both **Velocity** results and their associated **RI** calculation result in the **DDB** and continuously updates them after completing the PW trace when the user positions either caliper within the PW Doppler strip image

- **TA** max is generated by tracing the peak outline of one complete Doppler spectrum, which determines the average (mean) of the maximum velocities.

- Only a single **PI** measurement can be performed at any given time.

NOTE: In the **DDB**, **Max** velocity is identified as **PSV** (Peak Systolic Velocity) and **Min** velocity is identified as **MDV** (Minimum Diastolic Velocity).

▶ *To Measure Pulsatility Index (PI)*

1. Freeze the display with a PW Doppler strip image.
2. Press the **Measure** button.
3. Highlight and select **PI**.
4. The first PW trace caliper will be displayed.
5. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display. There is no **DDB** display at this time.
6. Press the **Set** button to fix PW trace start point and activate the second velocity caliper.
7. Use the **Trackball** to trace the desired portion of the waveform within the PW Doppler strip display. There is no **DDB** display at this time.
8. To undo any portions of the trace:

SmartCart	Press the **Delete** button
SmartCart *sp*	Press the **Back/Delete** button
Scan Engine	Press the **Back** button

9. Press the **Set** button to fix the trace end point and complete the PW trace and activate the **PSV** velocity caliper. At this time, the **DDB** only displays the **TA max** and the **PSV** velocity results. The system continuously updates the **PSV** velocity result as the user positions the caliper within the strip image.

NOTE: When the trace is completed, a vertical line is dropped from the start and end points of the trace to the baseline to clearly delineate the traced region used for **TA max**.

NOTE: The **PSV** velocity caliper is automatically positioned at the maximum traced velocity.

10. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display.

SmartCart/SmartCart *sp*	Only updates the **PSV** velocity result as the user positions the caliper within the strip image

NOTE: If the absolute value of the **MDV** velocity result is greater than the current **PSV** result, the **MDV** and **PSV** result displays are swapped and the caliper becomes a **PSV** caliper. The converse is also true when the absolute value of the **PSV** velocity result is less than the current **MDV** result.

NOTE: Pressing the **Set** button again toggles the active caliper selection between the first and second velocity calipers, allowing positional corrections to be made to both caliper instances within the strip image.

11. Press the **Set** button to fix the **PSV** velocity caliper and activate the **MDV** velocity caliper.

NOTE: If the absolute value of the **MDV** velocity result is greater than the current **PSV** result, the **MDV** and **PSV** result displays are swapped and the caliper becomes a **PSV** caliper. The converse is also true, when the absolute value of the **PSV** velocity result is less than the current **MDV** result.

NOTE: Pressing the **Set** button again toggles the active caliper selection between the first and second velocity calipers, allowing positional corrections to be made to both caliper instances within the strip image.

12. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display.

SmartCart/SmartCart *sp*	Continuously updates the **PSV** and **MDV** velocity results and the **PI** calculation result as the user positions the calipers within the strip image

13. Press the **Measure** button to remove the **PI** tools and exit **Measure** mode.

Acceleration

Acceleration (**Accel**) is defined as **DV/DT**, where **DV** is the velocity difference and **DT** is the time interval between two points as delineated by two concurrent PW **Velocity** calipers positioned within the same PW Doppler strip.

- Only a single instance of this tool can exist at any one time.
- The **DDB** displays both the **Delta Velocity** and **Delta Time Results** and their associated **Accel** calculation result, and continuously updates them when the user positions either caliper within the PW Doppler strip image.

▶ *To Measure Acceleration (Accel)*

1. Freeze the display with a PW Doppler strip image.
2. Press the **Measure** button.
3. Highlight and select **Accel**.
4. The first velocity caliper will be displayed.
5. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display. At this time, the **DDB** only displays the velocity result.

SmartCart/SmartCart *sp*	Continuously updates the result as the user positions the caliper within the strip image

6. Press the **Set** button to fix the first velocity caliper and activate the second velocity caliper.

NOTE: The delta velocity, delta time, and acceleration results are calculated and displayed once both velocity calipers have been activated.

7. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display. The **DDB** continuously updates the **Time**, **Velocity**, and **Accel** results as the user positions the caliper within the strip image.

NOTE: Acceleration is always calculated in the direction of positive time. The velocity caliper positioned at the earliest strip time is always the startpoint (and the other caliper is the endpoint) for calculating the delta velocity (**DeltaV**), delta time (**AT**), and acceleration (**Accel**) results.

NOTE: Pressing the **Set** button again toggles the active caliper selection between the first and second velocity calipers, allowing positional corrections to be made to both caliper instances within the strip image.

8. Press the **Measure** button to remove the **Accel** tools and exit **Measure** mode.

Systolic/ Diastolic Ratio

The PW Systolic/Diastolic (**S/D**) Ratio is defined as **abs (Max/Min)**, where **Max** and **Min** are determined by comparing the absolute velocities obtained by two concurrent PW **Velocity** calipers positioned within the same PW Doppler strip.

- Only a single instance of this tool can exist at any one time.
- The **DDB** displays both **Velocity** results and their associated **S/D** calculation result and continuously updates the results when the user positions either caliper within the PW Doppler strip image.
- In the **DDB**, **Max** velocity is identified as **PSV** (Peak Systolic Velocity) and **Min** velocity is identified as **EDV** (End Diastolic Velocity).

▶ *To Measure Systolic/Diastolic (S/D) Ratio*

1. Freeze the display with a PW Doppler strip image.
2. Press the **Measure** button.
3. Highlight and select **S/D**.
4. The **PSV** velocity caliper will be displayed.
5. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display. At this time:

SmartCart/SmartCart *sp*	Only displays the **PSV** velocity result (in the **DDB**) and the System updates the result as the user positions the caliper within the strip image

6. Press the **Set** button to fix the **PSV** velocity caliper and activate the **EDV** velocity caliper.

NOTE: The **S/D** result is calculated and displayed once both velocity calipers have been activated.

7. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display.

SmartCart/SmartCart *sp*	Only updates the **EDV** velocity result and the **S/D** calculation result as the user positions the caliper within the strip image

NOTE: If the absolute value of the **EDV** velocity result is greater than the current **PSV** result, the **EDV** and **PSV** result displays are swapped and the caliper becomes a **PSV** caliper. The converse is also true when the absolute value of the **PSV** velocity result is less than the current **EDV** result.

NOTE: Pressing the **Set** button again toggles the active caliper selection between the first and second velocity calipers, allowing positional corrections to be made to both caliper instances within the strip image.

8. Press the **Measure** button to remove the **S/D** tools and exit **Measure** mode.

A/B Ratio

The **A/B Ratio** is defined as **V1/V2**, where **V1** and **V2** velocities obtained by two PW **Velocity** caliper measurements separated by an Unfreeze/Freeze cycle.

- Only a single instance of this tool can exist at any one time. The **DDB** displays each **Velocity** result and continuously updates the result when the user positions its caliper within the PW Doppler strip image.
- The **DDB** does not display all results together until the **V2** measurement has been activated and/or completed.

▶ *To Measure A/B Ratio*

1. Freeze the display with a PW Doppler strip image.
2. Press the **Measure** button.
3. Highlight and select **A/B**.
4. The **Vel 1** velocity caliper will be displayed.
5. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display.

SmartCart/SmartCart *sp*	Only displays the **Vel 1** result and updates the result (in the **DDB**) as the user positions the caliper within the strip image

6. Press the **Select** button to fix the caliper and complete the **Vel 1** velocity measurement (activates the **Vel 2** velocity caliper). At this time, the **DDB** displays the **Vel 1** and **Vel 2** velocity results and the **A/B** calculation result.

SmartCart/SmartCart *sp*	Continuously updates the **Vel 2** result as the user positions the caliper within the strip image

7. Unfreeze the PW Doppler strip and acquire new data, and then press **Freeze**.
8. Press the **Measure** button.

NOTE: The **A/B Ratio Measure** menu is auto-selected and the **Vel 2** caliper is displayed when the user selects **Measure**.

9. Use the **Trackball** to position the caliper to the desired location within the PW Doppler strip display. At this time, the DDB displays the **Vel 1** and **Vel 2** velocity results and the **A/B** calculation result.

SmartCart/SmartCart *sp*	Continuously updates the **Vel 2** result as the user positions the caliper within the strip image

10. Press the **Enter** button (**Enter/Select** button on **SmartCart *sp***) to fix the caliper and complete the **Vel 2** velocity measurement. This also ends the **A/B** measurement.

11. Press the **Measure** button to remove the **A/B** tools and exit **Measure** mode.

OB Calculation Package

The **OB Exam** type includes an extensive selection of supported measurements and their associated calculations. The actual measurement availability is determined by the OB Setup configuration as well as the **Preset** selection and the active imaging mode when the OB Calculation Package is invoked.

SmartCart/SmartCart *sp*

Figure 9-12. Calculations Menu

The OB Calculation Package also supports the addition of new measurements based on user-supplied table data. To access, go to:

SmartCart/SmartCart *sp*	**Setup button | System Setup | Calcs | Custom**
Scan Engine	**Tools | System Setup | Calcs | Custom**

The following OB calculations (**OB calcs**) are available for all **Presets**; select the OB item in the calculations menu to access them under the **Fetal Heart** preset.

NOTE: See also “Printing OB & GYN Reports” on page 9-13 and “Exporting Report Data to Serial Device” on page 9-14.

Table 9-3. OB Calcs

B-Mode	PW Doppler	M-Mode
NT	UT S/D	HR
NBL	Cord S/D	GYN
GS	Umb A	
CRL	Plac	
BPD	Ut A	
OFD	Fetal Aorta	

Table 9-3. OB Calcs (Continued)

B-Mode	PW Doppler	M-Mode
HC	MCA	
CEREB	HR	
BOD	GYN	
AC		
TTD		
AD		
FL		
TIB		
FIB		
HL		
RAD		
ULNA		
AFI [Q1/Q2/Q3/Q4]		
GYN		

NOTE: Measurements from the **Generic** measurement package are also available when the OB Exam Type is selected, and can be accessed by pressing the **Measure** button. Pressing the **Measure** button exits the OB Calculations Package if it was active.

The following specific OB calculations are available for the **Fetal Heart** preset.

Table 9-4. Fetal Heart Calcs

B-Mode	PW Doppler	M-Mode
Asc Aorta	MV peak [E/A]	RV Wall [Sys/Dia]
MPA	TV peak [E/A]	RV Diam[Sys/Dia]
Duct Art	Asc Aorta	IVS [Sys/Dia]
LA	Desc Aorta	LV Diam [Sys/Dia]
RA	MR	LVPW [Sys/Dia]
RV Wall [Sys/Dia]	TR	OB

Table 9-4. Fetal Heart Calcs (Continued)

B-Mode	PW Doppler	M-Mode
RV Diam [Sys/Dia]	MPA	
IVS [Sys/Dia]	Duct Art	
LV Diam [Sys/Dia]	IVC	
LVPW [Sys/Dia]	Duct Ven	
Heart Circ	OB	
Thor Circ		
OB		

OB Worksheets and Reports

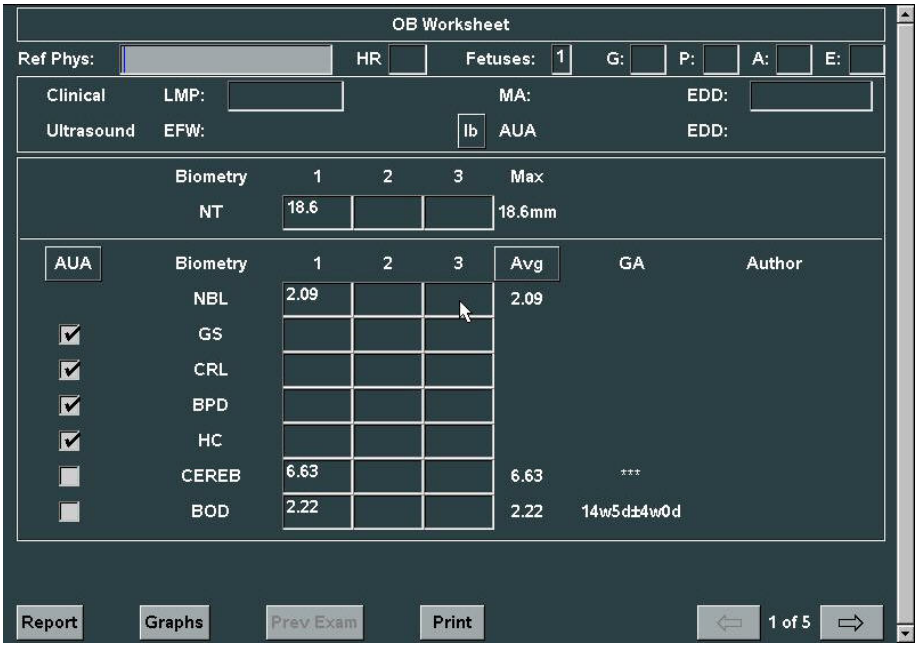


Figure 9-13. OB Worksheet (page 1)

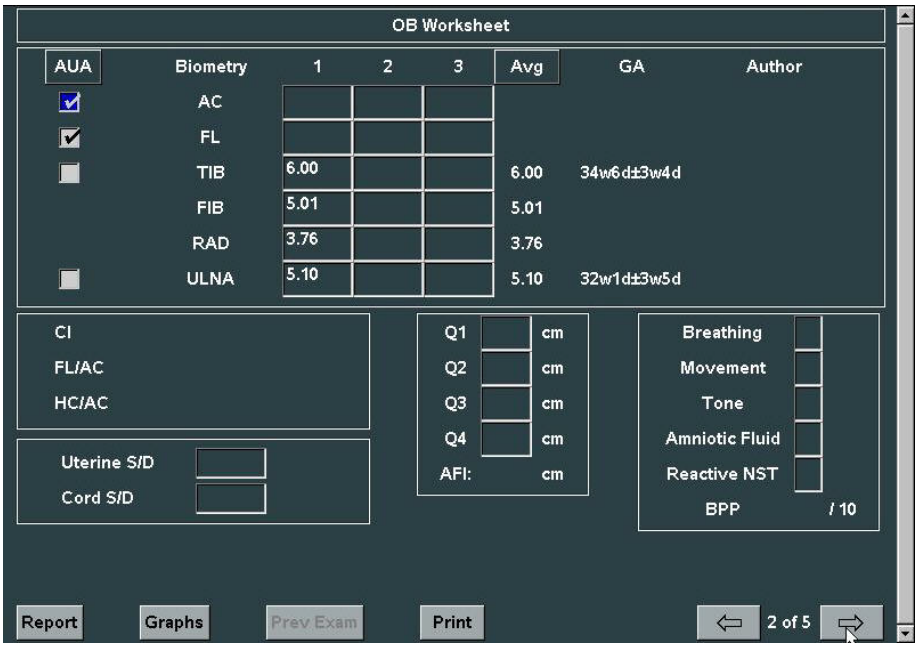


Figure 9-14. OB Worksheet (page 2)

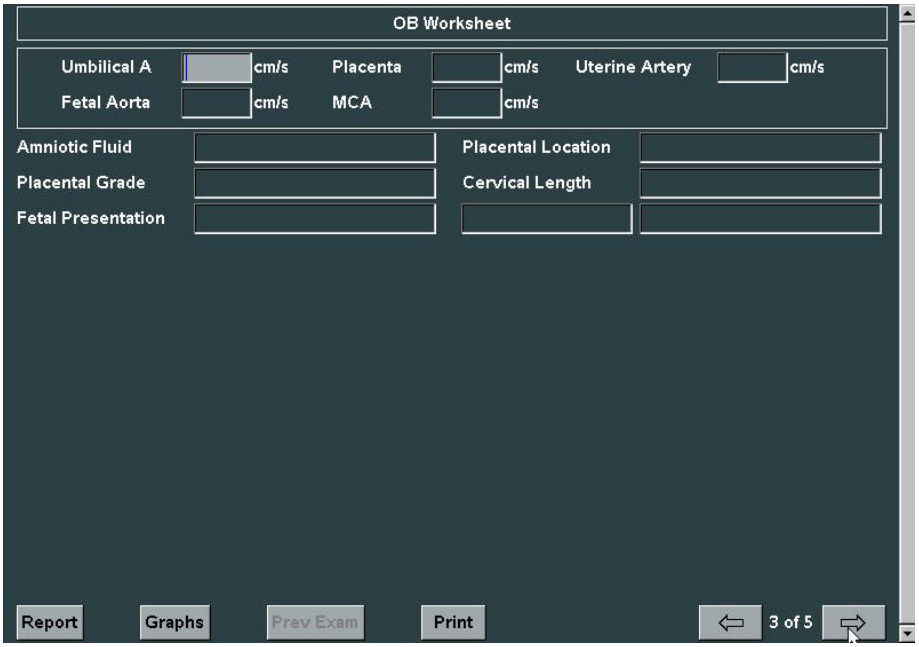


Figure 9-15. OB Worksheet (page 3)

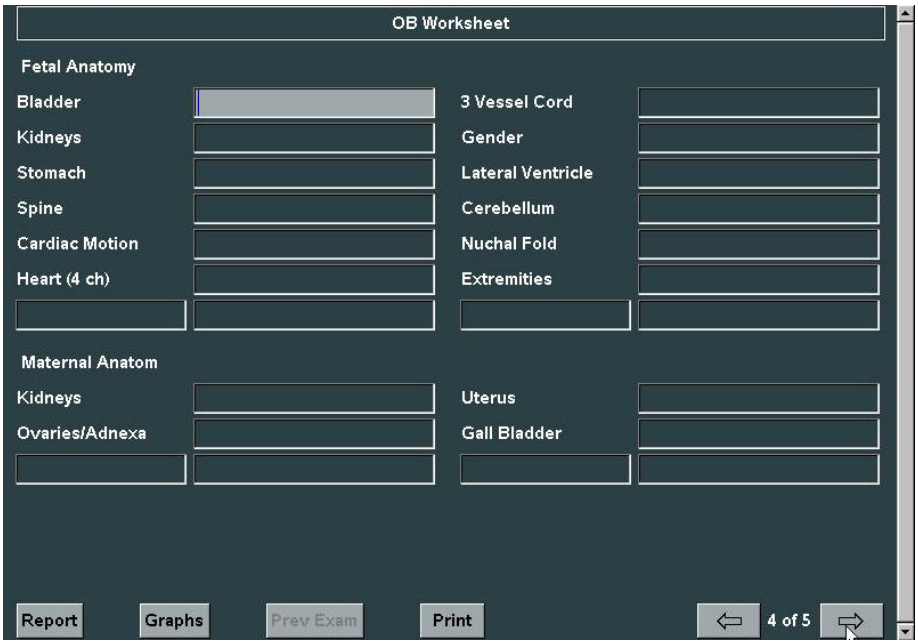


Figure 9-16. OB Worksheet (page 4)

Figure 9-17. OB Worksheet (page 5)

Figure 9-18. OB Report

NOTE: The actual contents and layout (including the number of pages displayed) for the **OB Worksheet** and **Report** will depend on the measurements enabled in OB Setup and the results that have been entered into the OB Calculations Package.

OB Calculation Trending

OB Trending currently only supports manual entry of a patient's prior OB Calculations for the current Patient exam. **OB Trending** data is saved with the exam but you cannot do a *query-and-retrieve* to import trending data into a subsequent exam.

Manual entry of the **OB Trending** data can be done prior to or as part of the preparation for the upcoming Patient exam. Patient exam can be restarted at a later time and the data entered then.

OB Trending supports OB Calculation data from up to 5 prior studies for a specific patient, including OB Calculation data for multiple gestations.

▶ *To Enter OB Trending Data*

1. Select the **OB Worksheet** display.
2. Navigate through the **OB Worksheet** displays until the **Trending** data entry page is reached (Figure 9-19).
3. Enter the data from up to 5 prior exams for the specific patient; all data for each prior exam are entered in a columnar format (one exam per column).

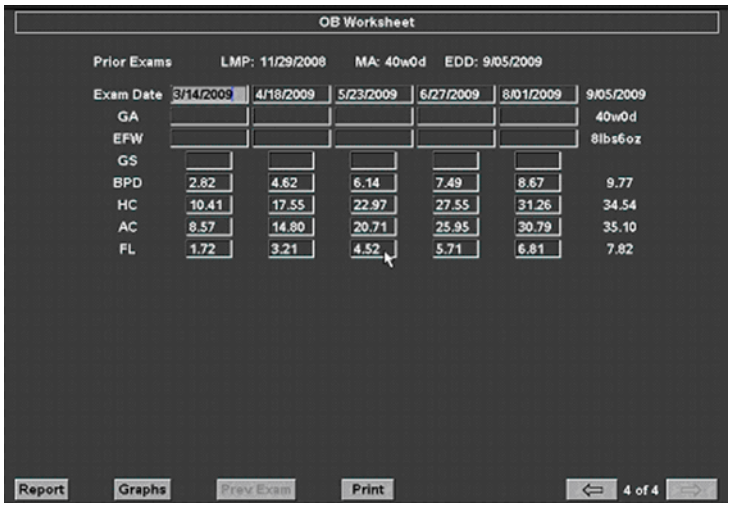


Figure 9-19. OB Worksheet - Trending Page

NOTE: **OB Trending** requires the date for each prior exam entered and an **LMP** date for the current exam. The LMP data can be entered on the first **OB Worksheet** page or on the **OB Trending Worksheet** page. If entered on the first **OB Worksheet** page, the **LMP** date will be transferred to the **OB Trending Worksheet** page and vice versa. However, once an **LMP** date has been entered, any subsequent edits to it must be made from the first **OB Worksheet** page, as the **LMP** date field will become noneditable on the **OB Trending Worksheet** page.

4. Select the **Graphs** softkey on any of the **OB Worksheet** displays and then select one of the items with trending data from the selection drop-down list to view the **OB Trending** data plot(s).

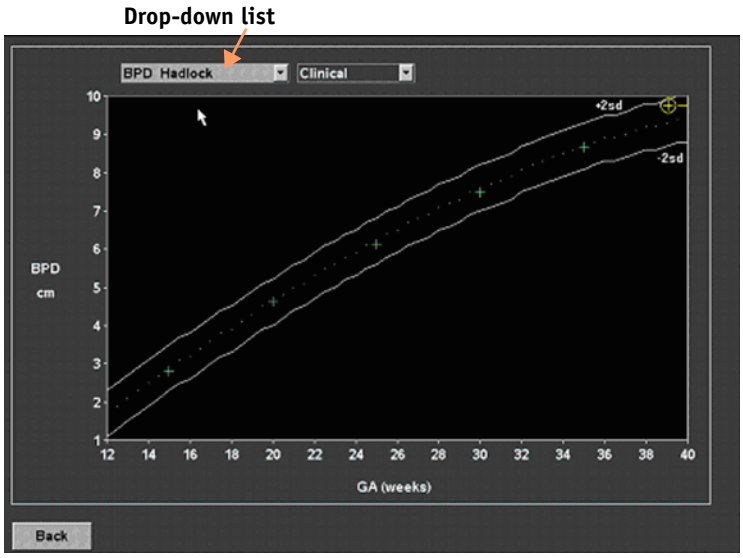


Figure 9-20. OB Trending - Graph Screen

OB Trending data will only be displayed on the graphs when the data are selected to be plotted for the **Clinical** (**LMP**); data are not presented on the graph if **Ultrasound** is selected.

Procedures for OB Calculation Packages

▶ *To Acquire GS Calculation*

1. Optimize the B-Mode image of the GS (gestational sac).
2. Press **Freeze** to open the **Freeze** menu and freeze the B-Mode image.
3. To view the **Calculations** menu:

SmartCart/SmartCart *sp*	Press **Calc** button
Scan Engine	Select **Calc**

4. The **Obstetrics Calculations** menu displays on the screen. Highlight **GS** and then press **Enter**. An active caliper displays in the Image area.
5. Use the **Trackball** to position the active caliper to the desired location within the image display.
6. Press the **Set** button to fix the first **Distance** caliper and activate the second caliper.
7. To finalize the measurement for the first pair and bring up the first distance caliper of the second pair:

SmartCart	Press **Enter**
SmartCart *sp*	Press **Enter/Select** button. Press **Set** button to activate next caliper.
Scan Engine	Press **Select**

8. Use the **Trackball** to position the first **Distance** caliper of the second pair to the desired location within the image display.
9. Press the **Set** button to fix the first **Distance** caliper of the second pair. This will activate the second **Distance** caliper of the second pair.
10. Use the **Trackball** to position this caliper. Then, to finalize the measurement for the second pair and bring up the first **Distance** caliper of the third pair:

SmartCart	Press **Enter**
SmartCart *sp*	Press **Enter/Select** button. Press **Set** button to activate next caliper.
Scan Engine	Press **Select**

11. Press **Freeze** to unfreeze the current image and obtain your next image. (Note that the caliper will momentarily disappear.)

12. To activate the first **Distance** caliper of the third pair, **Freeze** the new image and:

SmartCart	Press **Calc**
SmartCart *sp*	Press **Enter/Select** button. Press **Set** button to activate next caliper.
Scan Engine	Select **Calculations**

13. Use the **Trackball** to position the first **Distance** caliper of the third pair to the desired location within the image display.
14. Press the **Set** button to lock the first **Distance** caliper of the third pair. This will activate the second **Distance** caliper of the third pair.
15. Use the **Trackball** to position the second **Distance** caliper of the third pair to the desired location within the image display.
16. To lock the third caliper pair:

SmartCart	Press **Enter**
SmartCart *sp*	Press **Enter/Select** button.
Scan Engine	Press **Select**

17. All three distance measurements are copied to the **Worksheet**. The data display in the **Measurements** window inverts (to black-on-white).
18. To view the **Obstetrics Worksheet**:

SmartCart/SmartCart *sp*	Press **Report**
Scan Engine	Select **Report** from the **Calculations** menu

19. To edit the **Worksheet**, highlight the value to be edited, then press **Del Txt** or use **Bksp** to overtype replacement text.
20. To review the **Report:**

SmartCart/SmartCart *sp*	Press **Report**
Scan Engine	Select **Report** from the **Calculations** menu

▶ *To Calculate Heart-Rate (HR)*

1. Optimize the B-Mode image.
2. Press **M** to activate M-Mode.
3. Freeze the image.
4. To view the **Calculations** menu:

SmartCart/SmartCart *sp*	Press **Calc**

Scan Engine	Select **Calculations**

5. Heart Rate (**HR**) is active by default. A green vertical bar displays on the scroll.
6. Use the **Trackball** to position the green vertical bar at the beginning of a cardiac deflection. Press **Set** to lock the position of the bar. A second bar becomes active.
7. Use the **Trackball** to position the second vertical bar at the beginning of the next cardiac deflection (the number of cycles to use is configured on the **Calcs General Configuration** screen; see Figure 9-5 on page 9-5).
8. To lock the second green bar and complete the measurement:

SmartCart	Press **Enter**
SmartCart *sp*	Press **Enter/Select** button
Scan Engine	Press **Select**

9. The **HR** measurement result is copied to the **Worksheet**. The data display in the **Measurements** window inverts to black on white.
10. To view the **Worksheet:**

SmartCart/SmartCart *sp*	Press **Report**
Scan Engine	Select **Report** from the **Calculations** menu

11. To edit the **Worksheet**, highlight the value to be edited, then press **Del Txt** or use **Bksp** to overtype replacement text.
12. To review the **Report**:

SmartCart/SmartCart *sp*	Press **Report**
Scan Engine	Select **Report** from the **Calculations** menu

Additional Calculation Packages

Examples of the other supported Calculation Packages are described in the tables that follow. Steps for performing these calculations are similar to those previously described in the **Generic** and **OB** Calculation Package examples. Due to general similarity, detailed steps will not be repeated for these Calculation Packages unless there is a significant difference in the measurement protocol from that already established in the **Generic** and **OB** Calculation Packages.

Abdominal Package

B-Mode		Doppler
✔ Liver	✔ Ureter	✔ CIA
✔ Gallbladder	✔ Aorta	✔ EIA
✔ Spleen Vol	✔ Aneurysm	✔ Aorta
✔ Bile Duct	✔ CIA	✔ Celiac Artery
✔ Pancreatic Duct	✔ EIA	✔ SMA
✔ Pylorus	✔ Portal Vein	✔ Hepatic Artery
✔ Appendix	✔ Hepatic Vein	✔ Splenic Artery
✔ Pancreas	✔ Portosplenic Confl	✔ GDA
✔ Free Fluid	✔ Sup Mesenteric Vein	✔ IMA
✔ Kidney	✔ Splenic Vein	✔ Renal (main)
✔ Adrenal	✔ Renal Vein	✔ Renal (acc 1)
✔ Bladder		✔ Renal (acc 2)
		✔ Hilum
		✔ Interlobar
		✔ Arcuate

Aorta

B-Mode	PW Doppler
Aorta AP [prox/mid/dst/renl]	CIA [right/left]
Aorta trans [prox/mid/dst/renl	EIA [right/left]
Aneurysm	Aorta [prox/renl/mid/dist
R CIA [prox/mid/dist]	Celiac [1/2]
R EIA [prox/mid/dist]	SMA [1/2/3]
L CIA [prox/mid/dist]	Hepatic A
L EIA [prox/mid/dist]	Splenic A
	GDA
	IMA

Bowel

B-Mode	PW Doppler
Appendix	
Appendix Wall	
Pylorus	
Pylorus Wall	

GB

B-Mode	PW Doppler
GB Vol	
GB Wall	
CBD [prox/mid/dst]	

Liver/Spleen

B-Mode	PW Doppler
Liver Vol	
Shunt	
Spleen Vol	
Main Portal V	
Hepatic	
PS Conflnce	
Sup Mesen V	
Splenic	

Pancreas

B-Mode	PW Doppler
Pancreas [head/neck/body/tail]	
Panc Duct [prox/mid/dist]	

Renal

B-Mode	PW Doppler
[Right/Left]	[Right/Left]
Renal Vol	Renal RI [orig/prox/mid/dst]
Renal V	Renal AT [orig/prox/mid/dst]
Adrenal Vol	Ren A1 RI [orig/prox/mid/dst]
Ureter [rplv/prox/mid/dst]	Ren A1 AT [orig/prox/mid/dst]
	Ren A2 RI [orig/prox/mid/dst]
	Ren A2 AT [orig/prox/mid/dst]
	Hilum RI [sup/mid/inf]

B-Mode	PW Doppler
	Hilum AT [sup/mid/inf]
	Interlobar RI [sup/mid/inf]
	Interlobar AT [sup/mid/inf]
	Arcuate RI [sup/mid/dst]
	Arcuate AT [sup/mid/dst]

Bladder

B-Mode	PW Doppler
Bladder Vol	
Fluid	

Gyn and Follicular Package

B-Mode	PW Doppler
[Right/Left]	[Right/Left]
Uterine Size	Ovary RI
Endo Thick	Ovary PI
Ovary Vol [D1/D2/D3]	Uterus RI
Follicle Diam* (x 15)	Uterus PI
Follicle Vol* (x 15)	OB
OB	
* Setup configuration	

NOTE: For **Follicle Diam/Vol** measurements, double-clicking the **Set** button completes the current measurement and automatically advances to the next in the series. However, if multiple measurements are desired for the same **Follicle** (up to three are supported per **Follicle**), click the **Enter** button once. The **Follicle** measurements are ended by deselecting the **Follicles** or completing the last **Follicle** measurement.

Pediatric Hip Package

B-Mode	PW Doppler
[Right/Left]	[Right/Left]
Hip Angle [Base/Bony/Cart]	
Endo Thick	
Ovary Vol [D1/D2/D3]	
Follicle Diam* (x 15)	
Follicle Vol* (x 15)	
OB	
* Setup configuration	

▶ *To Acquire Pediatric Hip Angle*

1. Optimize the B-Mode image.
2. Freeze the image.
3. To view the Calculations menu:

SmartCart/SmartCart *sp*	Press **Calc**
Scan Engine	Select **Calculations**

4. **Hip Angle** (**Base**) is active by default. A green (+) caliper tool is displayed on the image.

Iliac Baseline

1. Use the **Trackball** to position the green caliper tool at the beginning of the iliac baseline.
2. Press **Set** to lock the position of the caliper tool. A second caliper tool becomes active.
3. Use the **Trackball** to position the second caliper tool at the end of the iliac baseline. A connecting line is drawn between the two calipers and is sized as the active caliper is positioned.
4. To fine-tune the iliac baseline, use the **Set** button to toggle the active caliper selection.
5. To lock the position of the iliac baseline:

SmartCart	Press **Enter**
SmartCart *sp*	Press **Enter/Select** button
Scan Engine	Select **Select**

6. A second caliper tool becomes active for the next **Hip Angle** measurement component.

Bony Roofline

1. Use the **Trackball** to position the green caliper tool at the beginning of bony roofline.
2. Press **Set** to lock the position of the caliper tool. A second caliper tool becomes active.
3. Use the **Trackball** to position the second caliper tool along the iliac baseline. A connecting line is drawn between the two calipers and is sized as the first caliper is positioned and the intersection with the iliac baseline is set by the second caliper position.
4. To fine-tune the bony roofline, use the **Set** button to toggle the active caliper selection.
5. To lock the position of the bony roofline:

SmartCart	Press **Enter**
SmartCart *sp*	Press **Enter/Select** button
Scan Engine	Select **Select**

6. A second caliper tool becomes active for the next **Hip Angle** measurement component.

Cartilage Roofline

1. Use the **Trackball** to position the green caliper tool at the beginning of cartilage roofline.
2. Press **Set** to lock the position of the caliper tool. A second caliper tool becomes active.
3. Use the Trackball to position the second caliper tool along the iliac base line. A connecting line is drawn between the two calipers and is sized as the first caliper is positioned and the intersection with the iliac baseline is set by the second caliper position.
4. To fine-tune the cartilage roofline, use the **Set** button to toggle the active caliper selection.
5. To lock the position of the cartilage roofline and complete the measurement:

SmartCart	Press **Enter**
SmartCart *sp*	Press **Enter/Select** button
Scan Engine	Select **Select**

6. The **Hip Angle** measurement results are copied to the **Worksheet**. The data display in the **Measurements** window inverts to black on white.

The Worksheet

- To view the **Worksheet**:

SmartCart/SmartCart *sp*	Press **Report**
Scan Engine	Select **Report** from the **Calculations** menu

- To edit the **Worksheet**, highlight the value to be edited, the press **Del Text** or use **Bksp** to type replacement text.

The Report

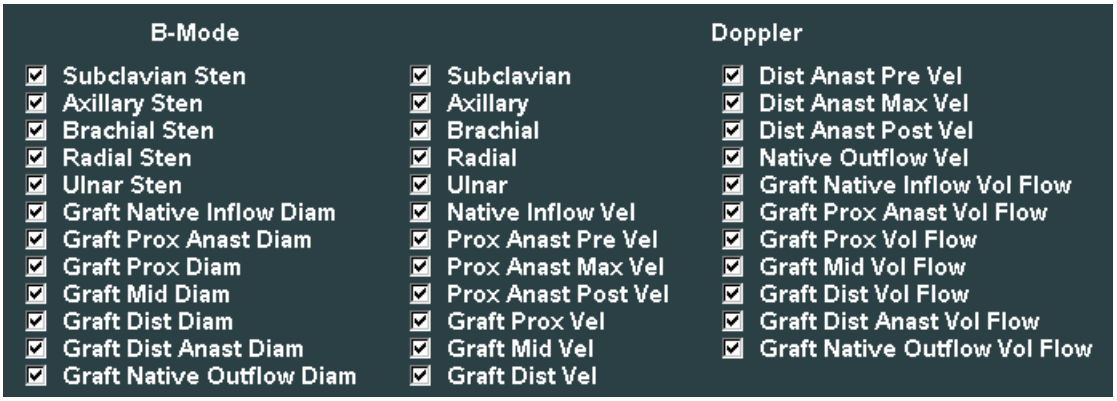
- To review the **Report**:

SmartCart/SmartCart *sp*	Press **Report**
Scan Engine	Select **Report** from the **Calculations** menu

Vascular Packages

Carotid Calc Package

Upper Extremity Arterial Calc Package

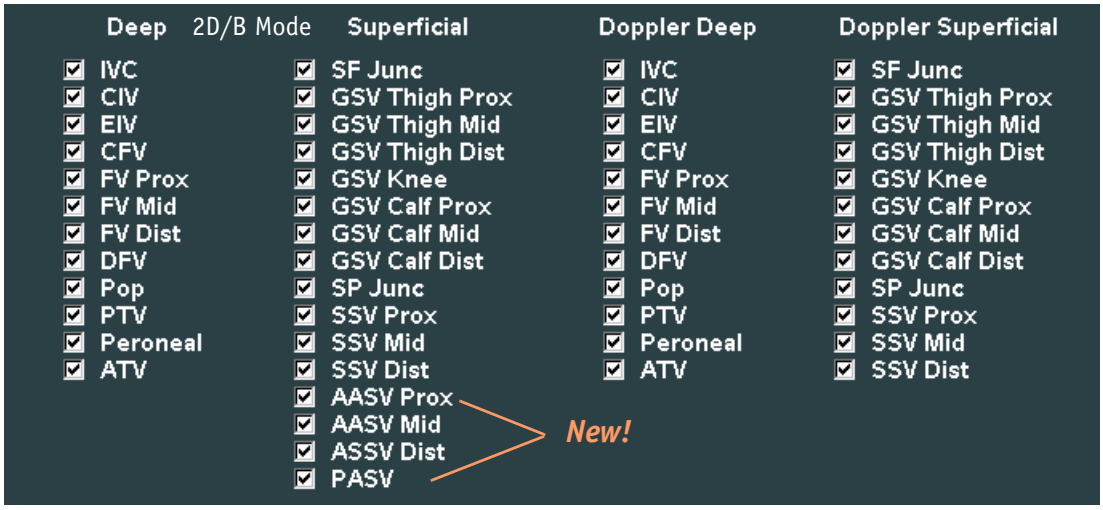


Grafts Submenu Selections

B-Mode	PW Doppler
Grafts*	Grafts Vel*
[Right/Left]	[Right/Left]
Native [inflow/outflow]	Native [inflow/outflow]
Anast [prx/dst]	Prx Anst [pre/max/post]
Graft [prx/mid/dst]	Graft [prx/mid/dst]
	Dst Anst [pre/max/post]

Lower Extremity Arterial Calc Package

Lower Extremity Venous Calc Package



Upper Extremity Venous Calc Package

2D/B Mode and Doppler

Venous Measurements

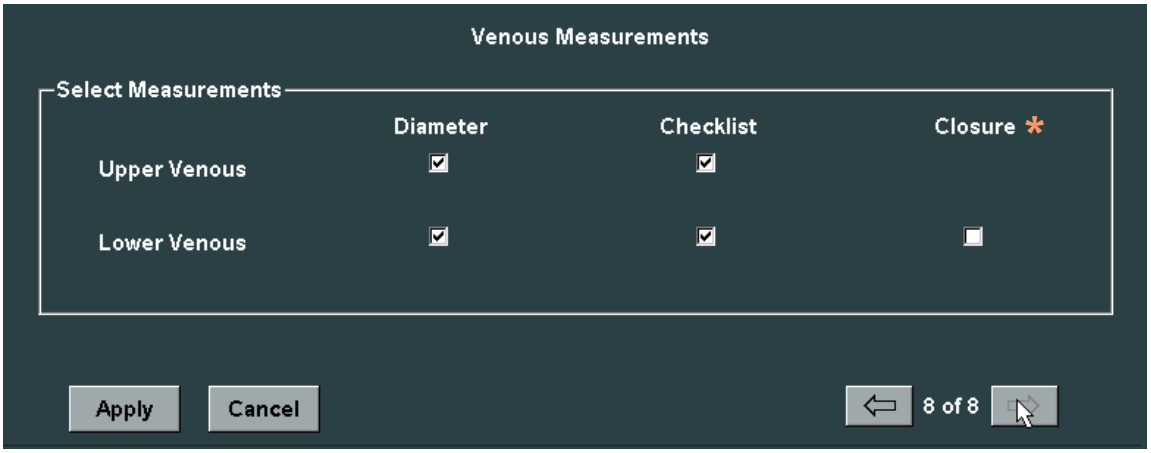


Figure 9-21. Vascular Calcs Page 8

* Closure (valve closure time) = reflux.

▶ *To Measure AP and Transverse Vein Diameters*

You can measure **AP** and **Transverse** diameters of veins (available with all **Venous** Presets: **Venous-LE**, **Venous-Calf**, **Venous-UE**).

1. Acquire **2D** image, then **Freeze**.
2. Press **Calcs**, then choose vein site you scanned.
3. Press **Set**, then measure **AP** or **Transverse** diameter.
4. Press **Enter**, then measure other dimension. System automatically labels whether **AP** or **Transverse**.
5. Press **Report** button to see results.
6. Click on **Report**. Note the system automatically picks the larger of the 2 diameters.

Auto-Dop Trace

Auto-Dop Trace enables the automatic tracing of waveforms on a PW strip. The default settings are configured using the **Auto-Dop Trace Configuration** screen. To access this screen, go to:

SmartCart/ SmartCart *sp*	**Setup | System Setup | Calcs | Auto-Dop Trace**
Scan Engine	**Tools | System Setup | Calcs | Auto-Dop Trace**

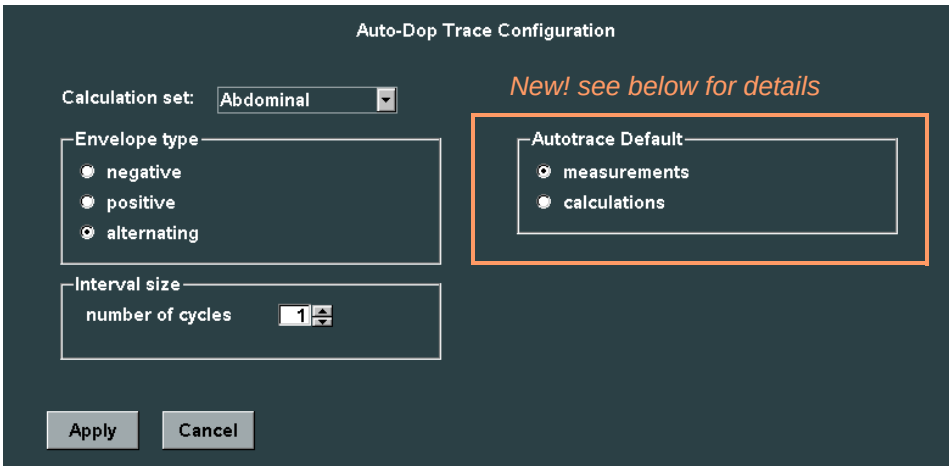


Figure 9-22. Auto-Dop Trace Configuration Screen

▶ *To Configure Default Settings*

The following parameters are configurable for **Auto-Dop Trace**:

- Calculation Set

  The **Exam** types listed below can be selected for calculations performed while in **Auto-Dop Trace**.

  - Abdominal
  - Obstetrics
  - Gynecology
  - Vascular
  - Pediatric
  - Small Parts

  NOTE: Some of the **Exam** types are available only with specific transducer selections.

- Envelope Type: (blood flow direction)

  The direction of blood flow that is selected for tracing by the **Auto-Dop Trace** function is specified in the **Envelope Type** selection:

  - Positive
  - Negative
  - Alternating (allows the **Auto-Dop Trace** to cross over the baseline)

- Interval Size: 1 - 10 (number of heart cycles)

  The number of heart cycles used in calculations for **Auto-Dop Trace** is specified in the **Interval Size** selection:

NOTE: If more than 1 cycle is chosen, averaging is enabled.

- Autotrace Default *New!*
  - **measurements** - Select to automatically display **Measure** menu when you activate **Auto-Dop Trace**. To switch to **Calcs** menu during the **Autotrace**, press **Calc** button.
  - **calculations** - Select to automatically display **Calcs** menu when you activate **Auto-Dop Trace**. To switch to **Measure** menu during the **Autotrace**, press **Measure** button.

Assign Function/Mode Key

1. Assign a **Function** or **Mode** key to activate **Autotrace**. See Figure 7-7 on page 7-10.

To Activate Auto-Dop Trace

See page 7-51.

To Deactivate Auto-Dop Trace

See page 7-52.

To Remove Trace and Redisplay Auto-Dop Trace

- If trace is occurring, press appropriate menu button (**Measure** button if active trace is a measurement; **Calc** button if active trace is a calculation) to display the menu, then press same button again to remove active trace.
- Press desired button (**Measure** or **Calc**) to display the menu; make your selection, and press **Set**.
- If manual caliper measurements are desired during **Auto-Dop Trace**, double-click **Measure** button to remove autotrace. Single-click **Measure** button to activate manual caliper measurements.

Autotrace Overview

Automeasure refers to generic PW measurements performed using **Auto-Dop Trace**, and the results are not associated with a Calculation Package. **Autocalc** refers to measurements performed using **Auto-Dop Trace** that are associated with a specific Calculation Package, and the results are entered in the Report.

If the strip is live or in cine play, the measurement will be updated at the end of each cardiac cycle or time interval.

If the strip is frozen, two **BLUE** vertical line calipers will delimit the current cardiac cycle (or cycles if averaging is enabled) and the current measurement for the interval will be displayed. Moving the **Trackball** left or right will shift the delimiters to the previous or next interval and update the measurement or calculation accordingly.

Pressing the **Set** button selects either the left or right **Auto-Dop** delimiters for individual positioning. This allows the user to fine-tune the cardiac cycle to be used in the **Auto-Dop** calculations by as much as 50% of that detected by **Auto-Dop Trace**. The first press of the **Set** button selects the delimiters for positioning in the order of **left > right > both**, with subsequent **Set** button presses repeating this selection cycling.

Auto Parameters

The user can override the default **Auto-Dop Trace** settings that were configured on the **Auto-Dop Trace Configuration** screen (Figure 9-22). Changes for **Auto-Dop Trace** are available within the **Autotrace** menu.

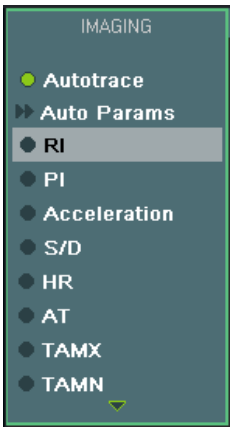


Figure 9-23. Auto Params Measure Menu

To Access Auto Params Menu

1. While in live **PW Doppler** mode, double-click **Measure** button.
2. Press **Menu** button to display the menu and select **Auto Params**.

Most of the parameters within the **Auto Params** menu (listed below) are the same settings previously described on the **Auto-Dop Trace Configuration** screen (Figure 9-22).

- Trace type:
  - Max (velocity)
  - Mean (velocity)
  - Both
- Env (Envelope type):
  - Pos (Positive flow direction)
  - Neg (Negative flow direction)
  - Alt (Alternating - both directions; allows the **Auto-Dop Trace** to cross over the baseline)
- N (Number) heart cycles
  - 1 - 10 (selectable)

NOTE: If more than 1 cycle is chosen, averaging is enabled.

Automeasure

Automeasure refers to generic PW measurements performed using **Auto-Dop Trace**.

- Pressing the **Calc** button while **Auto-Dop Trace** is on will display the **Autotrace Calc** menu associated with the current exam/preset selection (if any). It does not actually enter any **Calc** package results, which still need to be entered via

Enter, Enter/Select, or **Select**. Additionally, **Autotrace Calc** results can only be entered from a frozen strip display (not 'live' or **Cine Play**).

- While **Auto-Dop Trace** is active, the Doppler envelope will be outlined in green. When you freeze the strip, **Automeasure** numbers are displayed at the bottom right side of the image.
- When the image is frozen, vertical **BLUE line graphics delimiters** will appear on the PW strip. A small yellow arrow will appear at the top to mark the peak systolic velocity. When you have multiple cardiac cycles displayed, a small yellow arrow will also be displayed at the bottom to mark the peak end diastolic.
- The placement of the delimiters is determined by how many heart cycles were chosen in the **N Cycles** selection of the **Auto Params** menu. The heart cycle selected for active evaluation can be changed by scrolling the Trackball to the left or right.
- You can manually adjust the position of the delimiters by pressing the **Set** button. The first press will allow for adjustment of the **Left** delimiter; the second press will allowing adjustment of the **Right** delimiter. The calculated **Automeasure** values will be adjusted accordingly.
- **Auto-Dop Trace** is different from conventional autotrace functions in that the **Auto-Dop Trace** process is applied to the spectrum prior to any post-processing functions (such as gain, dynamic range, edge) being applied.
- Manual adjustments to any of these post-processing functions will not affect the **Auto-Dop Trace.**

NOTE: **Auto-Dop Trace** is intended to serve as an adjunct to the diagnostic process in evaluating blood flow during **PW Doppler** examinations. When using the **Auto-Dop Trace** feature, please evaluate the results to verify that you are in agreement before committing the values to the **Calc Report Package**.

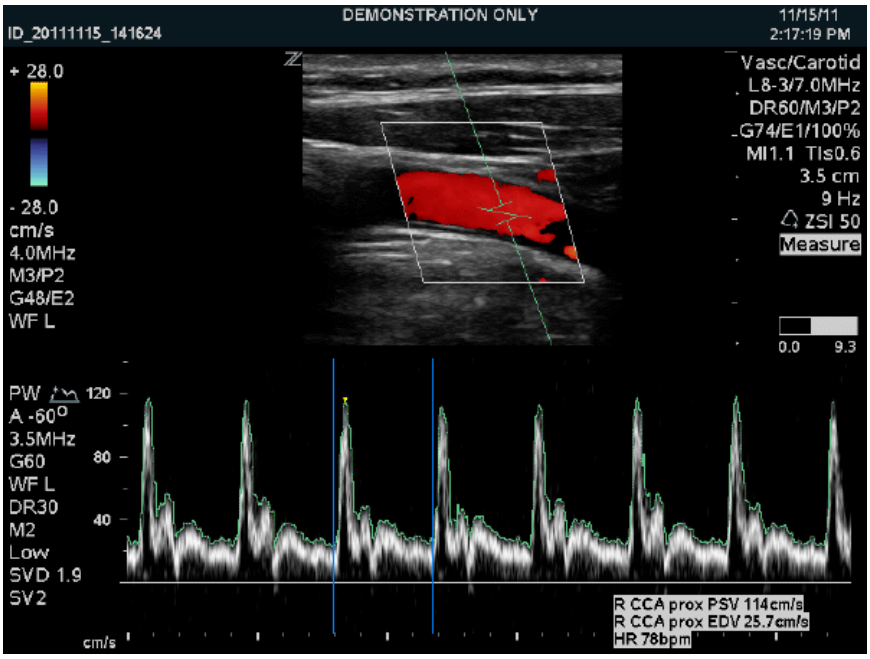


Figure 9-24. Auto-Dop Trace - Automeasure (Single Cycle)

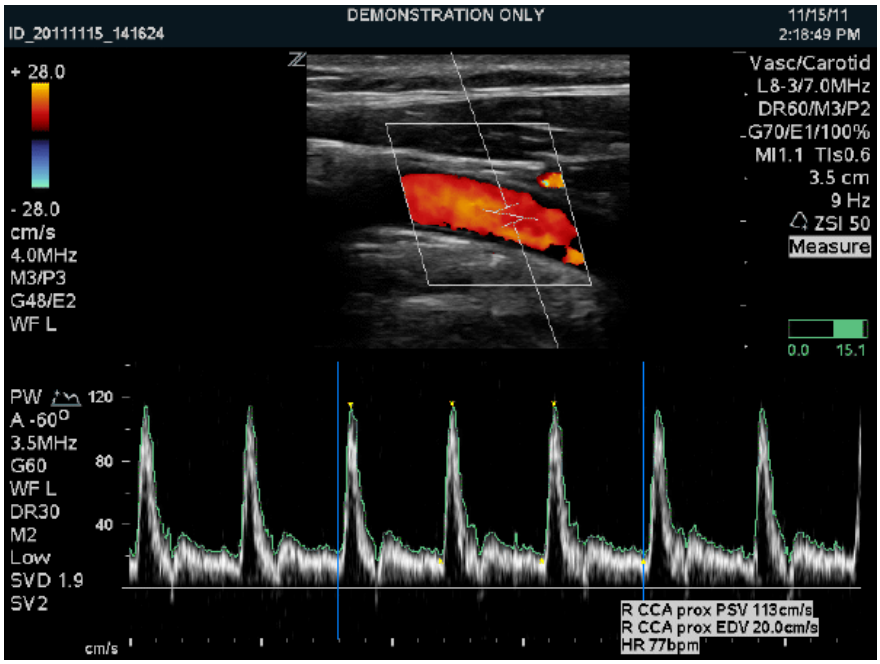


Figure 9-25. Auto-Dop Trace - Automeasure (Multiple Cycles)

Volume Flow

▶ *To Measure Volume Flow*

1. Acquire **PW Doppler** spectrum (spectral strip must be live).
2. Double-click **Measure** button. **Measure** menu appears.
3. Select **Vol Flow** (bottom of menu) and press **Set**.

4. On next menu are three selections: **Vessel Diam**, **PW Gate Size**, and **Start Trace**.
5. Highlight **Vessel Diam**. Then use **Trackball** or **Set** button to position horizontal lines on inner diameter of vessel. Vessel diameter represents diameter of flow area that blood passes through.
6. Next, highlight **PW Gate Size**. Then use **Trackball** or **Set** button to position **PW Gate** within vessel diameter to encompass entire flow.
7. Next, select **Start Trace** and press **Set**.
8. The following generic numbers will be displayed at the bottom of the image: **Diameter**, **TAMN**, **PSV**, **Volume Flow (ml/min)**.

Auto Doppler Volume Flow Grafts/Shunts (Vasc Calc)

Volume Flow Grafts/Shunts (Vasc Calc) is available only when using the **Vasc/Arterial-UE** and **Vasc/Arterial-LE** presets.

▶ *To Measure Volume Flow Grafts/Shunts (Vasc Calc)*

1. Press **Exam Type** button. Select **Vascular** exam softkey, then select **Arterial-UE** or **Arterial-LE** softkey.
2. Press **Function/Mode** key assigned to **Autotrace** (see "To Activate Auto-Dop Trace" on page 7-51).
3. Press **Calc** button. **Calc** menu displays. Select **Graft Vol Flow** and press **Set**.

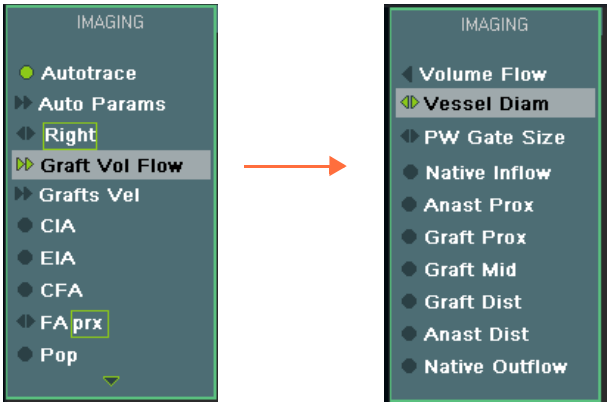


Figure 9-26. Calc Menu and Graft Vol Flow Submenu

4. Adjust **Vessel Diam** and **PW Gate Size** as needed (see "To Measure Volume Flow" on page 9-49).
5. Select one of the **Native**, **Anast**, or **Graft** options and press **Set**.
6. The following measurements will display at the bottom of the image: **Diameter**, **TAMN**, **PSV**, **Volume Flow (ml/min)**.
7. To redisplay the **Graft Vol Flow** submenu, press **Calc** button.

Measurement Accuracy

The description of the fundamental accuracy of 2D, time, and velocity measurements applies to all transducer types.

2D Measurement Accuracy

Because distance is a measure of the relative separation between two pixels in the image, distance is not affected by the delay tolerances in the front-end echo acquisition system, including variations in the response times of the transducer and analog electronics.

- Two main sources of error may affect distance measurements:
  - Sound speed assumed by the system does not match the actual sound speed of the medium
  - Algorithmic error associated with floating point versus fixed point math
- The conversion of time delay to distance is based on a sound speed of 1540 m/s for all transducers and application types.
  - This is independent of the **Speed of Sound Correction,** which, if activated, affects only the focus quality (and not the scaling) of the image.
  - Due to sound speed variations between different types of tissue, caliper measurement errors in the order of 5% are expected for images of the human body.
- With respect to algorithmic error, the entire digital signal processing chain in the System is designed with sufficient precision to ensure that the cumulative digital processor rounding errors from detection to scan conversion will not exceed one pixel in the final XY display.
  - While the display 2D image size varies with the image depth setting and zoom state, the image generally takes up more than 100 pixels along the range dimension.
  - Therefore, one pixel corresponds to a distance error of less than 1% of the maximum range of the image.
- Based on the above considerations, it should be safe to assume that for a medium whose sound speed is close to the 1540 m/s, the caliper distance measurement fractional error is:

  Tolerance in distance < +/-2% plus (1% of maxRange/distance)

- The area and circumference accuracies can be derived from the distance accuracy as follows:

  Tolerance in area =
  ((1+lateral distance tolerance) * (1+axial distance tolerance) -1)
  < +/-4% plus (2% of maxRange/smaller of 2 dimensions)

  Tolerance in circumference =
  sqrt(2)*(maximum of 2 distance tolerances)
  < +/-3% plus (1.4% of maxRange/smaller of 2 dimensions)

- The above accuracy statements are consistent with 2D measurement tests performed using a Gammex 403GS phantom with 0.5 dB/cm-MHz attenuation and a sound speed of 1540 m/s.

Elapsed Time or Rate Measurement Accuracy

In M-Mode and PW Doppler, strip records of tissue motion or blood velocities over time are produced.

- The user may use the calipers to analyze these records to measure the elapsed time between events, or, conversely, to determine the frequency of such events (as in heart rate determinations).
- The fundamental accuracy of these measurements depends on the accuracy of the caliper placement in measuring elapsed time on the time record.

Since the smallest possible error in placing each caliper is ±1 pixel, the average minimum error in estimating the elapsed time between two events is approximately ±1.5 pixels. The error in estimating the elapsed time between two events occurring 1.0 second apart depends upon the sweep speed (number of pixels per second). In general, for a sweep speed that is n pixels/sec, the fractional measurement error for an elapsed time of 1.0 sec is given by 1.5/n. The relationship between sweep speed and the full strip sweep time depends on how many pixels are allocated for a given strip mode display, which in turn depends on the pixel density of the LCD.

For the example of the 640-by-480-pixel z.**one** **Scan Engine** display, the M-mode strip is 492 pixels wide, and the corresponding error estimates are summarized in the tables below.

NOTE: Notice among the different LCDs, the **SmartCart/SmartCart *sp*** display has the best measurement accuracy due to its higher pixel density.

Accuracy of Caliper Measurements of Elapsed Time or Rate

Table 9-5. M-Mode Strip: Scan Engine Display

Sweep Speed (pixels/sec)	Sweep Time (sec)	Error in Measurement (1.0 sec)
180	2.7	0.8%
90	5.4	1.7%
60	8.1	2.5%

Table 9-6. M-Mode Strip: SmartCart/SmartCart sp Display

Sweep Speed (pixels/sec)	Sweep Speed (sec)	Error in Measurement (1.0 sec)
240	2.8	0.6%
120	5.6	1.3%
60	11.2	2.5%

Table 9-7. PW Strip: Scan Engine Displays

Sweep Speed (pixels/sec)	Sweep Speed (sec)	Error in Measurement (1.0 sec)
360	1.4	0.4%
180	2.7	0.8%
120	4.1	1.3%
90	5.4	1.7%
60	8.1	2.5%

Table 9-8. PW Strip: SmartCart/SmartCart *sp* Display

Sweep Speed (pixels/sec)	Sweep Speed (sec)	Error in Measurement (1.0 sec)
360	1.9	0.2%
240	2.8	0.6%
180	3.7	0.8%
120	5.6	1.3%
90	7.5	1.7%

These accuracy statements are consistent with PW elapsed time measurement tests performed using a CIRS Model 43 String Phantom with distilled water as the fluid medium.

Color Doppler Velocity Measurement Accuracy

Factors that limit the accuracy of velocity measurements in Color Doppler (CD) include the finite sample volume size and short period of sample volume interrogation. In addition, **z.one** systems may use different CD frequencies at different maximum depth of the CD box. Therefore, CD is not intended for making quantitative clinical measurements. Rather, CD should be used as an adjunct to quantitative techniques, allowing the user to search for the regions of interest and observe the flow dynamics in those regions.

Velocity Accuracy in CD

The best L10-5 CD velocity accuracy that has been achieved using a Gammex Model 1425A Doppler Flow Phantom is ±15% relative to the calculated velocity at the center of the 5-mm inner diameter flow tube, for volume flow rates from 0.5-1.0 meters/sec with a Doppler angle of 50°, and with a CD box of 40 mm maximum depth. However, due to the fundamental limitations of CD accuracy, larger mean velocity errors can be expected at other CD box depths and Doppler angles.

Registration Accuracy in CD

For CD scanning of Gammex Model 1425A Doppler Flow Phantom with a sound speed of 1540 cm/sec, the registration error between CD and 2D mode is generally less than 1.0 mm.

PW Doppler Velocity Measurement Accuracy

While CD gives an indication (at many points simultaneously) of the presence or absence of flow and its dynamic behavior during the cardiovascular cycle, PW Doppler provides a more precise quantification of flow velocity within the PW sample volume.

Velocity Accuracy in PW Doppler

PW Doppler velocity measurements were calibrated using a Gammex flow phantom with a small sample gate placed at the center of a diagonal flow tube and a Doppler angle of 50°. Maximum flow velocity measurements generally fall within ±10% of the phantom's calibrated velocity readings for volume flow rates from 0.5-1.0 meters/sec.

Angle Estimation

The precision of angle estimation is ± 0.5°. As with most electronically steered systems, the major error in angle estimation occurs through operator error in adjusting the angle calipers. Therefore, the operator should exercise care in the use of the angle calipers to achieve accuracy in their placement.

OB Tables Accuracy

All OB tables are implemented in software such that for the same input values, the output values (e.g., gestational age in weeks and days) match exactly the tables published in authoritative reference works.

All supplied OB tables have been verified independently by ZONARE test group. The verification process involves manually entering each of the data points from the source into the **z.one** system, and then verifying the output against that expected based on the corresponding table reference work.

Diagnostic Calculation Accuracy

All vascular, OB, and GYN calculations are implemented using standard geometric formulas and double-precision float point precision. The accuracy of the displayed output should be limited only by the display format and precision.

The diagnostic calculation packages (e.g.,%stenosis) have been verified independently by the ZONARE test group. The verification process involves manual entry of a set of randomly selected input values within the range of possible input values.

Numeric Display Precision

For display on the LCD monitor, all measurements and calculation results are generally rounded to a maximum of 2 digits after the decimal place. This policy ensures consistency between measured quantities (e.g., distance) and calculated values (e.g., area).

10

Echocardiography Option

Cardiac Calculation Package

NOTE: The **Echocardiography** option is available only on **SmartCart** workstations.

NOTE: See also "User Customizable Worksheets" on page 9-7 for information about new **Worksheets/Report** for **Cardiac Calc Package**.

The **Cardiac Exam Type** includes a selection of supported measurements and their associated calculations. The available measurements are configured on the **Cardiac Configuration** screen.

NOTE: The **Auto-Dop Trace** function has not been optimized for **Cardiac** applications.

▶ *To Configure the Cardiac Calculation Package*

1. Go to **Setup button | System Setup | Calcs | Cardiac**
2. The **Cardiac Configuration** screen displays.

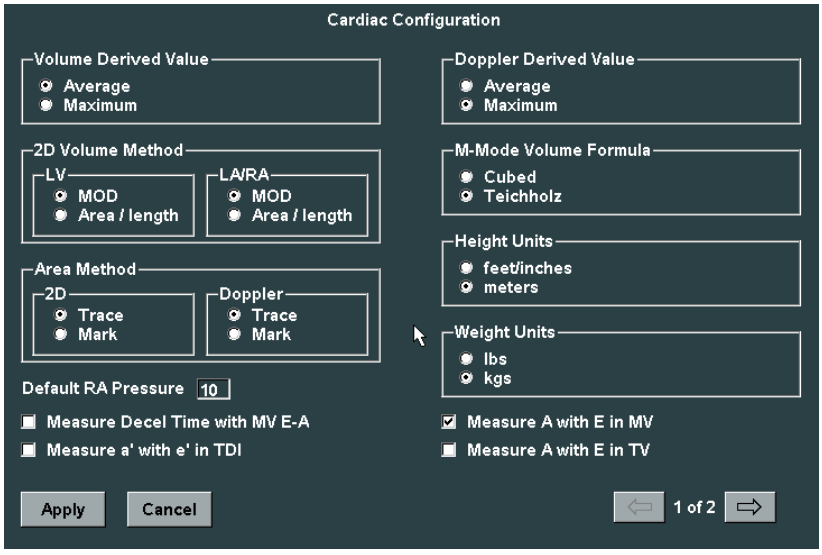


Figure 10-1. Cardiac Configuration Screen

3. Select the options you want, then click **Apply** to save your changes.
4. Then click the arrow button at the bottom of the screen to go to page 2.

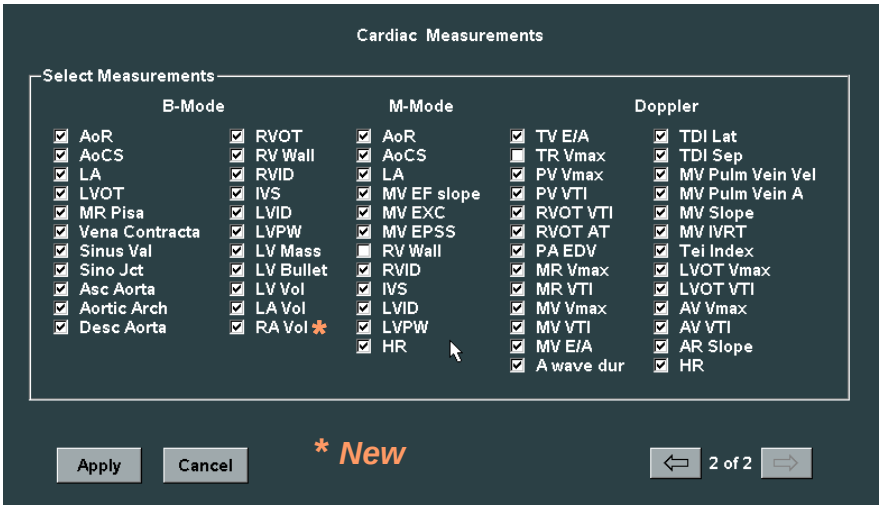


Figure 10-2. Page 2: Cardiac Measurements

5. Select the measurements you want, then click **Apply** to save your changes.

NOTE: You enter the patient's height and weight on the **Patient Information Form**.

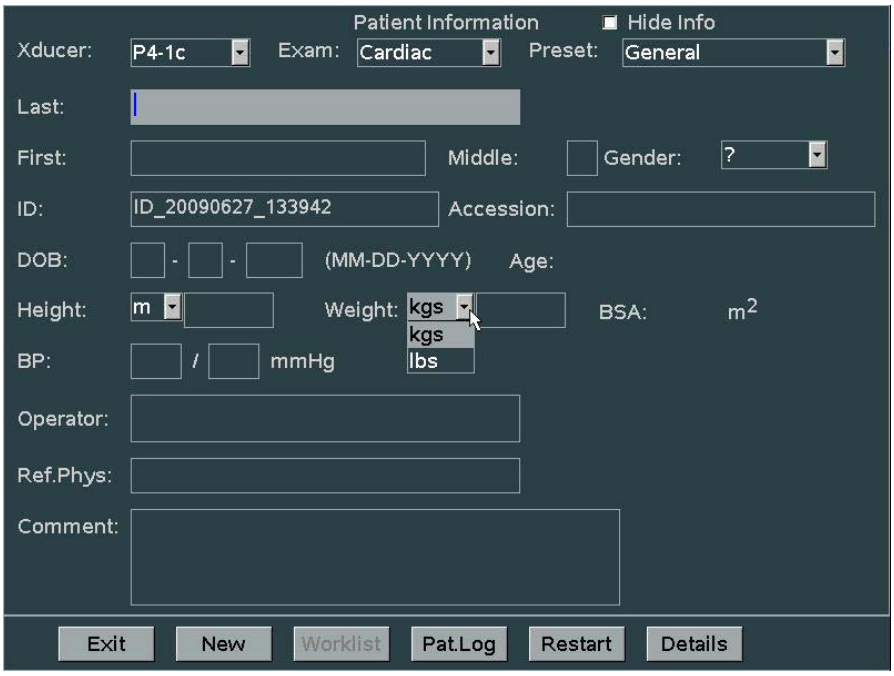


Figure 10-3. Patient Information Form: Height & Weight for Cardiac Exam

The following calculations are listed in the **Cardiac Report** and are available for the **Cardiac Exam Preset**:

Table 10-1. Cardiac Calculations - 2D (B-Mode)

Cardiac Exam Preset: Available 2D (B-Mode) Calculations
Aorta
Plax
AoR
LA
AoCS
LVOT
Sinus Valsalva
Sinotub Junc
Asc Aorta
SSN
Asc Aorta
Aortic Arch
Desc Aorta
LV
Diastole
RV Wall
RVID
IVS
LVID
LVPW
Systole
RV Wall
RVID
IVS
LVID
LVPW
LV Function
Apical 4
Volume [Dias/Syst]
Length [Dias/Syst]
Apical 2
Volume [Dias/Syst]
Length [Dias/Syst]
S Axis
Endo [Dias/Syst]

Table 10-1. Cardiac Calculations - 2D (B-Mode) (Continued)

Cardiac Exam Preset: Available 2D (B-Mode) Calculations
LV Mass
Epi/Endo
Length
LA Volume
Apical 4
Volume
Apical 2
Volume
Mitral
Vena Contracta
MR PISA Radius
Shunts
RVOT
LVOT

Table 10-2. Cardiac Calculations - M-Mode

Cardiac Exam Preset: Available M-Mode Calculations
Aorta
AoR
LA
AoCS
Mitral
D-E excursion
MV E-F Slope
EPSS
LV
Diastole
RV Wall
RVID
IVS
LVID
LVPW
Systole
RV Wall
RVID
IVS
LVID
LVPW
HR

Table 10-3. Cardiac Calculations - Doppler

Cardiac Exam Preset: Available Doppler Calculations
NOTE: Auto-Dop Trace is not available with Cardiac Calculations.
Aortic
LVOT [VTI/max]
AV [VTI/Vmax]
AR Slope
HR
Tricuspid
TR Vmax
TV E-A
HR
Pulmonic
PV [VTI/Vmax]
RVOT VTI
PA EDV
HR)
Mitral
MR [VTI/Vmax]
MV [VTI/Vmax]
LVOT VTI
MV E-A
MV Slope
A Wave Dur
TDI [Lat/Sep]
PulmV S-D-A
PulmV A Dur
IVRT
TEI Index
MCO
ET
HR

Cardiac Imaging and Related Functions

ECG

The ECG trace is available only on **SmartCart** systems equipped with the Echocardiology Option. ECG does not operate on the **SmartCart *sp*** or **Scan Engine**.

The ECG trace is part of the **Cardiac Exam Preset** and automatically scrolls at the bottom of the 2D image. In strip modes (M, PW, and CW modes) the ECG trace will default to the top of the strip. The ECG trace position can be adjusted anyplace within the strip box.

WARNING: The ECG is not intended for ECG diagnosis. It must not be used for intraoperative applications of the heart. Use only the recommended patient cable supplied by ZONARE. Make sure that bare parts of the electrodes and the patient do not come in contact with conductive parts, such as metal examination beds, trolleys, and similar items.

WARNING: When using the ECG input and defibrillation is required, *always* disconnect the ECG cable from the system before defibrillation and keep cable away from conductive surfaces.

NOTE: ZONARE recommends the following ECG patient cables and lead wires from Advanced Medical Cables (www.advantagemed.com):

- AMC LW-3700024/31 (International patient lead wire replacements)
- AMC LW-3700024/3A (Domestic patient lead wire replacements)
- AMC CB-83340 (ECG trunk cable)
- AMC CB-33598-00 (Accessory cable for use without lead wires)

▶ *To Use ECG Function*

- A transducer (such as the P4-1c or P10-4 transducer) needs to be initialized for the ECG to operate.
- Plug the ECG cable into the ECG port on the **SmartCart** (see Figure 2-1 on page 2-2) to display the ECG trace.
- Connect the three patient leads to the patient.

▶ *To Activate ECG Trace*

1. Press the **ECG** key on the **SmartCart** QWERTY keyboard (Figure 10-4). This will activate the **ECG** softkey controls (Figure 10-5).

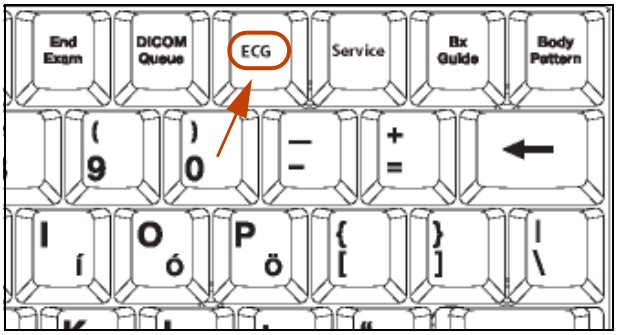


Figure 10-4. ECG Key on SmartCart QWERTY Keyboard

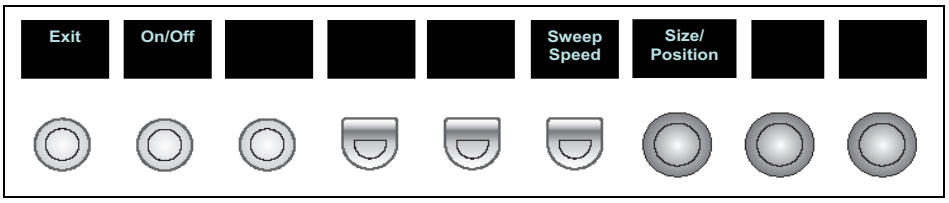


Figure 10-5. ECG Softkey Controls

Table 10-4. ECG Softkey Controls

Control	Description
Exit	■ Removes the ECG controls from the OLED but still allows the ECG trace to scroll
On/Off	■ Turns ECG On/Off
Sweep Speed	■ Controls the ECG sweep speed (Min, Low, Med, High)
Size/Position	■ Press the knob to activate **Size** or **Position**. ■ With **Size** active: Turn the knob to change the size of the ECG. ■ With **Position** active: Turn the knob to move the ECG anyplace within the strip box. **NOTE: Position** does not operate while in 2D modes.

Sweep Speed

The sweep speed in **B-Mode (2D)** when the **ECG** strip is active is as follows:

Figure 10-6. Sweep Speed: B-Mode (2D)

Sweep Speed	Normal Imaging (mm/s)	Full-Image Display (mm/s)
Low	25.0	40.0
Med	50.0	80.0
High	100.0	160.0
Max	150.0	240.0

The sweep speeds in **M-Mode**, **CW-Mode**, and **PW-Mode** when the **ECG** strip is active are as follows:

Figure 10-7. Sweep Speeds: M, CW, and PW Modes

Sweep Speed	Normal Imaging (mm/s)	Full-Image Display (mm/s)
Min	26.1	41.8
Low	34.8	55.7
Med	52.2	83.5
High	69.6	111.4
Max	104.4	167.0

M-Mode Calculations

▶ *To Perform M-Mode Cardiac Calculations*

1. Obtain the desired M-Mode image and press the **Freeze** button.
2. Press the **Calc** button and use **Trackball** to highlight and select the desired measurement (**Aorta, Mitral, LV**)n.
3. When the measurement is chosen, use **Trackball** to cycle up/down, left/right.
4. The first caliper will appear on screen.
5. Use **Trackball** to position the first caliper. Press the **Set** button to fix the first caliper and activate the next caliper(s).
6. Press **Enter** to finalize the measurement.
7. Repeat steps 1 - 6 for any additional measurements.
8. To view the **Cardiac Worksheet**, press **Report**.
9. The Worksheet will display the last measurement calculated.

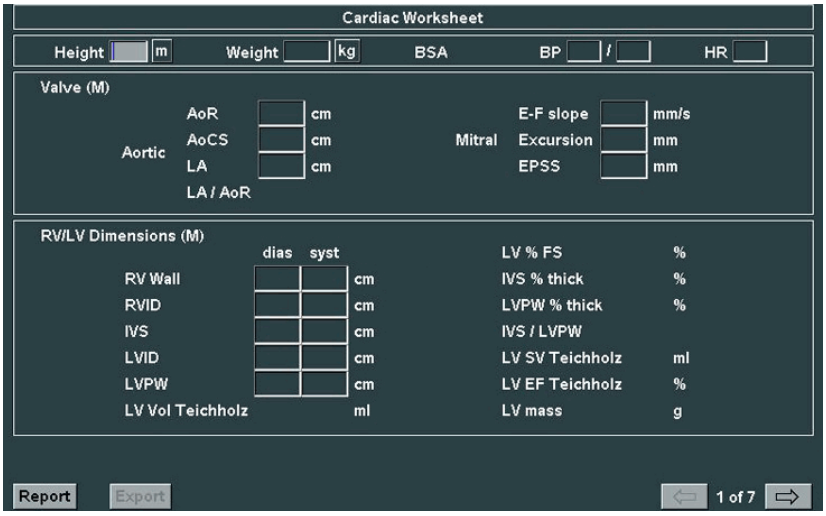


Figure 10-8. Cardiac Worksheet

2D (B-Mode) Calculations

▶ *To Perform 2D Calculations*

1. Obtain the desired 2D image and press the **Freeze** button.
2. Press the **Calc** button and use **Trackball** to highlight the desired measurement and press the **Select** button.
3. When the measurement is chosen, use **Trackball** to cycle up/down, left/right.
4. The first caliper will appear on the screen.
5. Use the **Trackball** to position the first caliper. Press the **Set** button to fix the first caliper and activate the next caliper(s).
6. Press **Enter** to finalize the measurement.
7. Repeat steps 1 - 6 for any additional measurements.
8. To view the **Cardiac Worksheet**, press **Report**.

9. To edit the **Worksheet**, highlight the value to be edited, then press the **Delete** button or use the **Backspace** key on the QWERTY keyboard.

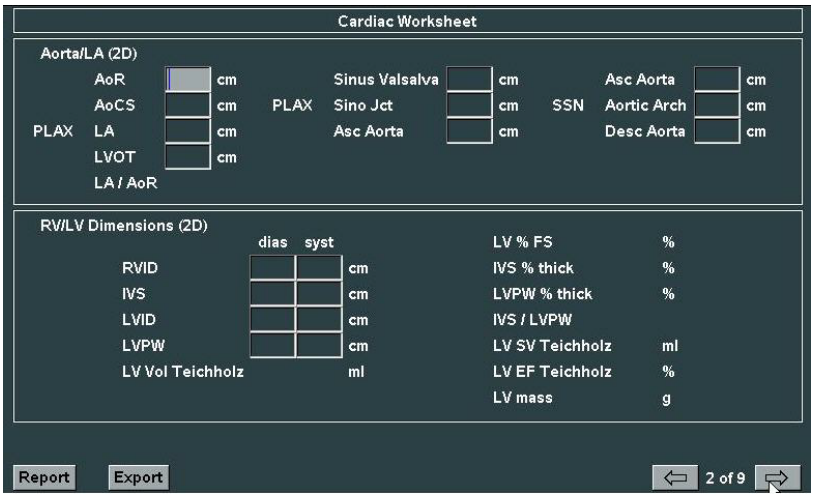


Figure 10-9. Cardiac Worksheet: Aorta, LV

2D Calculations (Trace/Mark Function)

▶ *To Perform 2D Calculations (LV Function, LA Volume)*

1. Obtain the desired 2D image and press the **Freeze** button.
2. Press the **Calc** button and use **Trackball** to highlight and select the desired measurement (**LV Function, LA Volume**).
3. When the measurement is chosen, use **Trackball** to cycle up/down, left/right.
4. The first caliper will appear on the screen
5. Use the **Trackball** to position the first caliper. Press **Set** button to fix the caliper and with the **Trackball** begin to **Trace** or **Mark** the area.
   - If **Trace** was chosen on the **Cardiac Configuration** screen (Figure 10-1) you trace the area of interest with the **Trackball**. If you want to backup what you traced, you can move the **Trackball** back over the **Trace**; this will erase what you drew.

NOTE: You can also use the **Delete** button to delete the trace.

   - If **Mark** was chosen on the **Cardiac Configuration** screen (Figure 10-1) position the caliper with the **Trackball** and press **Set** to fix the position. Repeat positioning the **Trackball** and pressing **Set** until the area of interest has been outlined. To delete calipers press the **Delete** button.
6. With the caliper at the last fixed position press **Enter** or double-click **Set** button to finalize the measurement.
   - If a **Diastolic/Systolic** measurement was being performed, when you have completed either of those measurements and pressed **Enter** (or double-clicked **Set**) you can now move the **Trackball** to cycle to the next **Diastolic/Systolic** measurement from **Cine**.
7. Repeat steps 1 - 6 to obtain any additional measurements.

8. To view the **Cardiac Worksheet**, press **Report**.
9. To edit the Worksheet, highlight the value to be edited, then press the **Delete** button or use the **Backspace** key on the QWERTY keyboard.

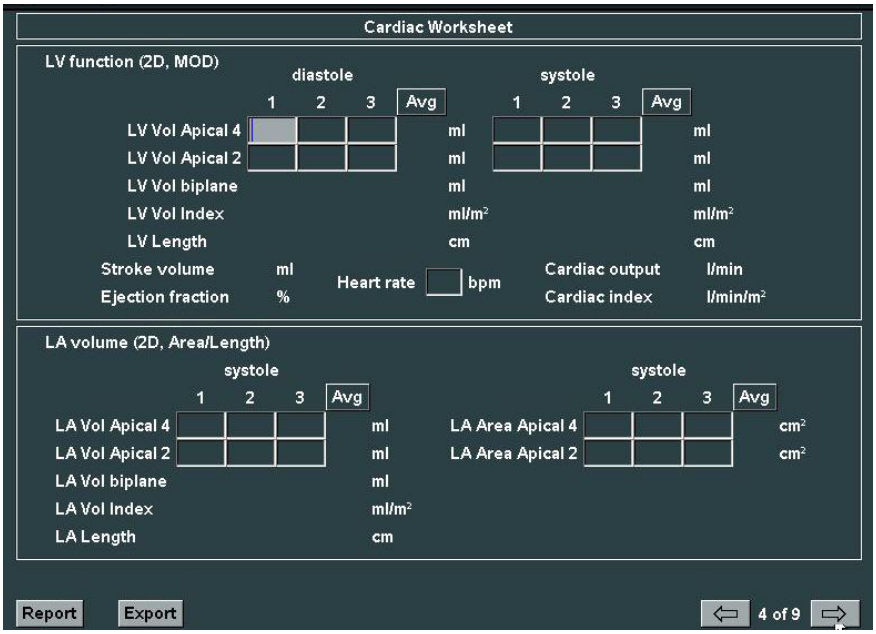


Figure 10-10. Cardiac Worksheet: LV Function, LA Volume

Doppler Calculations

▶ *To Perform Doppler Calculations*

NOTE: **Auto-Dop Trace** is not available with Cardiac Calculations.

1. Obtain the desired Doppler image and press the **Freeze** button.
2. Press the **Calc** button and use **Trackball** to cycle left/right or up/down to choose the appropriate Doppler measurement.
3. The first caliper will appear on the screen.
4. If a **Vmax** measurement is being done, use **Trackball** to position the caliper and press **Enter** to finalize the measurement.
5. If a **VTI** measurement is being performed, use **Trackball** to begin the **Trace** or **Mark** of the area.
   - If **Trace** was chosen on the **Cardiac Configuration** screen (Figure 10-1), trace the area of interest with the **Trackball**. To backup what you traced, move the **Trackball** back over the **Trace** and this will erase what you drew.

NOTE: You can also use the **Delete** button to delete the trace.

   - If **Mark** was chosen on the **Cardiac Configuration** screen (Figure 10-1) position the caliper with the **Trackball** and press **Set** to fix the position. Repeat positioning the **Trackball** and pressing **Set** until the area of interest has been outlined. To delete calipers press the **Delete** button.
6. With the caliper at the last fixed position, press **Enter** to finalize the measurement.

7. Repeat steps 1 - 6 for any additional measurements.
8. To view the **Cardiac Worksheet**, press **Report**.
9. To edit the **Worksheet**, highlight the value to be edited, then press the **Delete** button or use the **Backspace** key on the QWERTY keyboard.

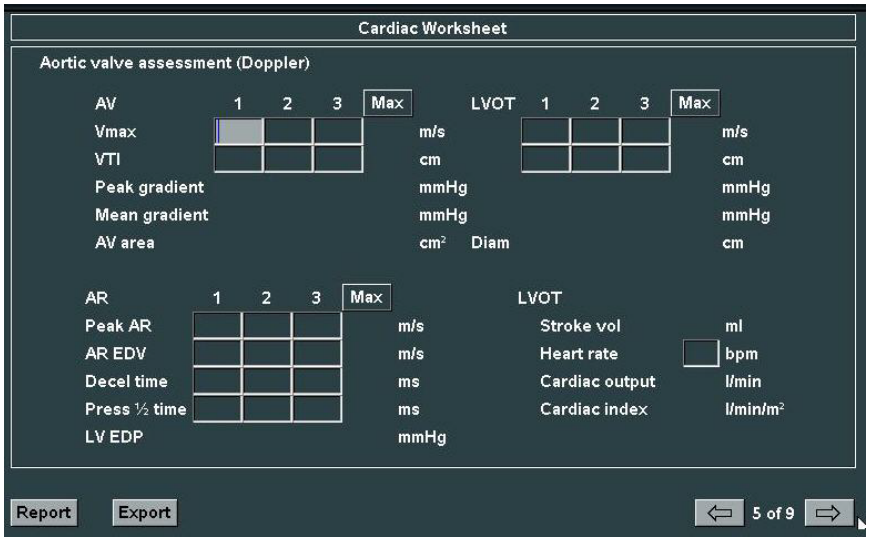


Figure 10-11. Cardiac Worksheet: Doppler

Heart Rate Measurements

▶ *To Perform Heart Rate Measurements*

You can obtain a **Heart Rate** value while in **M-Mode** or **Doppler**.

M-Mode

1. Freeze the image showing either the Aortic or Mitral Valve.
2. Press **Calc** then use **Trackball** to highlight and select **HR**.
3. The first cursor will appear. Position the cursor with the **Trackball**.
4. Press **Set** to activate the second cursor. Position the cursor with the **Trackball**.
5. Press **Enter** to finalize the measurement.

Doppler Mode

1. Freeze the image.
2. Press **Calc** then use **Trackball** to highlight and select **HR**.
3. The first cursor will appear. Position the cursor with the **Trackball**.
4. Press **Set** to activate the second cursor. Position the cursor with the **Trackball**.
5. Press **Enter** to finalize the measurement.

Clip/Image Store (Protocol Button)

The **Protocol** button on the **SmartCart** enables users to easily configure **Clip Store** parameters in seconds or beats. See “Clip/Image Store (Protocol Button - SmartCart only)” on page 7-12 for information.

Image Width Button (SmartCart only)

The **Image Width** button allows you to have a narrow sector, which gives you higher frame rates while in **2D** or **Color Doppler** modes. The size is completely customizable.

To Use Image Width Button

1. Press the **Image Width** button. The image mode defaults to panning, allowing you to move the sector left or right.
2. Press the **Set** button. This allows you to change the size.
3. Once the size has been adjusted, press the **Set** button again to resume panning.

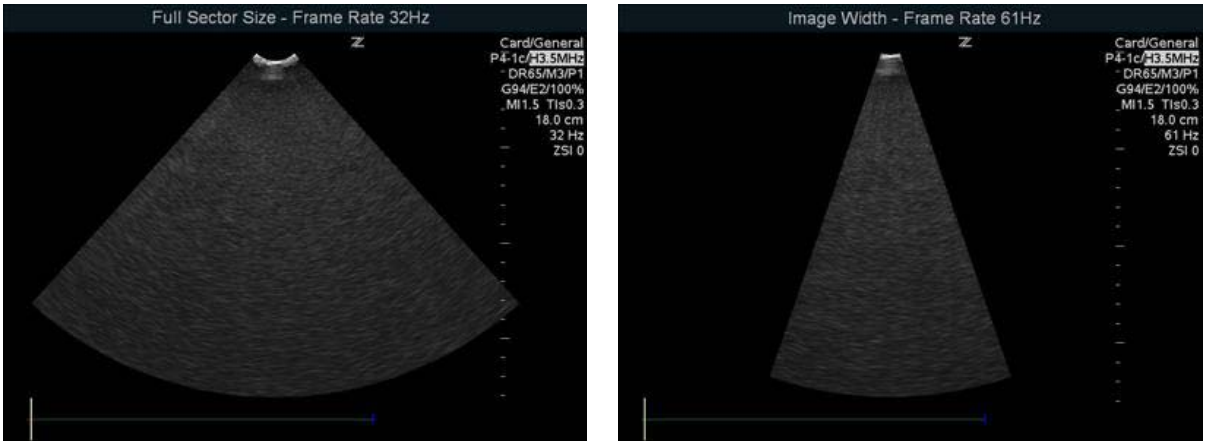


Figure 10-12. B-Mode: Full Sector Size (left); After Pressing Image Width Button (right)

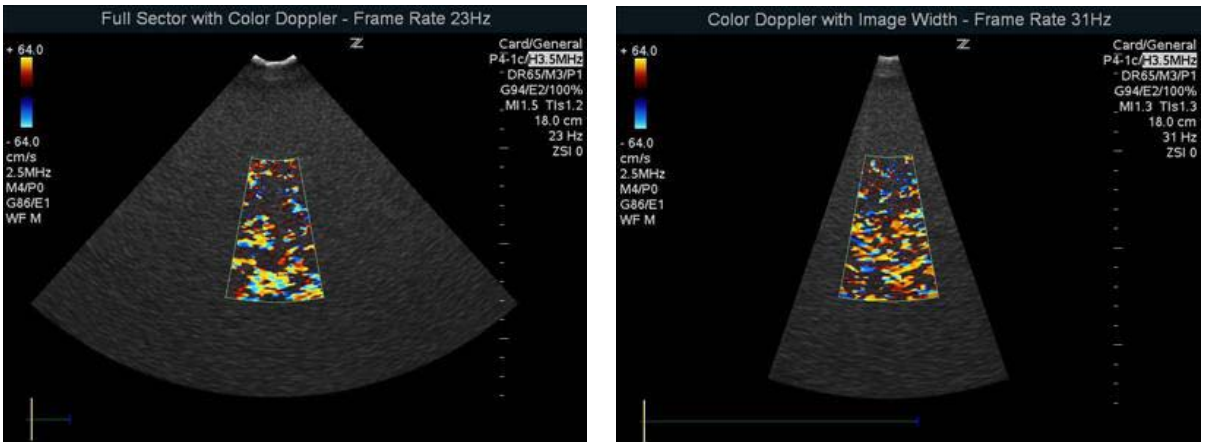


Figure 10-13. Color Doppler: Full Sector Size (left); After Pressing Image Width Button (right)

PW/CW/TDI (Pulsed Wave/ Continuous Wave/Tissue Doppler Imaging)

To Select Desired Doppler Mode

1. Press the **D** button to begin **PW** display.
2. Turn the right-most softkey to select the desired Doppler mode - options are **CW**, **PW**, and **TDI** [tissue doppler imaging].

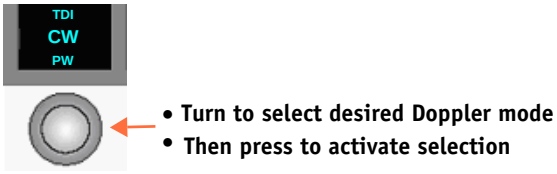


Figure 10-14. Doppler Mode Softkey (far right on SmartCart softkey panel)

3. To activate the selected Doppler mode, press the same softkey. The softkey label will display the active mode in large font and the Doppler data field appears in lower left of imaging screen (see Figure 10-15 through Figure 10-19).

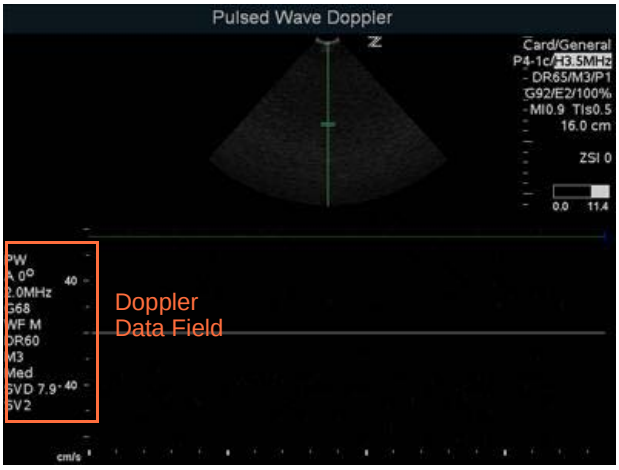


Figure 10-15. Location of Doppler Data Field

Doppler Data Field	Functionality
PW	Mode
A 0*	Angle
2.0MHz	Frequency
G68	Gain
WF M	Wall Filter (high, medium, low)
DR60	Dynamic Range
M3	Map
Med	Sweep Speed (min, low, med, high, max
SVD 7.9	Sample Volume Depth
SV 2	Sample Volume Gate Size (mm)
40	Nyquist Limit (Scale)

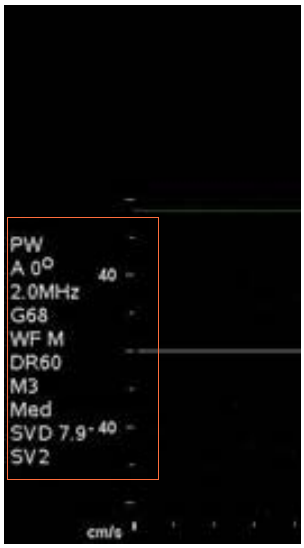


Figure 10-16. PW Doppler - Doppler Data Field & Legend

NOTE: For a list of the controls available during PW Doppler imaging, see Table 7-4 on page 7-45.

Doppler Data Field	Functionality
TDI	Mode
G40	Gain
WF L	Wall Filter (high, medium, low)
DR40	Dynamic Range
M3	Map
Med	Sweep Speed (min, low, med, high, max
SVD 7.9	Sample Volume Depth
SV 5	Sample Volume Gate Size (mm)
10	Nyquist Limit (Scale)

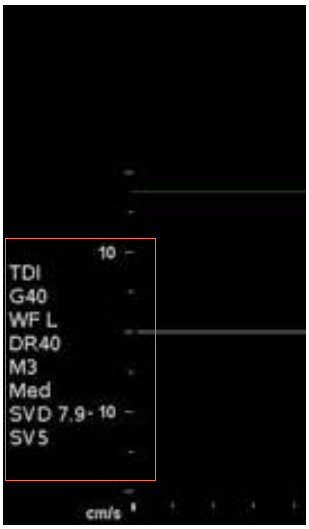


Figure 10-17. TDI - Doppler Data Field & Legend

NOTE: For a list of the controls available during TDI imaging, see Table 7-4 on page 7-45.

Doppler Data Field	Functionality
CW	Mode
2.0MHz	Frequency
G72	Gain
WF H	Wall Filter (high, medium, low)
DR60	Dynamic Range
M3	Map
Med	Sweep Speed (min, low, med, high, max
FD 6.7	Focal Depth
150	Nyquist Limit (Scale)

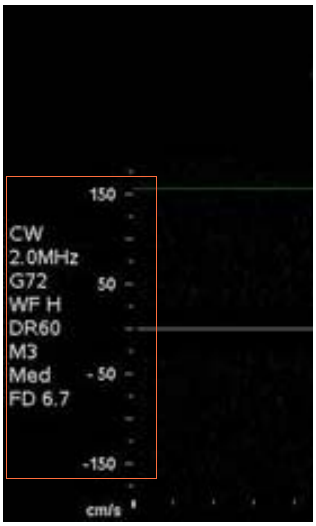


Figure 10-18. CW Doppler - Doppler Data Field & Legend

NOTE: For a list of the controls available during CW Doppler imaging, see Table 7-5 on page 7-53.

Doppler Data Field	Functionality
AUX CW	Mode
Card/Aux.CW	Exam Preset
2.0MHz	Frequency
G72	Gain
WF H	Wall Filter (high, medium, low)
DR60	Dynamic Range
M3	Map
Med	Sweep Speed (min, low, med, high, max
MI0.09	Mechanical Index
100%	Output Power
100	Nyquist Limit (Scale)

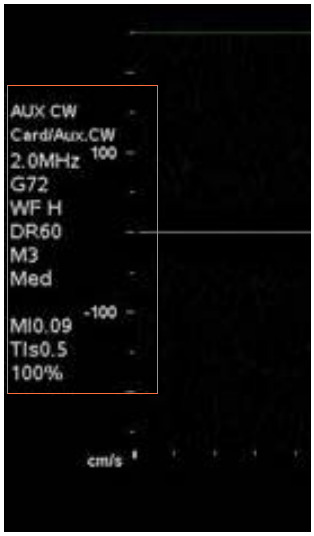


Figure 10-19. Aux CW Doppler - Doppler Data Field & Legend

NOTE: For a list of the controls available during **Aux CW** imaging, see Table 7-5 on page 7-53.

NOTE: For information on using the **Aux CW** transducer, see "To Activate Aux CW Doppler Imaging" on page 7-53.

Intracardiac Echocardiography (P9-3ic ICE Catheter)

For information, see page 6-20.

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11

Archive and Review

- Any screen displayed in the Image area can be saved (stored) electronically to the **Scan Engine**'s internal hard drive.
  - Ultrasound images and data screens are stored as screen images in DICOM format (.DCM files).
- ZONARE ultrasound systems can also be used for capturing dynamic clips of real-time image frame sequences.
  - The number of still images or clips that can be stored for an exam is limited only by the capacity of the internal storage media.
  - The duration of the stored clip is configurable by using the **Protocol** button.
  - Images or clips that have been printed or stored to a DICOM storage device (from the internal storage media) should be deleted on a regular basis (page 11-17).
  - Regular deletion will ensure adequate space is available for storing new images as well as optimize the performance (speed) for image storage on the System.
- In-progress exam images and images from exams stored on the internal storage media can be recalled for review.
- Annotations and measurements performed on in-progress exams can be saved as part of the archived images.
- Exams can be restarted, and images in those exams can have additional annotations and measurements performed.
- The user can also simultaneously save still images, screens, and clips to DICOM network storage devices.
  - The networking and DICOM parameters must be preconfigured before storing or printing to external devices.
  - See Chapter 13 "DICOM and FTP Connectivity" for more information on DICOM.

Image files cannot be retrieved from network storage for review on the System. These files can, however, be sent to a network review station directly from the System.

Preparation for Archive & Review

Storage Media Screen

On the **Storage Media** screen, the user configures the **Modality** for the DICOM **Worklist** server (if DICOM is activated on the System) and the compression level and quality for storing still images and clips. To access the **Storage Media** screen, go to **Setup | System Setup | Archive | Media**.

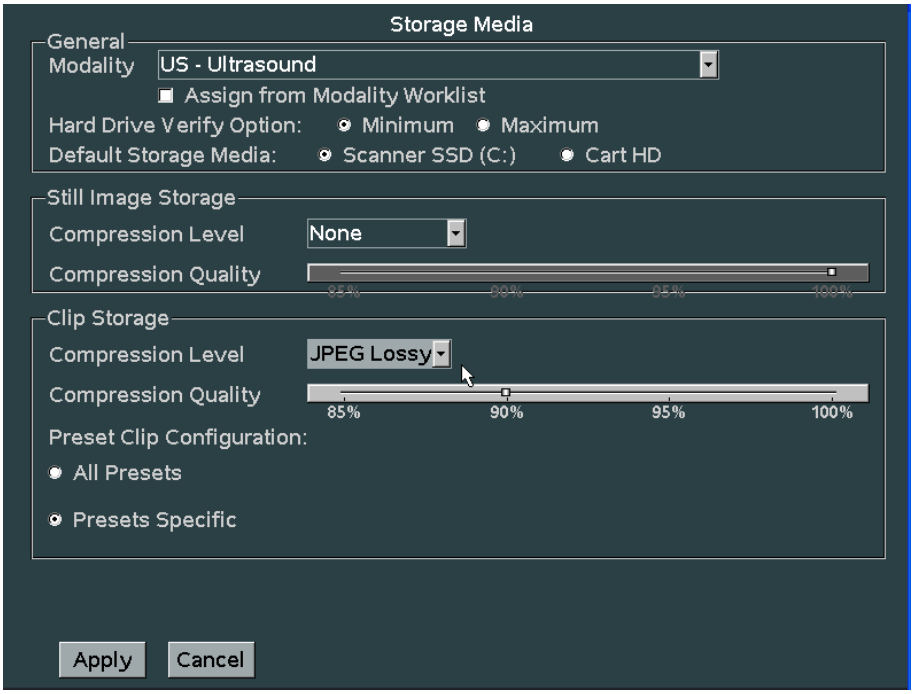


Figure 11-1. Storage Media Screen

NOTE: The option to **Rebuild** the DICOM media directory (DICOMDIR) is now found on the **Patient Exam Management** screen (Figure 11-19, page 11-36).

Table 11-1. Storage Media Screen Parameters

Parameter	Description
General	
Modality	Select from pull-down menu modality that will be specified to the DICOM Worklist server; Default: **US - Ultrasound**. Or check the **Assign from Modality Worklist** box to use the modality specified by the DICOM Worklist server.
Hard Drive Verify Option *New!*	■ **Minimum** = Default. **Minimum** significantly reduces the time and system resources needed to verify hard drive.
Default Storage Media *New!*	■ Select **Scanner SSD (C:)** (default) to save exams to Scan Engine/Module hard drive. ■ Select **Cart HD** to save exams to Cart hard drive. See also "To Automatically Store to Cart HD" on page 11-4. ■ To save exams to *both* **Scanner SSD** and **Cart HD**, select **Scanner SSD (C:)**, then select **CartHD** on **Image Store/Print Buttons** screen:  **NOTE:** You can also store to FTP (page 11-5).
Still Image Storage	
Compression Level	See "Compression Settings" below
Compression Quality	See "Compression Settings" below
Clip Storage	
Compression Level	**JPEG Lossy** is only selection.
Compression Quality	Select compression level (and resultant loss) using **Compression Quality (85-100%)** scale slider. Higher % equals larger file size but with less loss of source resolution. Default is 90%.
Preset Clip Configuration	■ Select **All Presets** to apply **Clip Storage Compression Level** and **Quality** specified here to all **Presets**. ■ Select **Presets Specific** to specify **Clip Storage Compression Level** and **Quality** for individual **Presets**.

Compression Settings

The size of the stored image files is determined by the preconfigured **Compression Level** and **Compression Quality** settings on the **Storage Media** screen.

- Compressing images allows for smaller image file sizes, which reduces disk storage and improves transfer rates.
- The **RLE Lossless** compression method reduces image file size without any loss of raw data during transmission.

- The **JPEG Lossy** method provides a significant reduction in file size (more compression than **RLE Lossless** or **None**) with some loss of raw data during the transfer. When **JPEG Lossy** compression type is selected, the user can specify the level of compression (and resultant loss) using the **Compression Quality (85-100%)** scale slider.

▶ *To Select Compression Level*

1. Using the drop-down box in the **Compression Level** field, select the desired level of compression that will be used for **Still Image Storage**.

NOTE: If **JPEG Lossy** compression format is selected, use the cursor on the onscreen bar graph to select the percentage (from 85% - 100%) of **Compression Quality** desired. (Higher % equals larger file size but with less loss of source resolution.) Factory default settings: **Still Image** = **None**.

▶ *To Automatically Store to Cart HD*

You may want to store exam data/images directly to the **CartHD** *rather than* the **Scanner SSD/C:** drive.

NOTE: To store *simultaneously* to **SSD/C:** *and* **CartHD**, see "Default Storage Media" on page 11-3 in Table 11-1.

1. Go to **Setup | System Setup | Archive | Media**. The **Storage Media** screen (Figure 11-1) displays:

Figure 11-2. Storage Media Screen - detail

2. For **Default Storage Media**, select **Cart HD**, then click **Apply**.
3. Go to **Setup | System Setup | Archive | Exam Export**. The **Exam Export Options** screen displays:

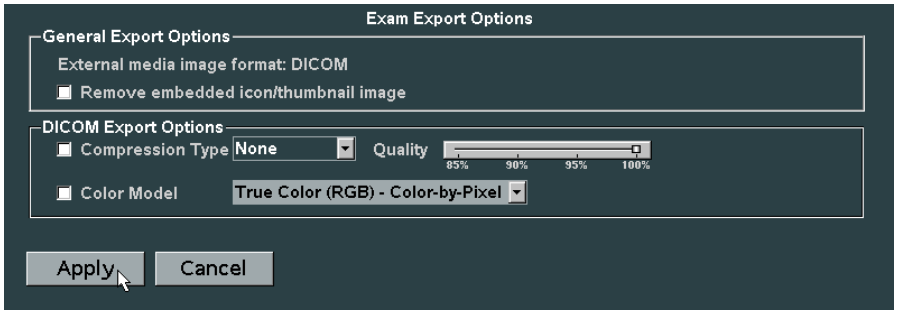


Figure 11-3. Exam Export Options Screen

4. Make your selections (Table 11-2), then click **Apply**.

Table 11-2. Exam Export Options

Option	Description
Remove embedded icon/thumbnail image	■ Check to remove icon/thumbnail; reduces size of exported file.
Compression Type	■ See "Compression Settings" on page 11-3.
Quality	■ See "Compression Settings" on page 11-3.
Color Model	■ See "Color Model" on page 13-12.

▶ *To Store to FTP*

You can store exam data/images directly to an FTP site. See "FTP Storage" on page 13-21.

Store/Print Button Configuration

The **Store** button can be configured to store to a local or networked location (e.g., PACS, FTP).The **Print** button can be configured to print via a network connection to a DICOM printer or to a locally attached printer (e.g., Sony UP-D897 Digital B/W USB 2.0 printer or Sony UP-D25MD Digital (USB 2.0) Color Printer.

▶ *To Access Image Store/Print Buttons Screen*

1. Go to:

SmartCart/SmartCart *sp*	**Setup | System Setup | Archive | Store/Print**
Scan Engine	**Tools | System Setup | Archive | Store/Print**

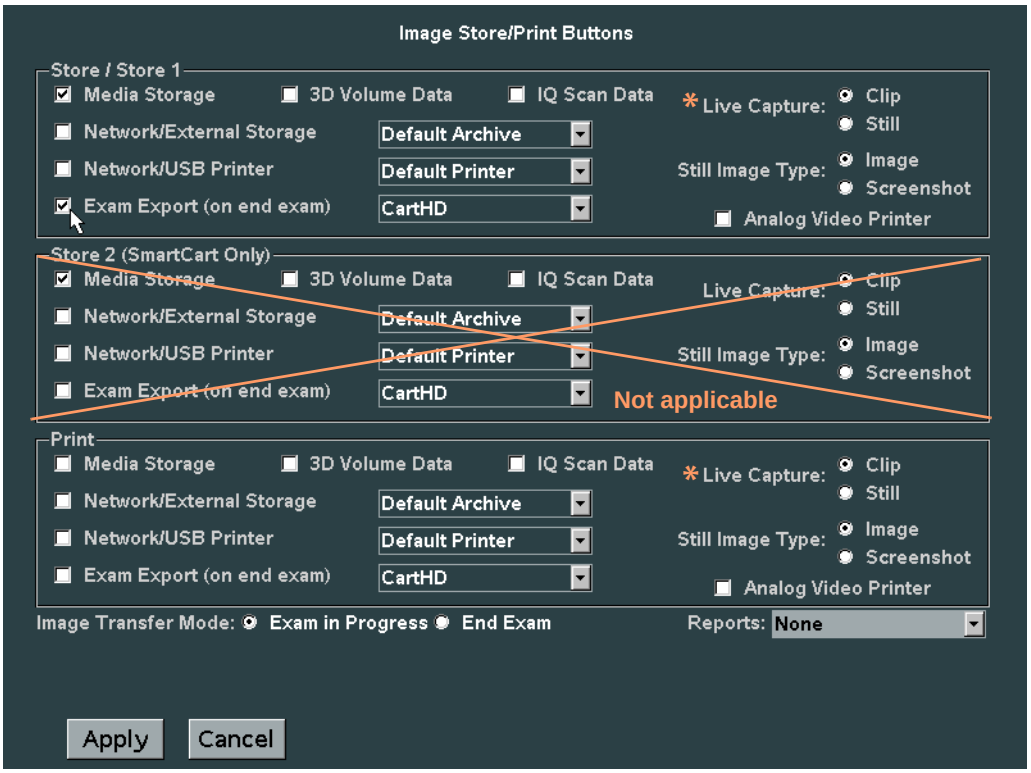


Figure 11-4. Image Store/Print Buttons Screen

* To print (by pressing **Print** or **Store** button) when **Live Capture** in **Print/Store** section is set for **Clip**, first freeze image by pressing **Freeze** button.

NOTE: The section **Exams Restarted Using** that used to appear on this screen can now be found on the **Patient Exam Management** screen (page 11-36).

Table 11-3. Image Store/Print Buttons Screen Parameters

Parameter	Description
Media Storage	■ Default is checked.
IQ Scan Data	■ Check **IQ Scan Data** box to enable capture of **IQ Scan** data for corresponding **Store** or **Print** button. Also see page 11-10. **NOTE:** Capturing **IQ Scan Data** will increase image file size. It is recommended to store **IQ Scan Data** sparingly.
3D Volume Data	■ Check **3D Volume Data** box to enable capture of **3D/4D Volume Data** for corresponding **Store** or **Print** button. Also see page 11-11.

Table 11-3. Image Store/Print Buttons Screen Parameters (Continued)

Parameter	Description
Live Capture	Options: ■ **Clip**: If ultrasound image is live (**Freeze** button not depressed), pressing **Store** or **Print** button will capture a realtime **Clip** sequence to the selected **Network/External Storage** device. The duration (in seconds) of **Clip** is configured using the **Protocol** button. For detailed information, see "Clip/ Image Store (Protocol Button - SmartCart only)" on page 7-12. ■ **Still**: If the ultrasound image is live, pressing the **Store** or **Print** button will result in momentarily capturing a single still frame image to the selected **Network/External Storage** device (or sending to the printer). This can save time and is particularly useful when inconvenient to press **Freeze** before storing an image.
Still Image Type	Options: ■ **Image**: Still image captured will include imaging area only. ■ **Screenshot**: Still image captured will include entire ultrasound screen.
Analog Video Printer	■ Check the box if printing to analog video printer.
Network/External Storage	■ Select **Storage** location from drop-down list.
Network/USB Printer	■ Select **Printer** from drop-down list.
Exam Export (on end exam)	■ Check the box and select **CartHD** to automatically export all exams to Cart's hard drive at end of exams. Exams are still saved directly to the scanner drive **SSD (C:)**. **NOTE:** If you check this box, you must also configure options on the **Archive Exam Export Options** screen (Figure 11-10).

Table 11-3. Image Store/Print Buttons Screen Parameters (Continued)

Parameter	Description
Image Transfer Mode	If **Image Transfer Mode** is configured, images are immediately stored to the internal storage media each time the **Store** (or **Print**, if configured) button is pressed. The timing for when the images are actually sent to the target printer or network storage device is user configurable. Options: ■ **Exam in Progress**: Immediately places each successive image into the queue (where network transfer will immediately begin) upon each press of the **Store** button by the user. ■ **End Exam**: Images in exam are temporarily buffered each time the user presses the **Store** button. Images are not placed into the queue, and no network transfer is initiated to the storage device until the user closes the current exam. This method allows the user to delete images from the **Current Exam** before the exam is transferred to the storage or print device.
Reports	■ If storing **DICOM structured reports** (page 13-14) or **User Customizable Worksheets/Reports** (page 9-7), select storage destination from drop-down list.

▶ *To Configure Store/Print Button*

NOTE: See also "Setting Up or Adding a Local (USB) Printer" on page 12-5 and "To Configure a DICOM Printer" on page 13-7 to set up your printer destination.

The System has a **Store** button and a **Print** button. The steps below describe configuring the **Print** button to print to a local printer. These are the same general instructions you would use to configure the **Store** button.

1. On the **Image Store/Print Buttons** screen, point the cursor over the checkbox next to **Network/USB Printer** under the **Print** heading. Press **Set** to check the box.
2. Move the cursor to the drop-down box to the right of **Network/USB Printer**.
3. Press **Set** to open the drop-down list of all configured printers. Options may include printing via a network connection to a DICOM printer and printing to a local dedicated printer (e.g., Sony UP-D897 Digital B/W USB 2.0 printer).
4. Select the printer you want and click **Apply**.
5. The System will now print to the selected printer when **Print** button is pressed.

NOTE: See Table 11-3 on page 11-6 for information on configuring **IQ Scan**, **3D Volume Data**, **Live Capture**, and **Still Image Type** options.

Still & Clip Image Store

The **Store** and/or **Print** buttons can be configured to send the currently displayed *still* image (single frame) or a sequence of live imaging frames (*clip* image store in live mode) to the internal hard drive.

Media Storage selections for each of the buttons is configured on the **Image Store/Print Button** screen (Figure 11-4).

▶ *To Store Single-Frame Image (SmartCart/SmartCart sp/Scan Engine)*

1. Press the **Freeze** button to freeze the image. Then press the appropriate **Store** button to store the image.

   Or

   While live imaging, press the **Store** button that has been configured for **Still** to store the **Still** image capture.

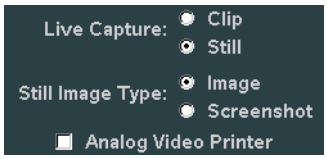


Figure 11-5. Image Store/Print Button Screen (detail) - Live Capture Still

2. The System beeps and displays the message **Saving to disk**, which disappears when the **Store** is complete.

NOTE: The **Store** and **Print** buttons may be configured to send images to DICOM network storage devices and DICOM printers in addition to local internal storage media. See Chapter 13 “DICOM and FTP Connectivity”.

▶ *To Store Clip Image (SmartCart/SmartCart sp/Scan Engine)*

NOTE: To set the duration when storing a **Clip**, press the **Protocol** button (**SmartCart**). For detailed information, see “Clip/Image Store (Protocol Button - SmartCart only)” on page 7-12.

1. Achieve the desired scanning view of patient anatomy and continue live scanning (do not press **Freeze** button).
2. Press **Store** button configured for **Clip** (see Figure 11-5) to begin capture (store) of clip image sequence.
3. The System beeps once to indicate storage has begun. A scrolling bar graph displays (lower right corner of Image) showing progress of store sequence. At end of store sequence, image will momentarily pause, and scrolling bar graph disappears, giving user visual feedback. After pause, System starts to write image data to internal hard drive. Another scrolling bar appears, and an icon indicating store is in progress  displays.
4. When storage is complete, System beeps again. The scrolling bar graph disappears from screen. An icon indicating store is complete  displays.

IQ Scan Data

The **IQ Scan** feature allows you to store raw source (prescan converted/ processed) ultrasound data to the internal storage and make retrospective adjustments to 2D, Color, and spectral Doppler. After these adjustments are made, you can restore the newly adjusted image.

However, due to the raw ultrasound data process involved in **IQ Scan** image capture, storage space on the internal archive will fill up more quickly and image store times may be noticeably longer.

IQ Scan data is not intended for permanent patient exam of record image archival. The normal exam of record comprises standard images, archived in DICOM format, that are maintained and supported for viewing across all software releases.

NOTE: Archived **IQ Scan** data images cannot be guaranteed to be compatible for importing back into the System due to potential compatibility conflicts of new software releases.

▶ *To Store IQ Scan Data*

Go to **Image Store/Print Button** screen (Figure 11-4) and check box for **IQ Scan Data** and/or **3D Volume Data**

SmartCart/SmartCart *sp*	Has one **Store** button and one **Print** button for storing **IQ Scan Data**
Scan Engine	Has one **Store** button and one **Print** button for storing **IQ Scan Data**

▶ *To Store 2D and Color Doppler Clips - IQ Scan*

Still Images

1. Freeze the 2D or Color Doppler image.
2. Press **Store** button associated with **IQ Scan**.

Clips

1. Freeze the 2D or Color Doppler image.
2. Press **Menu** button and activate **Cine**.
3. While in **Cine** playback, press the **Store** button. The length of the stored clip was defined when you configured **Clip Storage Duration** using the **Protocol** button (see “Clip/Image Store (Protocol Button - SmartCart only)” on page 7-12).

NOTE: If desired, trim the **Cine** before storing the clip.

4. Go into **Current Exam**, press **Menu,** and select **IQ Scan**. The **IQ Data** will load.
5. Press **Freeze** to run clip. Depending on the mode you are in, you can adjust various 2D, Color Doppler parameters while clip is playing back.

6. While **IQ Data** is playing back, you can store a clip with the new parameter settings.

NOTE: You can also **Freeze** the clip, scroll through the frames, make adjustments, and **Store** a single frame as a still image.

To Store Strip (PW or M-Mode) Mode - IQ Scan

1. To store strip mode (Spectral Doppler or M-Mode) into **IQ Scan Data,** freeze the desired strip and store with **Store** button associated with **IQ Scan**.

To Review Cine IQ Data: Strip (PW or M-Mode) or 2D Modes

1. Go to **Current Exam** (if exam has not been closed) or **Archive** and pull up the desired image with the small **IQ** below the number.
2. Press **Menu** and select **IQ Scan**. The **IQ Scan** data will load.
3. Press **Freeze** to play back an **IQ Scan** clip or an M-Mode or PW strip with audio. You can make adjustments to the images, including B-Mode, C-Mode, M-Mode, or PW Doppler strip modes at this time.
4. If reviewing through **Current Exam**, you can make adjustments and store another image or clip with new adjustments if desired.

NOTE: The **Auto-Dop Trace** function can be applied to a PW strip when it is being retrieved and reviewed from the **IQ Scan Data**.

3D/4D Volume Data

3D/4D Volume data can be stored and reopened to allow you to manipulate the data using **3D/4D** controls. The resulting images can then be stored as an image file in the patient's exam. The image number will also show **3D** beneath for quick identification.

To Open a Stored 3D/4D Volume Set

1. Press the **Current Exam** or **Archive** key (if exam has been ended).
2. Hover the arrow over the image with a **3D/4D Volume** set, then press **Set**. The image reformats to full size.
3. Press **Menu/Tab** button and then select **3D Volume**.
4. Volume data loads and 3D/4D softkeys appear for postacquisition processing.

To Configure Store Button for 3D/4D Volume Data

1. Go to:

SmartCart/ SmartCart *sp*	**Setup | System Setup | Archive | Store/Print**
Scan Engine	**Tools | System Setup | Archive | Store/Print**

2. The **Image Store/Print Buttons** screen displays (Figure 11-4).
3. Click the checkbox for **3D Volume Data**.

DICOM Transfer of Clip Image Stores

Store and **Print** buttons may be configured to send clip images to DICOM network storage devices. See Chapter 13 for detailed information on this procedure.

If the DICOM storage device (PACS system) at the installation site does *not* accept clip stores (accepts still images only), the system should be configured for **Still/ Single-Frame Image** in the **DICOM Network Storage Destination** screen (see Figure 13-12, page 13-10).

Keyboard Keys

SmartCart/ SmartCart *sp*

The **SmartCart/SmartCart *sp*** QWERTY keyboard includes keys for archive and review in addition to the standard alphanumeric keys. These controls are described in Table 3-2 on page 3-4.

Scan Engine

The Scan Engine Virtual Keyboard (**VKB**) includes some keys used for archive and review (see "Virtual Keyboard (VKB)" on page 5-2).

Current Exams: Review Procedures

▶ *To View Images in Current Exam: SmartCart/SmartCart sp*

1. Press the **Current Exam** key on the QWERTY keyboard.
2. Images for the in-progress exam will display, most recently stored image first.
   - The **SmartCart/SmartCart *sp*** displays up to 9 images at once (multi-image view).

NOTE: If no images have been stored for the exam, the System displays **Warning: No current exam data**.

- To view an image full size (full screen), use the **Trackball** to highlight the desired image by hovering the arrow over the desired image. The image will become framed in green. Press **Set** to view the image full size.
- To see the next image as full size, press the **Pg Fwd** key. To see the preceding image as full size, press the **Pg Back** key.
- To switch from full-screen image view back to multi-image view, press the **Set** again. **Set** toggles between full-screen single-image view and multi-image view.
- To view previous page of multi-image views, press **Pg Back** key or move **Trackball** to far left of display.
- To see next page(s) (if any) of multi-image views, press **Pg Fwd** or move **Trackball** to far right of display.
- To view first or last image in exam, press **First/Last** key as appropriate.
- To exit current exam review, press **Current Exam** key to return to live imaging.

  Or

- Press **Back** key twice. The first press displays **Current Exam** review menu; the second press returns to live imaging.

NOTE: See also "Clip/Cine Review (Frozen)" on page 7-12.

▶ *To View Images in Current Exam: Scan Engine*

Users can access archive and review functions via the **Tools** tab on the **Scan Engine** (Figure 11-6).

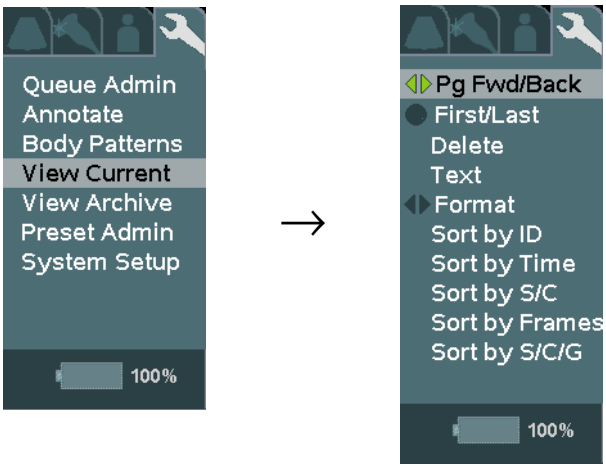


Figure 11-6. Scan Engine Tools Tab - View Current and Submenu

1. Using **Menu Control**, highlight the **View Current** item on the **Tools** tab and press the **Select** button.

NOTE: If no images have been stored for the current exam, the System displays **Warning: No current exam data**.

2. Images for the current exam display, most recently stored image first. The **Scan Engine** displays up to 4 images at a time (multi-image view).
3. To see subsequent multi-image view pages (if any), use **Menu Control** and left/right arrows to select **Pg Fwd/Back** on the menu (Figure 11-6). To view the previous page of multi-image views, select **Pg Fwd/Back**.
4. To view the first or last image in the exam, use **Menu Control** and arrows to select **First/Last** as appropriate.
5. To view an image full size (full screen), use **Menu Control** to navigate to **Current Exam**. Full size is the default for the **Scan Engine**.
6. To see the next image as full size, select **Pg Fwd/Back**.
7. To switch from full screen image view back to multi-image view, use **Menu Control** to highlight **Format**; then use the left/right arrow keys to switch back and forth between full screen single-image view and multi-image view.
8. To exit current exam review, press the **Back** button to return to live imaging.

   Or

   Use **Menu Control** to highlight **Exit** and press the **Select** button. The System returns to live imaging.

▶ *To Play a Clip Image From Review*

1. Use **Pg Fwd/Back** or **Trackball** to find the desired **Clip** (movie icon distinguishes image as a **Clip**).
2. Press **Freeze** to play the **Clip**. Press **Freeze** again to stop the **Clip**.
3. When **Clip** is frozen, use the **Trackball** to move through individual frames if desired.

Archived Exams: Review Procedures

The **Archive Exam Selection Table** (Figure 11-7) is a database of all exams stored on the System. In addition, you can view studies from the **SmartCart/ SmartCart *sp*** hard drive, CD/DVD drive, or an inserted USB drive. The default directory is the **Scan Engine**'s internal hard drive [**SSD (C:)**]. Use the pointer and **Trackball** to change the drive directory.

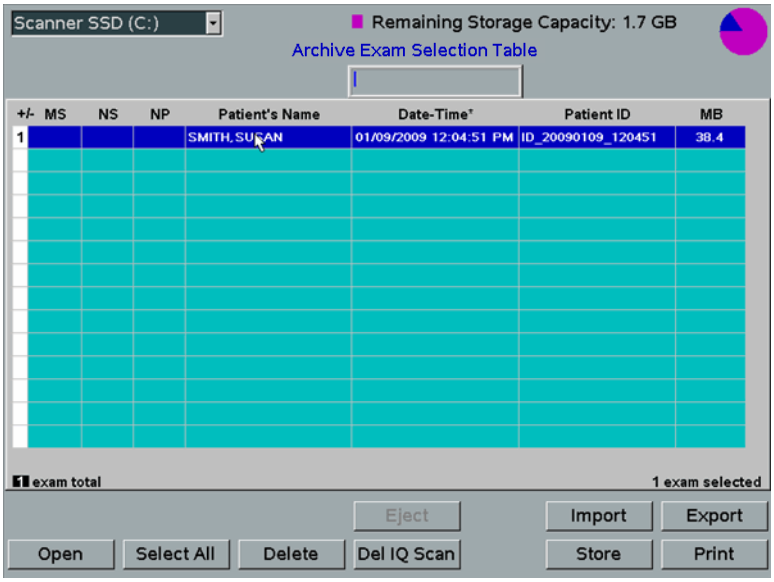


Figure 11-7. Archive Exam Selection Table

SmartCart/ SmartCart *sp*

▶ *To Set Up Archive Exam Selection Table*

1. Press **Archive** key. The **Archive Exam Selection Table** displays.
   - Exams display by **Date-Time**, with the most recent exam displayed first. Exams in the **Archive Exam Selection Table** can be sorted by **Patient Name**, **Date**, **ID**, or **Size** (in megabytes).

NOTE: If no exams have been archived, a message will display.

2. To define the **Archive Exam Selection Table** headings:
   a. Using the **Trackball**, move the pointer over the **+/-** heading.
   b. Press the **Set** button to bring up the **+/-** pull-down menu (Figure 11-8).

c. Place the pointer to the left of the desired parameter(s) on the pull-down menu, and press the **Set** button to check (select) or uncheck (un-select) each item as desired.

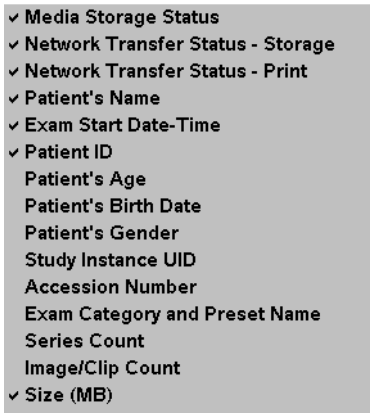


Figure 11-8. Archive Exam Selection Table Pull-Down Menu

3. To select a sort variable:
   a. Using the **Trackball**, move the pointer over the desired column heading.
   b. Press the **Set** button. The **Find** data field moves over the selected column and the column is noted by an asterisk. (The factory default is set on the **Date-Time** column, with the most recent exam at the top of the list.)
   c. To reverse the sort order within a column, click on the same column again.
4. Use the keyboard to enter data in the **Find** field.
5. As data is entered in the **Find** data field, the sort is refined.
   - For example, if the sort is by **Patient Name** and a **T** is entered in the **Find** data field, all names beginning with **T** will display. If an **H** is added, all names beginning with **TH** will be displayed.

NOTE: All of the columns cannot be displayed together. The default will always start with the left-most columns displayed. Use the horizontal scroll bar at the bottom of the window to slide the columns to the right to view the other columns.

▶ *To Open an Archived Exam for Review*

1. Using the **Trackball**, move pointer over desired exam in **Archive Exam Selection Table** and press **Set** button once. The exam is highlighted.
2. Press **Open** softkey. The images in the exam display.

   OR

   Using the **Trackball**, move pointer over desired exam in **Archive Exam Selection Table** and press **Set** button twice quickly (double-click). The images in exam display.
3. If the wrong exam is selected:

a. With the wrong exam still highlighted, move pointer over desired exam and press **Set** button to highlight exam.

b. Move pointer over wrong exam and press **Set** button. The highlighting is removed from wrong exam.

c. Press **Set** button to open desired exam and display its images.

NOTE: If more than one exam is selected (highlighted), you cannot open any images. De-select exam(s) until only one exam is highlighted, then proceed as indicated above.

▶ *To View Images in an Archived Exam*

The procedure for viewing images in an archived exam is the same as for viewing images in a current exam (see "Current Exams: Review Procedures" on page 11-12).

▶ *To Exit Archived Exam Review*

Press **Archive** or **Back** key. System returns to live imaging.

Scan Engine

▶ *To Set Up Archive Exam Selection Table*

The **Archive Exam Selection Table** is a database of all exams stored on the System.

1. From the **Tools** tab, use **Menu Control** to scroll to the **View Archive** item and press the **Select** button. The **Exam Selection Table** displays.
   - Exams display by **Date-Time**, with the most recent exam displayed first. Exams in the **Archive Exam Selection Table** can be sorted by **Patient Name**, **Date**, **ID**, or **Size** (in megabytes).

NOTE: If no exams have been archived, a message displays.

2. To select a sort variable:
   a. Using the **Trackball**, move the pointer over the desired column heading.
   b. Press the **Set** button. The **Find** data field moves over the selected column and the column is noted by an asterisk.
3. Use **Menu Control** to scroll to the keyboard menu item and press the **Select** button. The **VKB** (Virtual Keyboard) displays.
4. Use the stylus to press characters on the **VKB** for entry in the **Find** data field.
5. As data is entered in the **Find** data field, the sort is refined.
   - For example, if the sort is by **Patient Name** and a **T** is entered in the **Find** data field, all names beginning with **T** will display. If an **H** is added, all names beginning with **TH** will be displayed.

▶ *To Open Archived Exam for Review (Scan Engine)*

1. Using the **Trackball**, move the pointer over the desired exam in the **Archive Exam Selection Table** and press the **Set** button once. The exam is highlighted.
2. Press the **Set** button again. The images in the exam display.

3. If the wrong exam is selected:
   a. With the wrong exam still highlighted, move the pointer over the desired exam and press the **Set** button to highlight the desired exam.
   b. Move the pointer over the wrong exam and press the **Set** button. The highlighting is removed from the wrong exam.
   c. Press the **Set** button to open the desired exam and display its images.

▶ *To View Images in an Archived Exam*

The procedure for viewing images in an archived exam is the same as for viewing images in a current exam (see "Current Exams: Review Procedures" on page 11-12).

▶ *To Exit Archived Exam Review*

Press the **Back** key. This returns the System to live imaging.

Deleting Images and Exams

The user can delete images from current and archived exams. The procedure is the same for both. The user can delete a single exam, multiple exams, pages of exams, or all exams on the internal storage media.

WARNING: Once deleted, exams cannot be restored. Their data is lost.

SmartCart/ SmartCart *sp*

▶ *To Delete Images*

1. Enter current exam review or select and open an archived exam, as described earlier in this chapter.
2. To select an image for deletion in multi-image format, use the **Trackball** to move the pointer over the desired image to highlight it (framed in **green**).
3. Press the **Delete** key on the keyboard. A red **X** is drawn across the image.
4. Multiple images, up to the total number of images in the exam, can be tagged for deletion by repeating Steps 2 and 3.
5. To delete a full-size image, press the **Delete** key. A red **X** is drawn across the image.
6. Multiple full-size images can be tagged for deletion by using the **Pg Back** and **Pg Fwd** keys to select the desired images and then pressing the **Delete** key.
7. To untag an image for deletion, select an image with a red **X** through it and press the **Delete** key. The red **X** is removed.
8. To complete the delete operation, exit current exam review or archived image review as described earlier in this chapter.
9. A message requiring confirmation to delete the desired number of images displays.
10. Press the **Delete** key to answer **Yes**.

11. The images are deleted and the System returns to live imaging. If the user opens a current exam or archived exam for review again, the deleted images are replaced by other images in the exam so that there are no blank spaces.

To Delete Single or Multiple Exams

1. Press the **Archive** key on the keyboard to display the **Archive Exam Selection Table** (Figure 11-7).
2. Use the **Trackball** to move the pointer over the desired exam and press the **Set** button to highlight the exam. Click on as many exams as desired to delete them all at once. The exams selected for deletion will all be highlighted.
3. Move the pointer over the **Delete** softkey and press the **Set** button. The System displays a message requiring confirmation to delete the exam(s).
4. Press the **Select** button to answer **Yes**. The exam(s) is/are deleted and the **Archive Exam Selection Table** is refreshed to leave no blank rows.

To Delete All Exams (SmartCart/SmartCart sp)

1. Press the **Archive** key on the keyboard to display the **Archive Exam Selection Table** (Figure 11-7).
2. Use the **Trackball** (to move the pointer over the **Delete All** softkey and press the **Set** button.
3. All the exams on the **Archive Exam Selection Table** are highlighted and the System displays a message requiring confirmation to delete the exams.
4. Press the **Select** button to answer **Yes**. All exams are deleted, displaying a blank **Archive Exam Selection Table**.

NOTE: If you **Select** all the exams for deletion, you can de-select individual exams by clicking on them. Only exams that are highlighted will be deleted.

NOTE: You can also delete all exams by going to **Setup button | System Setup | Archive | Exam Mgmt**.

Scan Engine

To Delete Images

1. Enter current exam review or open an archived exam, as described earlier in this chapter.
2. Using Menu Control, find the desired image by using the **PgFwd/Back** key. Use **Menu Control** to scroll to **Delete** and press the **Select** button. A red **X** is drawn across the image.
3. Multiple images, up to the total number of images in the exam, can be tagged for deletion by repeating steps 2 and 3.
4. To delete images from the multi-image format, first use **Menu Control** to scroll to **Format** and press the **Select** button.
5. Use the **Trackball** to move the pointer over the desired image to highlight it (framed in **green**).
6. Select the **Delete** key. A red **X** is drawn across the image.

7. Multiple full-size images can be tagged for deletion by using the **Pg Back** and **Pg Fwd** keys to select the desired images and then selecting the **Delete** key.
8. To untag an image for deletion, select an image with a red **X** through it and use **Menu Control** to scroll to **Delete** and press the **Select** button. The red **X** is removed.
9. To complete the delete operation, exit current exam review or archived image review as described earlier in this chapter.
10. A message requiring confirmation to delete the desired number of images displays.
11. Press the **Select** button to answer **Yes**.
12. The images are deleted and the System returns to live imaging. If the user opens a current exam or archived exam for review again, the deleted images are replaced by other images in the exam so that there are no blank spaces.

▶ *To Delete Single or Multiple Exams*

1. From the **Tools** menu, use **Menu Control** to scroll to **View Archive** and press the **Select** button to display the **Archive Exam Selection Table** (Figure 11-7).
2. Use the **Trackball** to move the pointer over the desired exam and press the **Set** button to highlight the exam.
3. Use **Menu Control** to scroll to **Delete** and press the **Select** button.
4. The System displays a message requiring confirmation to delete the exam.
5. Press the **Select** button to answer **Yes**. The exam is deleted and the **Archive Exam Selection Table** is refreshed to leave no blank rows.
6. Multiple exams can be deleted by repeating step 2 until all the desired exams have been highlighted for deletion.
7. Use **Menu Control** to scroll to **Delete** and press the **Select** button.
8. The System displays a message requiring confirmation to delete the exams.
9. Press the **Select** button to answer **Yes**. The exams are deleted and the **Archive Exam Selection Table** is refreshed to leave no blank rows.

▶ *To Delete All Exams*

1. From the **Tools** menu, use **Menu Control** to scroll to **View Archive** and press the **Select** button to display the **Archive Exam Selection Table** (Figure 11-7).
2. Use **Menu Control** to scroll to **Select All** and press the **Select** button.
3. All the exams on the **Archive Exam Selection Table** are highlighted. Use **Menu Control** to scroll to **Delete** and press the **Select** button.
4. Press the **Select** button to answer **Yes**. All exams are deleted, displaying a blank **Archive Exam Selection Table**.

NOTE: You can also delete all exams by going to **Tools | System Setup | Archive | Exam Mgmt**.

Storing Archived Exams to DICOM Devices

SmartCart/SmartCart *sp* Systems can store archived exams to DICOM storage devices. This might be required if the **Scan Engine** has been used to perform exams while in standalone mode or if the DICOM network experienced connectivity problems. For more information on DICOM, see Chapter 13 “DICOM and FTP Connectivity”.

▶ *To Store Archived Exams to DICOM Storage Devices*

1. Press **Archive** key on the keyboard to display **Archive Exam Selection Table** (Figure 11-7).
2. Use **Trackball** to move pointer over desired exam and press **Set** button to highlight exam.
3. Move pointer over **Store** softkey and press **Set** button.
4. Verify that target destination network storage device is correct (select desired device if not currently selected).
5. Move pointer over **Store** softkey and press **Set** button.
6. The selected exam is stored to the DICOM storage device. This is done in the background, so the System can be operated normally while transfer is taking place.

Restarting an Exam

Any exam can be restarted based on how **Restart** is configured on the **Patient Exam Management** screen (Figure 11-19). Previous **Calc** data, demographic data, and images in the restarted exam are available as with a **New** exam. Any newly stored images, clips, and data are added to the restarted exam.

When the **Restart** period has ended, the exam directory is automatically archived. Image and data files in the directory are available from the archive, but no new images or data can be saved (added) to the exam directory.

▶ *To Restart an Exam (SmartCart/SmartCart sp)*

1. Press **New Patient** key to display **Patient Information** screen (Figure 7-1, page 7-1).
2. Use **Trackball** to move pointer over **Restart** softkey and press **Set** button.
3. A list of exams available for restart (similar to **Archive Exam Selection Table**) displays.
4. Place pointer over desired exam and press **Set** button to highlight exam.
5. Move pointer over **Select Exam** softkey and press **Set** button to open exam.

   OR

   Place pointer over desired exam and double-click **Set** button to open exam.

6. The **Patient Information** screen displays, populated with patient demographic data from restarted exam. User can continue exam as with a new exam.

NOTE: The default for **Restart** will place any additional images within the original series of images; this is the **Prior Series**. To place new, additional images within a **New Series**, see Figure 11-19, "Patient Exam Management Screen," on page 11-36.

▶ *To Restart an Exam (Scan Engine)*

1. Open **Patient Information** screen (Figure 7-1, page 7-1).
2. Use **Menu Control** to scroll to **Restart Exam** menu item and press **Select** button.
3. A list of exams available for restart (similar to **Archive Exam Selection Table)**, displays.
4. Follow Steps 4 - 6 as described above in "To Restart an Exam (SmartCart/SmartCart sp)" on page 11-20.

Annotations and Measurements

The user can enter annotations and perform measurements on current and restarted exams. For more information, see Chapter 8 "Annotations" and Chapter 9 "Measurements and Calculations".

Exporting Exams

Exam data (images) can be moved in/out of the ultrasound system using the **Import/Export** functions. Exam data can be exported from the **Scan Engine** hard drive [**SSD (C:)**] to the **SmartCart/SmartCart *sp*** hard drive (**CartHD**), FTP site, USB Memory Stick, or CD/DVD (**SmartCart/SmartCart *sp***) systems.

▶ *To Export Exams to Cart Hard Drive (CartHD)*

1. Press **Archive** key (**SmartCart/SmartCart sp**) or select **View Archive** on **Tools** tab (**Scan Engine**) to view **Archive Exam Selection Table** (Figure 11-7).
2. Move pointer over **Export** softkey and press **Set** button. The **Archive Exam Export** screen displays.

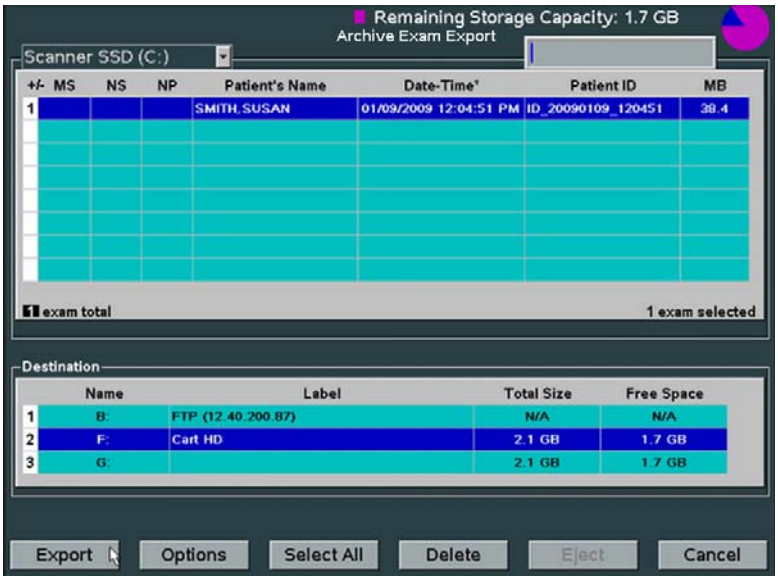


Figure 11-9. Archive Exam Export Screen

3. In **Destination** field, select **Cart HD** and press **Set** button.
4. In **Archive** field, select exam to export and press **Set** button.
5. Click **Export**.

NOTE: Multiple exams can be selected (highlighted) by using the same method. All exams can be selected (highlighted) by clicking on the **Select All** key. Once the exam(s) are selected, they can be "deselected" by clicking on them a second time.

6. A message appears when **Export** task is completed.
   - Selected exams on external USB Memory Stick can be deleted by highlighting them (with **Trackball** and **Set** button) and using **Delete** softkey on **Archive Exam Export** screen.

▶ *To Export Exams to FTP Site*

1. Follow the steps above "To Export Exams to Cart Hard Drive (CartHD)".
2. In **Destination** field, select **FTP [xx.xx.xxx.xx]** and press **Set** button.

NOTE: See "FTP Storage" on page 13-21 to set up an FTP location.

▶ *To Export Exams to USB Memory Stick*

1. Insert a USB Memory Stick into a USB port on the System.
2. Follow the steps above "To Export Exams to Cart Hard Drive (CartHD)".
3. In **Destination** field, select **USB [name]** and press **Set** button.

▶ *To Export Exams to SmartCart/SmartCart sp Built-in CD/DVD Drive*

IMPORTANT: You must install system software as described in "To Install System Software (SmartCart/SmartCart sp)" on page 14-16 for the Showcase® viewer to work properly.

1. Insert a blank disc into drive. Disc icon  will appear in upper left corner of imaging screen.

NOTE: Wide variability in CD and DVD quality may prevent the system from reliably writing to and reading from some commercially available discs. ZONARE has tested the CD and DVD in the table below and currently recommends their use. For up-to-date CD/DVD recommendations, go to: www.zonare.com/products/accessories.

Manufacturer	Part No.	Media	Capacity	Speed
CD-R				
Maxell	648200	100 Pack Spindle	700 MB	48X (Max)
DVD+R				
Taiyo Yuden	DVD+ZZ100SB16	YUDEN000T03	4.7 GB	16X (Max)

2. Follow the steps above "To Export Exams to Cart Hard Drive (CartHD)".
3. In **Destination** field, select **CD** or **DVD** and press **Set** button.
4. When export is complete, Click **OK**. The disc will automatically eject.

NOTE: You can also eject a disc by clicking **Eject** softkey on screen or by pressing and holding down **Record** button located on **SmartCart** Control Panel.

NOTE: During export procedure, the DICOM Showcase viewer is automatically written to the disc along with selected exams. See "Showcase® CD/DVD Viewer Basics" on page 11-27 for more information.

IMPORTANT: **Before deleting any Exam data from the Scan Engine or Cart hard drive, *always* verify that data was successfully transferred to the CD/DVD by viewing it on an external reader/player.**

Export Options

Users can customize the format of exam data that will be exported to USB Memory Stick or CD/DVD.

- This formatting includes compression type and color mapping method that can be set to match the requirements for the final usage of the image files (PC, PACS device, etc.).
- User can also remove embedded icon/thumbnail images from the exported exams.
- *HIPAA Feature*: Users can also remove the identity of patients and assign a unique patient identity or a common patient identity to individual or all exported exams.

NOTE: With this option, all proprietary patient identity information and/or data is removed from the exported images and cannot be recovered from the exported images.

- User can select to include a copy of a DICOM structured report (**SR**) data for exams that contain vascular/abdominal calc data.

To Customize Archive Exam Export Options

1. On **Archive Exam Export** screen (Figure 11-9), use **Trackball** and **Set** button to select **Options** softkey.
2. The **Archive Exam Export Options** screen displays.

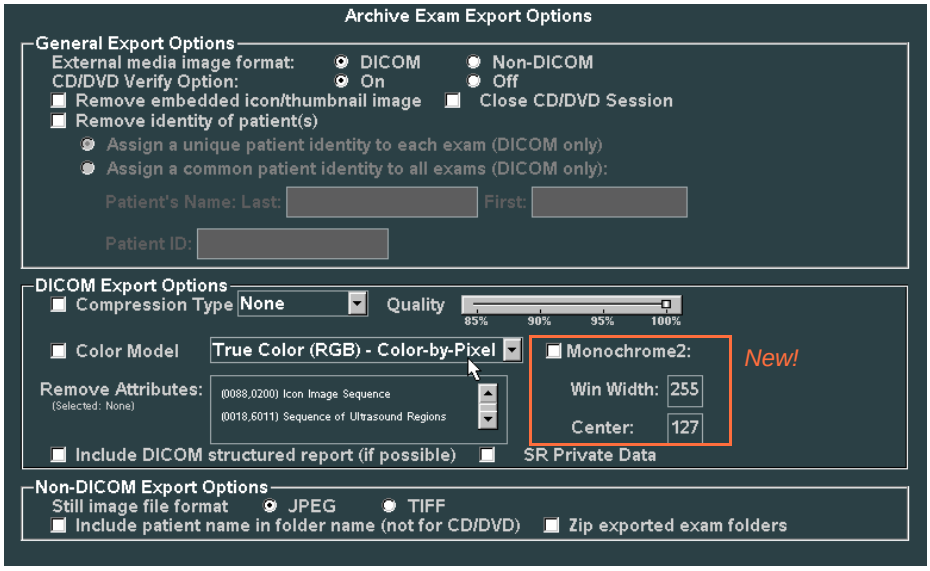


Figure 11-10. Archive Exam Export Options Screen

3. Use **Trackball** and **Set** button to make desired selections on **Archive Exam Export Options** screen. Then select **Apply** to save the new settings.

NOTE: Changes made to **Export Options** on this screen will apply to future exams. For example, if **Non-DICOM** is selected, future exams will export to external media as **Non-DICOM** formats until **DICOM** is re-selected on this screen.

Table 11-4. Archive Exam Export Options

Parameter	Description
General Export Options	
External media image format	■ **DICOM** or **Non-DICOM** Select desired format.
CD/DVD Verify Option	■ **On** or **Off** When **On** is selected (default), system will try to verify that exam data was properly exported to disc by comparing checksums for the raw data. This is done at end of the export and will increase time required to export data.
Remove embedded icon/thumbnail image	■ Check if desired.
Close CD/DVD Session	■ CD/DVD export: Click to close session after export.

Table 11-4. Archive Exam Export Options (Continued)

Parameter	Description
Remove identity of patient(s)	■ To remove the identity of patient(s), check the box next to **Remove identity of patient(s)**. When this option is selected and the patient identity is removed from the exported image, the patient identity cannot be restored in the exported image. By default, the identify of the patient is not removed from the exported images. ■ When the option to remove the patient identity is selected for exported images, then an option is available to **Assign a unique patient identity to each exam**. This option is only available for DICOM-format exports. ■ When the option to remove the patient identity is selected, then an option is available to **Assign a common patient identity to all exams**. This option is only available for DICOM-format exports. ■ If the option to **Assign a common patient identity to all exams** is selected, enter the patient's **Last Name**, **First Name**, and **Patient ID**. These entries will be associated with all exported DICOM-format exams. ■ See **NOTE** below table.
DICOM Export Options	
Compression Type	■ Check box. Then select desired compression type from drop-down box (see "Compression Settings" on page 11-3).
Color Model	■ To change **Color Model**, check box. Then select desired type from drop-down box: choices are True Color (RGB) - Color-by-Pixel; Color (RGB) - Color-by-Plane; Grayscale (MONOCHROME2.
Monochrome2	■ If you select **Grayscale (MONOCHROME2)**, you may need to check the **Monochrome2:** box and change the values to accommodate your DICOM system. You can change the values for **Win Width** and **Center**, though not advised. The defaults are **Width 255** and **Center 127**. *This option is not needed for typical system usage.*
Remove Attributes	■ If images do appear as expected after export, removing attributes for exports may correct the problem. *This occurs rarely.*
Include DICOM structured report (if possible)	■ Check to export DICOM structured reports; see "DICOM Structured Reports" on page 13-14 for more information.

Table 11-4. Archive Exam Export Options (Continued)

Parameter	Description
SR Private Data	■ Default is unchecked. For most users, this is the correct setting. If checked, raw calculation data in XML format is appended to structured report files, increasing file size and requiring more system memory. See "User Customizable Worksheets" on page 9-7.
Non-DICOM Export Options	
Still image file format	■ Select **JPEG** or **TIFF**
Include patient name in export folder name (not for CD/DVD)	■ Check if desired
Zip exported exam folders	■ Check if desired

4. Click **Apply** to save settings.

NOTE: When the patient identity is removed from exported exams or reassigned using the options above, the original patient information is deleted from the exported images and cannot be restored from those exported images. When the option to remove the patient identity is selected and the user presses the **Export** button to begin the export operation, a warning dialog is displayed with the message **The identity of all patients for the selected exams will be removed. Proceed?** If **Yes** is selected, the export operation is initiated, and the images are exported without the original patient information. If **No** is selected, the export operation is not performed.

NOTE: You cannot remove patient identity when exporting to **CartHD**.

IMPORTANT: Before deleting any Exam data from the Scan Engine or Cart hard drive, always verify that image data was successfully transferred to the CD/DVD by viewing it on an external reader/player.

Key Images

You can select individual images from within an exam to **Export** to a drive without exporting the entire set of images.

1. Go to **Archive** and open desired exam.
2. Use **Trackball** to hover over image you want to export. Image will be highlighted in **GREEN**.
3. Press **Enter** button. Key icon will appear on selected image.

Figure 11-11. Key Icon

4. Repeat until you marked all desired images for exporting.
5. To de-select a keyed image, place arrow over image again, and press **Enter** (or **Enter/Select**) again. Key icon will disappear.
6. When finished, press **Archive**. A message appears asking for confirmation.

7. Select **Yes** if you want only keyed images to export.
8. Use **Export** feature as described above. Only selected images (with Key icons) will export to the archive media.

Showcase® CD/DVD Viewer Basics

During the export procedure, the DICOM Showcase viewer is automatically written to the disc along with the selected exams. Showcase allows you to review the images on any PC with a CD/DVD drive (see "PC Requirements" below) that can read **CD-R** or **DVD+R** discs.

NOTE: Read the Showcase documentation that comes on the export CD/DVD for the latest instructions to use the Showcase viewer.

When the CD/DVD containing the exported studies is inserted into a PC, the ShowCase viewer *automatically* runs directly from the CD/DVD. No DICOM viewing software on the PC is required to view the studies. Currently, the user interface is in English only.

Using the Showcase viewer, you can **Export** (save) still images into JPG, TIFF, or BMP formats and clips into AVI formats. You can also send **Print** requests, crop off the patient's name, and **Annotate** the images before you **Export** or **Print**.

IMPORTANT: Multiframe images captured on the ZONARE ultrasound system require the latest version of ShowCase, which is included with the release. Multiframe clips are optimized and include a couple of private tags that are valid DICOM tags but may not be handled correctly on all systems. Versions of ShowCase prior to release 5.2.3 are unable to display the clips.

Other features:

- Study directory that shows all studies residing on the CD/DVD listed by patient name, ID, study type, and number of images
- Selectable image sizes-- thumbnail to full screen
- Contrast / gamma control
- Study comparisons: right/left or top/bottom
- Stress echo displays by stage and by view
- Drag & drop rearrangement of images while viewing (cannot save)
- Temporary cropping and annotating of images (can save to disc)
- Display of an image's DICOM elements
- Viewing of Calc / Structured Report data, if applicable

PC Requirements

Windows operating system is required (2000, XP, Vista). A minimum of 512 MB of free memory and 512 MB of free disk space is necessary for viewing studies. 1 GB of memory and disk space is preferred for Cardiology customers. The viewing monitor must support 24- or 32-bit color. The PC must be able to read **CD-R** or **CD-RW** discs.

▶ *To View Studies on Exported CD/DVD*

1. Insert the disc into the appropriate drive on your PC. The **Zonare DICOM Viewer** (Showcase) will *automatically* load and display the **Directories** screen on your PC monitor.

NOTE: For first-time users, select the **Help** tab and read the contents of the **Help** file. The viewer is simple to use and the **Help** file is not long. You may want to print each page for future reference.

2. The **Directories** screen (below) shows all the studies on the CD/DVD. To view a study, highlight it (single-click) with the mouse and then click the **Show** button at the bottom of the screen.

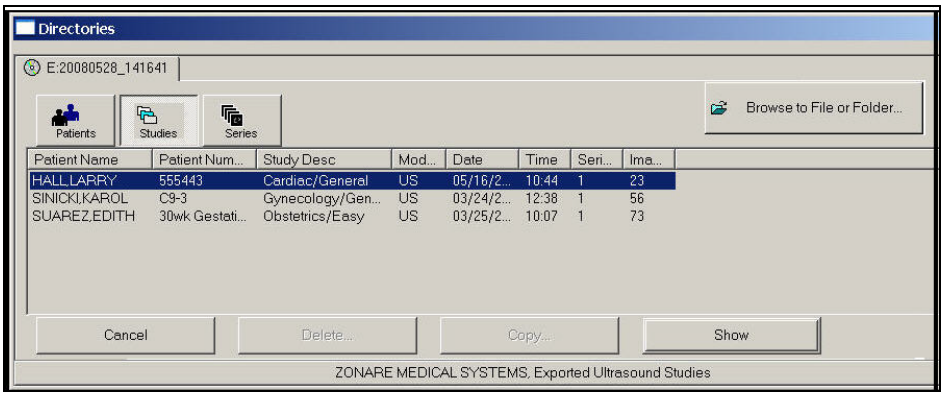


Figure 11-12. Directories Screen

3. The selected study will display on the **Series** screen (Figure 11-13).

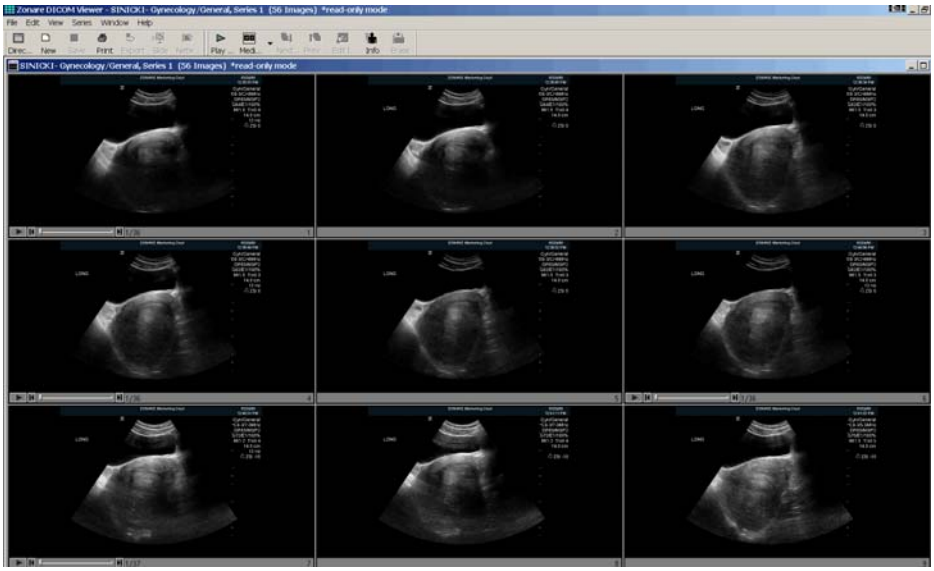


Figure 11-13. Display of Images/Clips from a Study (Series Screen)

Basic Navigation of the Series Screen

- To select an image or clip, click it once with the mouse. The selection will be outlined in yellow.
- To play a clip, right-click on the clip. To stop play, right-click again.

- To view an image or clip in larger format, double-click it. An enlarged image appears that can be annotated and exported/saved to your PC (see "Enlarged Image/Clip Screen" on page 11-31 for more information).

Table 11-5. Showcase Series Screen - Navigation

Button/Key	Description
NOTE: You are using a customized version of the Showcase software. Features that are not available are disabled (grayed out). The buttons below are all fully operable with your Showcase Viewer.	
	■ Click to display the **Directories** screen (Figure 11-12).
	■ Click to open a study on your PC that is not on the current CD/DVD.
	■ Click to print image/clip on your printer.
	■ After you have selected an image/clip, click to save it to your PC. Save options: Bitmap, TIFF, JPEG for stills; AVI for clips.
	■ Click to play all clips in series. Click again to stop play.
	■ Click the arrow to change the size of images/clips in the Series window (Figure 11-13). Options: 
	■ Click **Prev** to view the previous study you have open and were viewing. ■ Click **Next** to view the next open study.
	■ Highlight an image/clip, then click this button to view an enlarged version as shown in Figure 11-14.

Table 11-5. Showcase Series Screen - Navigation (Continued)

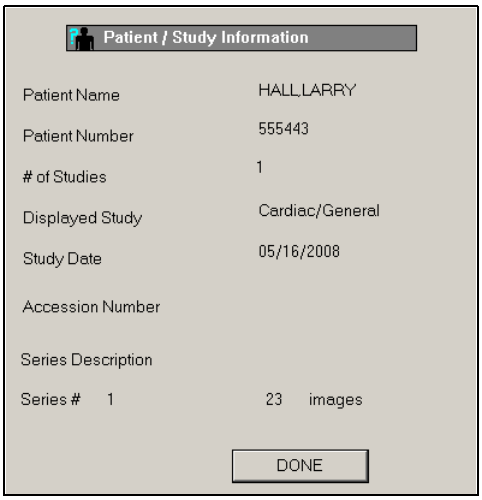
Button/Key	Description
	■ Click to display the **Patient/Study Information** screen: 
Clip Slider	■ When a clip is stopped, you can use the slider to position the clip to a specific frame:  ■ When a clip is playing, the up and down arrows on the slider will speed and slow the clip: 
Scroll Wheel	■ If you have a scroll wheel on your mouse, it can be used to scroll through the images in a series, or through entries in a long directory
Right-click	■ Start/stop a clip playback
Double-click	■ Open **Enlarged Image/Clip Window** to show image full size and access tools to modify image (contrast, annotation, margins, speed)
Ctrl-A	■ Select **All** images
Ctrl-O	■ Open **Directories** screen to select a new study
Ctrl-P	■ Print the current series of images
F1	■ Show the **Help Dialog**
F7	■ Move to the next image size (cycles thru all sizes)
F9	■ Toggle to/from “one-up auto-play”
Pg Up	■ Move to the next screen full of images
Pg Down	■ Move to the previous screen full of images

Table 11-5. Showcase Series Screen - Navigation (Continued)	
Button/Key	**Description**
Home	■ Move to the first image in the set
End	■ Move to the last image in the set
↑ (up arrow)	■ Move up one row of images
↓ (down arrow)	■ Move down one row of images
Alt-FX	■ Exit

Enlarged Image/Clip Screen

Images/clips can be adjusted (contrast/brightness), annotated, and exported/saved to your PC via the **Enlarged Image/Clip** screen.

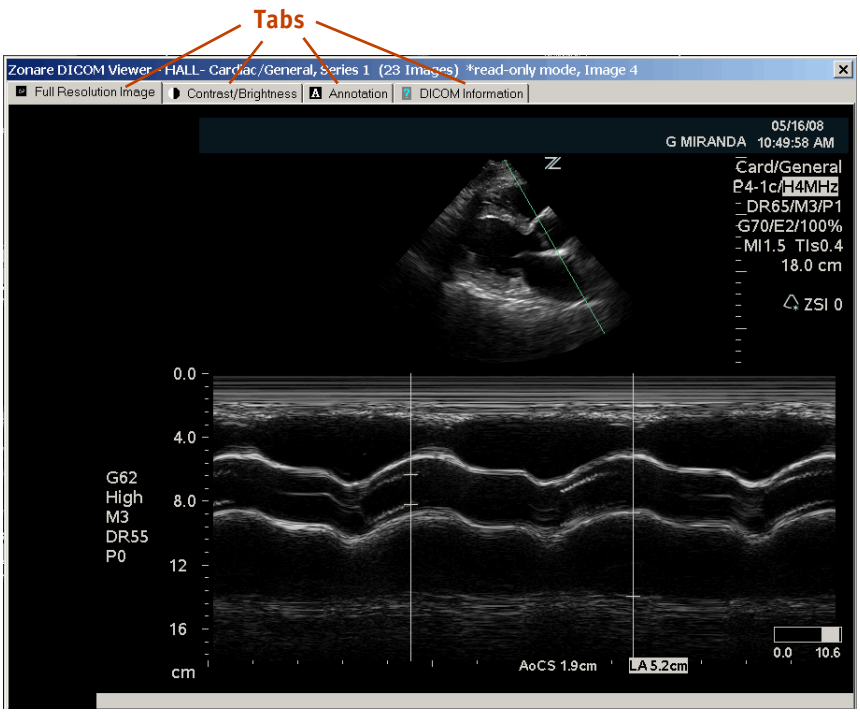
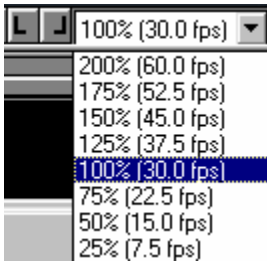


Figure 11-14. Enlarged Image/Clip Screen

Table 11-6. Showcase Image/Clip Screen - Navigation	
Tab/Control	**Description**
NOTE: You are using a customized version of the Showcase software. Features that are not available are disabled (grayed out). The buttons below are all fully operable with your Showcase Viewer.	

Table 11-6. Showcase Image/Clip Screen - Navigation (Continued)

Tab/Control	Description
Full Resolution Image	Click to view the full-resolution image.
Contrast/Brightness	Click to adjust contrast/brightness.
Annotation	Click to annotate the image with text and arrows; crop; set playback speed; save annotated images in Bitmap, TIFF, JPEG, or AVI (clips) formats on your PC (see also "AVI Compression" on page 11-32).
DICOM Information	Click to View DICOM information for the study.
Clip Slider	■ To reset the frame rate, click the arrow in the lower right corner of the screen to show the frames-per-second drop-down box: 

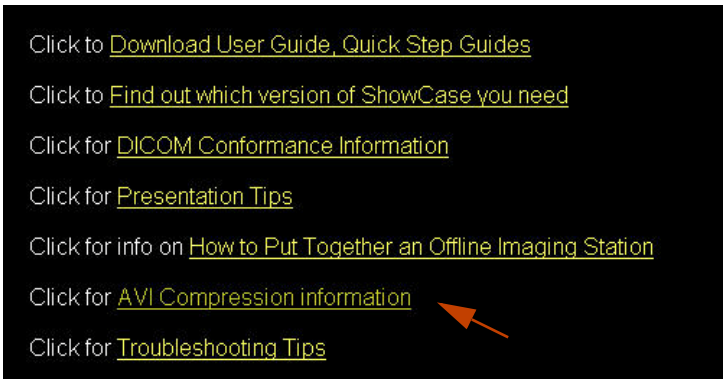
AVI Compression

AVI files are extremely large when uncompressed, so you want to compress clips when you export them to AVI format.

Each computer can have a different selection of AVI compressors available. ShowCase® does not install these AVI compressors on your machine. They come with your operating system or sometimes with other media software you may have installed.

ShowCase provides a drop-down box (see Figure 11-17) showing all compression options resident on your machine and allows you to chose which to use.

NOTE: Before selecting a compression option, you should go to www.triltech.com/customerinfo.htm and read the **AVI Compression Information** file:



To Export Clips and Set AVI Compression

1. View the study in the **Series** window.
2. Highlight the selected clip and click Export. The **Export Images** screen displays.

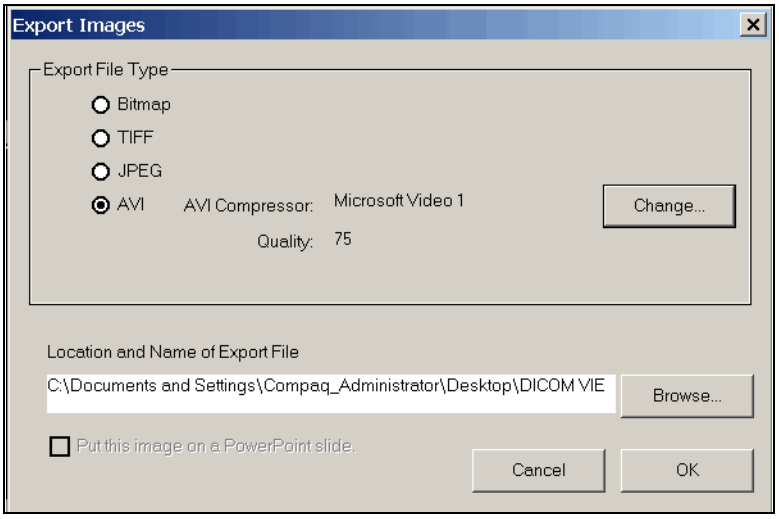


Figure 11-15. Export Images Screen

3. Select **AVI** and then click **Change** button. The **Choose Compressor** screen will display.

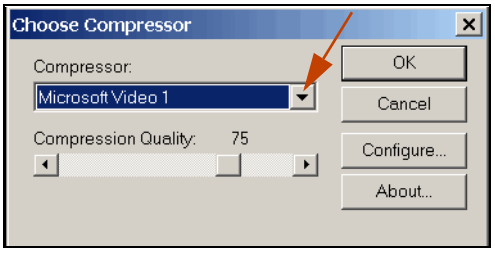


Figure 11-16. Choose Compressor Screen

4. To view a list of **AVI Compressors** available on your PC, click the arrow shown in Figure 11-16. The drop-down box (Figure 11-17) will display your choices.

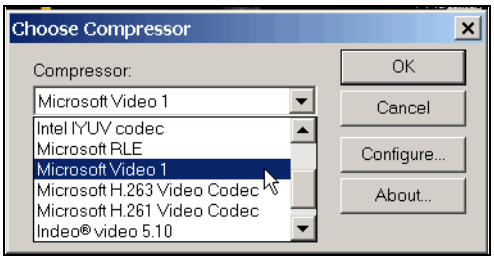


Figure 11-17. Compressor Options Drop-Down Box

5. To set **Compression Quality** (Figure 11-16), click the arrows to increase/ decrease quality.

NOTE: The default is **75%**. The higher the number, the better the resolution but the larger the file. If the compressor is set to **0%**, the size of the file is smaller but resolution is degraded.

If you have further questions about the ShowCase Viewer, you can email TrilliumTechnology at support@TrilTech.com.

Importing Exams

NOTE: You cannot import exams from an FTP site. To export exams to an FTP site, see page 11-22.

▶ *To Import Exams from USB Memory Stick*

NOTE: For DICOM exams only. You cannot import non-**DICOM** exams.

1. Insert a USB Memory Stick into a USB port on the System.
2. Press **Archive** key (**SmartCart/SmartCart sp**) or select **View Archive** on **Scan Engine Tools** tab to view **Archive Exam Selection Table** (Figure 11-7, page 11-14).
3. Use **Trackball** to move pointer over **Import** softkey and press **Set** button. **Archive Exam Import** screen displays.

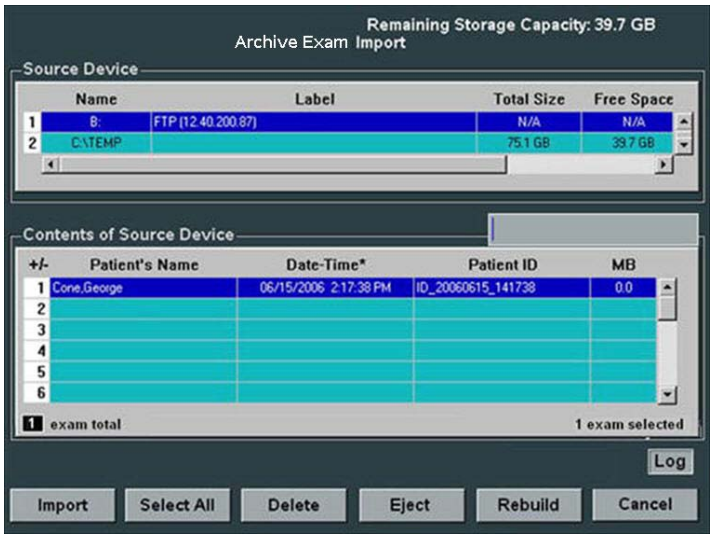


Figure 11-18. Archive Exam Import Screen

4. Use **Trackball** and **Set** button to highlight desired source device (USB Memory Stick) in **Source Device** table.
5. The contents (exams) of the selected source device will populate in **Contents of Source Device** list.
6. Use **Trackball** and **Set** button to highlight exam(s) on **Contents of Source Device** to be imported from USB Memory Stick.

NOTE: Multiple exams can be selected (highlighted) by using the same method. All exams can be selected (highlighted) by clicking on **Select All** key. Once exam(s) are selected, they can be "unselected" by clicking on them a second time.

7. Use **Trackball** and **Set** button to select **Import** softkey to initiate download (import) of selected exam(s) to internal storage media archive.
8. A message appears when **Import** task is completed.
9. Imported exams can now be reviewed via the **Archive** menu.

NOTE: You can **Import** exams from all active directories attached to the System, e.g., **SmartCart/SmartCart *sp*** hard drive, CD/DVD drive, USB drives, and FTP. Select the appropriate drives from the **Export/Import** windows using **Trackball** and **Set** button.

▶ *To Import Exams from SmartCart/SmartCart sp CD/DVD Drive*

IMPORTANT: You must install system software as described in "To Install System Software (SmartCart/SmartCart sp)" on page 14-16 for the Showcase™ viewer program to work properly and/or to be exported to CD/DVD.

1. Insert the CD/DVD disc into the CD/DVD drive. A disk icon will appear in the icon list.
2. Follow the same **Import** functions as described above, but **Select** the **CD/DVD** drive as the **Source Device**.

Patient Exam Management Screen

On the **Patient Exam Management** screen, users can perform tasks such as configuring exam restart options, rebuilding patient exam databases, erasing all patient data, and formatting storage media data.

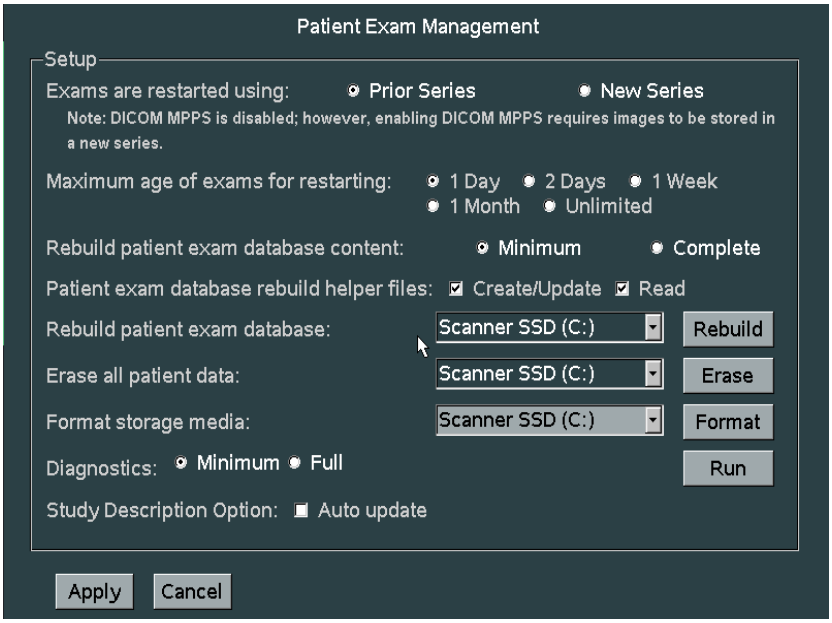


Figure 11-19. Patient Exam Management Screen

▶ *To Access the Patient Exam Management Screen*

1. Go to **Setup | System Setup | Archive | Exam Mgmt**. The **Patient Exam Management** screen displays.
2. Select your choice for restarting exams. Then click **Apply**.

NOTE: Set the **Restart** age to **Unlimited** (Figure 11-19) to restart exams without restriction.

Table 11-7. Patient Exam Management Parameters

Parameters	Description
Exams are restarted using:	■ Select **Prior Series** or **New Series**. See "To Restart an Exam (SmartCart/SmartCart sp)" on page 11-20.
Maximum age of exams for restarting:	Select your choice for restarting exams. **NOTE:** Set **Restart** age to **Unlimited** to restart exams without restriction.
Rebuild patient exam database content:	■ Only applies to patient exams on **Scanner SSD** or **Cart HD**. ■ Select **Minimum** to significantly reduce the amount of time and system resources needed to rebuild a large patient exam. **Minimum** is the default.

Table 11-7. Patient Exam Management Parameters (Continued)

Parameters	Description
Patient exam database rebuild helper files	■ Only applies to patient exams on **Scanner SSD** or **Cart HD**. ■ Helper files are small files that maintain summary information about the most recent activity for an exam. There is at most one helper file (e.g., exam summary file) per exam. ■ The creation and updating of helper files are a performance optimization that can significantly reduce the amount of time and system resources needed to rebuild a large patient exam database. ■ When the **Create/Update** option is selected, the rebuild operation will create helper files for exams that do not currently have one. Also, when this option is selected, the helper file is updated for an exam in progress when there is exam activity to be recorded (e.g. demographics updates or image/clip stores). ■ When the **Read** option is selected, the rebuild operation attempts to open and read the helper files for each exam. ■ The default has both these options selected.
Rebuild patient exam database:	■ If desired, click the **Rebuild** softkey on the screen to repair corrupted patient databases. First select the database to rebuild in the drop-down box next to the softkey. The System asks you to confirm before proceeding with the rebuild.
Erase all patient data:	■ Click the **Erase** softkey to delete all patient studies from a directory. First select the directory in the drop-down box next to the softkey. The System asks you to confirm before erasing the data.
Format storage media:	■ Click the **Format** softkey to format media, such as a USB memory stick, for use with the ultrasound system. First select the media in the drop-down box next to the softkey. The System asks you to confirm before formatting the selected media. **NOTE:** Formatting will erase all the files on the media. Be sure to back up important files before using this function.
Diagnostics:	■ Verifies newly formatted media after you press **Format** softkey (see above). **Minimum** (default) significantly reduces time and system resources needed to verify formatted media. **Run** softkey to initiate.

Table 11-7. Patient Exam Management Parameters (Continued)

Parameters	Description
Study description option:	■ Box for **Auto Option** is *not* checked (the default): Enables User to enter text into the **Study Description** field on the **Patient Information** screen (Figure 7-1, page 7-1). ■ Box for **Auto Option** is checked: System automatically populates the **Study Description** field with the **Exam Type**. User cannot enter text in this field when box is checked.

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Emergency System Backup

To export all internally stored patient exam archive to a USB Memory Stick because the System is not able to get to the normal **Archive** menu (System problem), the following procedure can be used.

▶ *To Backup System Data to USB Memory Stick*

1. Remove the **Scan Engine** from its docking location and open up the LCD Display for viewing.
2. Ensure the **Scan Engine** is initially powered off.
3. Insert a USB Memory Stick into a USB port on the **Scan Engine**.
4. Press the **Scan Engine** power button. As soon as you see the ZONARE splash screen appear on the display (approximately 4 seconds), press the **Back** button on the **Scan Engine**. This performs a *user-break* of the normal boot-up sequence.
5. The **User Break** screen displays. Press the **F1** button on the **Scan Engine** to initiate the **Backup of System Data** (contents of internal storage media) to the USB Memory Stick.

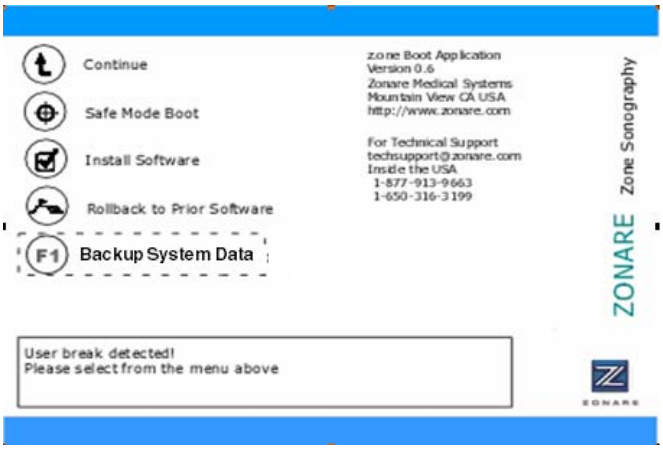

Figure 11-20. User Break Screen

12

Printers and Peripherals

NOTE: For information and pricing on ZONARE system upgrades & features, transducers, accessories, and peripherals, please call 1-877-966-2731, ext. 3.

This chapter provides basic operating instructions for use of peripheral devices that are sold by ZONARE (as an option) for use on the following systems:

SmartCart/SmartCart *sp*	• AVED - Audio Video Extension Device • Sony UP-D897 Digital (USB 2.0) Black & White Printer • Sony UP-D25MD Digital (USB 2.0) Color Printer

WARNING: Peripheral devices not sold and/or authorized by ZONARE for use on these systems should not be used. ZONARE is not responsible for any problems or damage that may result from connection of unauthorized devices.

AVED - Audio-Video Extension Device

ZONARE offers an optional Audio-Video Extension Device (AVED) box that can be connected remotely to the rear panel of the **SmartCart/SmartCart *sp***. This device enables the **SmartCart/SmartCart *sp*** to produce an extended range of video and audio output formats (primarily analog) to support connection to additional peripheral devices.

NOTE: Be sure to connect the AVED box to the **SmartCart/SmartCart *sp*** *before* powering on the ultrasound system. If not, the AVED box will not work.

Refer to the AVED manual for additional information about its use.

Follow guidelines provided by IEC 60601 when connecting peripherals (e.g., VCR).

Figure 12-1. AVED (Audio-Video Extension Device)

The AVED box receives its input via a remotely connected cable at the HDMI port on the rear of the **SmartCart/SmartCart *sp***. AVED converts the digital video and audio information from the **SmartCart/SmartCart *sp*** into a variety of analog video formats. The I/O ports and their functions on the AVED are listed in Table 12-1.

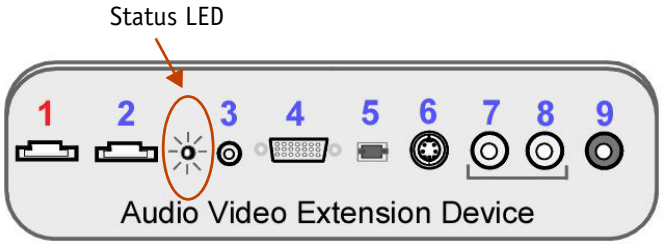

Figure 12-2. AVED I/O Panel

Table 12-1. AVED I/O Connectors

#	Function	Direction
1	DVI Digital Video/Audio (using HDMI connector)	Input
2	DVI Digital Video (using HDMI Connector)	Output
3	Remote Print Trigger - 3.5 mm (0 to +5V Digital)	Output
4	VGA Video (Analog)	Output
5	TOS LINK Audio (Digital)	Output
6	S-Video (Analog)	Output
7	Audio Out - Right (Analog)	Output
8	Audio Out - Left (Analog)	Output
9	Composite Video (Analog)	Output

Status LED

The status LED (Figure 12-2) displays the current status of I/O activities as follows:

Blinking Pattern	I/O Status
Three short blinks of LED followed by one long Off of LED; pattern repeats	HDMI IN connected but box “Idle” (no out)
One long blink of LED followed by one long Off of LED; pattern repeats	AVED initialized; video active but audio not
LED remains constantly On	Coded audio detected; video and audio active

AVED Video Output

Video output is as follows:

- NTSC Output: Horizontal frequency = 15.733 KHz
Vertical frequency = 59.94 Hz
- PAL Output: Horizontal frequency = 15.625 KHz
Vertical frequency = 50.0 Hz

Microphone Recording

Voice audio can be captured from the **SmartCart/SmartCart sp**’s microphone and sent out over the audio channels of the AVED box. This can be used for recording voice audio to a VCR device connected to the AVED. To use the microphone you must first configure a **Function Key** for that purpose.

▶ ***To Set Up Function Key for Microphone Use***

1. Go to **Setup | System Setup | Keys** to access the **Function Key Assignments** screen (Figure 7-7 on page 7-10).
2. Select the desired **Function Key** (**F1**–**F4**); then select **Microphone** from the drop-down list. Click **Apply** to save.
3. Once configured, the **Function Key** toggles microphone use ON and OFF.

Sony UP-D897 Digital (USB 2.0) B&W Printer

Figure 12-3. Sony UP-D897 B&W USB Printer

The following section assumes that the Sony UP-D897 B&W USB Printer has already been mounted on the **SmartCart/SmartCart *sp*** and properly connected to the System.

- For information on installation/hook-up, see the ***Proc, Installation, Sony UP-D897 B&W USB Printer*** (ZONARE P/N: S00075-00) document provided in the installation kit shipped from ZONARE with each printer. This information is also provided in the **z.one *ultra*** Service Manual.
- For detailed information on proper operation of this device, see the **SONY UP-D897 Operators Manual.**

▶ *To Operate*

1. Power on the **SmartCart/SmartCart *sp*** and allow it to fully boot.
2. Open the front door of the unit and install the film pack.
3. Power on the printer by pressing the ON button on the printer's front panel.
4. Acquire the desired ultrasound image on the system.
5. Press the **Freeze** button.
6. Depending on the **Store**/**Print** button configuration, press the appropriate button (**Store1, Store2,** or **Print** on the **SmartCart/SmartCart *sp***) to trigger a print of the current onscreen image to the Sony UP-D897 printer.

NOTE: If the **Print**/**Store** configuration is set up in **Exam Completed** mode (see "To Configure Image Transfer Mode" on page 13-20), it will be necessary to press **End Exam** before the printed image(s) will be placed in the print queue and sent to the printer.

Sony UP-D25MD Digital (USB) Color Printer

Figure 12-4. Sony UP-D25MD Digital (USB 2.0) Color Printer

- For information on installing and configuring this printer, see the **Procedure, Install (Unmounted), SONY UP-D25MD Color Printer** (ZONARE P/N: S00119A) document provided in the installation kit shipped from ZONARE with each printer. This information is also provided in the **z.one *ultra*** Service Manual.
- For detailed information on proper operation of this device, see the **SONY UP-D25MD Operators Manual.**

NOTE: Due to its physical size, the Sony UP-D25MD printer is not mountable within the chassis of the **SmartCart/SmartCart *sp***. The printer requires only a power and USB cable (no mounting hardware).

▶ *To Set Up*

1. Attach AC power cable and USB print cable to the back of the UP-D25MD printer.
2. Connect AC power cable to an open receptacle in the room.
3. Connect the USB data cable between the USB port on the Sony UP-D25MD printer and any of the USB ports at the rear of the **SmartCart/SmartCart *sp***.

▶ *To Operate*

1. Power on Sony UP-D25MD color printer.
2. Power on **SmartCart/SmartCart *sp***.
3. Acquire desired ultrasound image on the system.
4. Press **Freeze** button.
5. Depending upon **Store/Print** button configuration, press appropriate button (**Store1** or **Print**) to trigger a print of the current onscreen image to the Sony UP-D25MD color printer. (See "Setting Up or Adding a Local (USB) Printer" below.)

NOTE: If the **Store/Print** button configuration page is setup in **Exam Completed** mode (see "To Configure Store/Print Button" on page 11-8), you must press the **End Exam** key to complete the current study before the printed image(s) will be sent to the Sony UP-D25MD printer.

Setting Up or Adding a Local (USB) Printer

▶ *To Set Up or Add a Local USB Printer*

1. Access the **Printer** screen:

   Setup | System Setup | Archive | DICOM | Printers | New

2. The **Printer** screen displays.

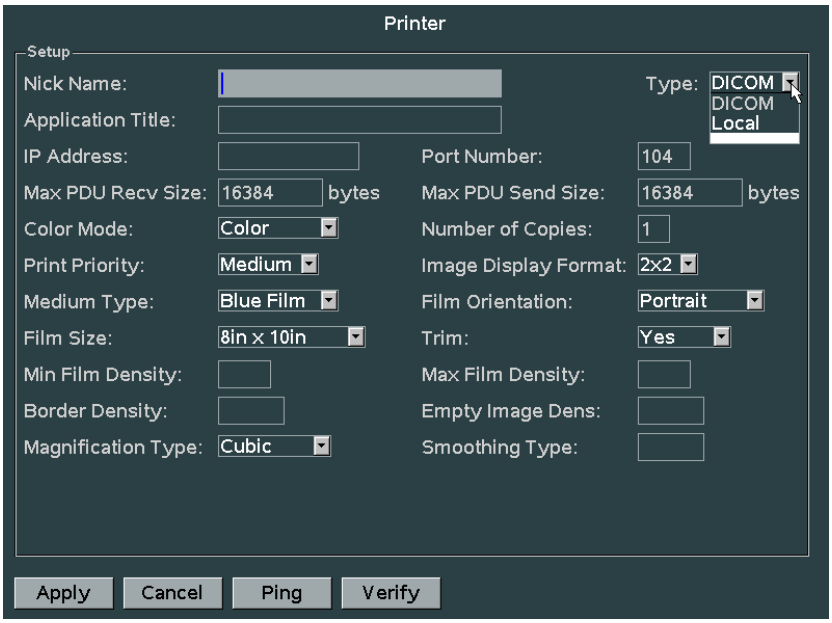

Figure 12-5. Printer Screen

3. Using the pull-down menu under the **Type** selection, select **Local/USB** and press the **Set** button.
4. The menu will change to the setup page for a USB printer.

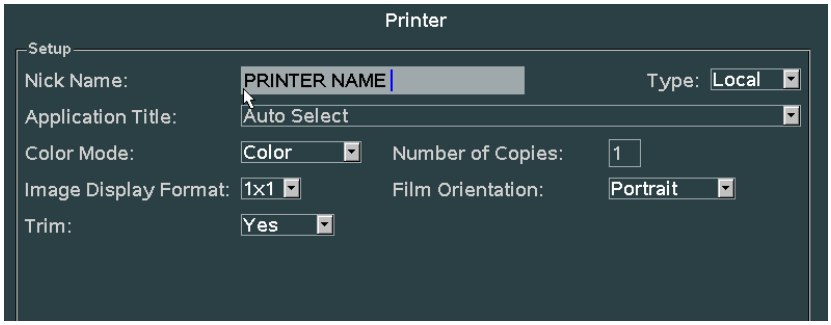

Figure 12-6. Printer Setup Screen: Local/USB

5. Type the name of the printer into the **Nick Name** field: for example, **SONY UP-D897** or **SONY UP-D25MD** or whatever **Nick Name** you have chosen to identify the printer.
6. Set other print parameters as desired. See documentation that came with the printer.
7. Select **Apply** to save the settings

▶ *To Configure Print Button for This Printer*

1. To view the **Image Store/Print Buttons** screen, tab to:

   Setup | System Setup | Archive | Store/Print

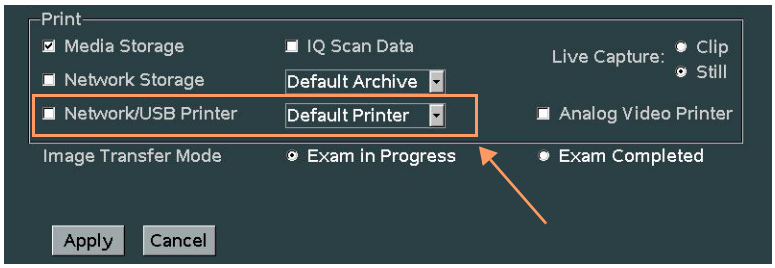

Figure 12-7. Image Store/Print Buttons Screen: Print Section

2. In the **Print** section of the screen, check the box to the left of the **Network/USB Printer** selection (Figure 12-7 above).
3. In the drop-down menu next to **Network/USB Printer**, select the target USB printer. Select **Apply** to save the settings.

Postscript Level 3 Network-Capable Color Printer

NOTE: The following section assumes that a Postscript Level 3 color printer has already been connected to the System (power and USB/network cables properly connected). For information on installation/hook-up, please refer to the document provided in the installation kit shipped from ZONARE with each printer. This information is also provided in the Service Manual.

▶ *To Set Up*

1. Power on the System and allow it to fully boot.
2. Open the paper tray of the unit and install the desired paper.
3. Power on the printer by pressing the ON button.

▶ *To Print Reports*

1. Perform the desired OB/GYN calculations and measurements on the System.
2. At the conclusion of the OB/GYN measurement process, to manually trigger the print of an OB Report, select the **Print** softkey on the **Calculations | Report** page.
3. If the OB Report printing was configured for **Print at end of exam**, the OB/GYN Report will automatically be output to the Postscript printer upon ending the current exam.

NOTE: For information on configuring the System for OB/GYN Report printing with a Postscript Level 3 color printer, refer to “Measurement Accuracy” on page 9-51.

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13

DICOM and FTP Connectivity

DICOM connectivity is an optional software feature on **SmartCart/SmartCart *sp*** systems. When activated and configured, DICOM connectivity enables the ZONARE ultrasound systems to exchange data – including ultrasound images and associated patient and exam data – with DICOM-compliant archive devices, output devices, and worklist applications over an institution's network. Each such device must be configured as described in this chapter.

The **SmartCart/SmartCart *sp*** has one RJ-45 Ethernet network connector to provide this network capability.

WARNING: To comply with electromagnetic compliance it is necessary that ZONARE ultrasound systems be connected to available Ethernet resources using a high quality *shielded Cat-5* cable.

WARNING: Once all of the DICOM parameters have been configured, back up the System as described in "To Back Up System" on page 14-10. This will save you from having to redefine the DICOM parameters you just set. Then power OFF and reboot the ZONARE ultrasound system to initialize the new configuration.

Network

Configuring **Network** parameters is an important step in enabling DICOM and other networking communication on ZONARE ultrasound systems.

▶ *To Configure Network Parameters*

1. Go to: **Setup | System Setup | Archive | Network**
2. The **Network Configuration** screen displays (Figure 13-1).

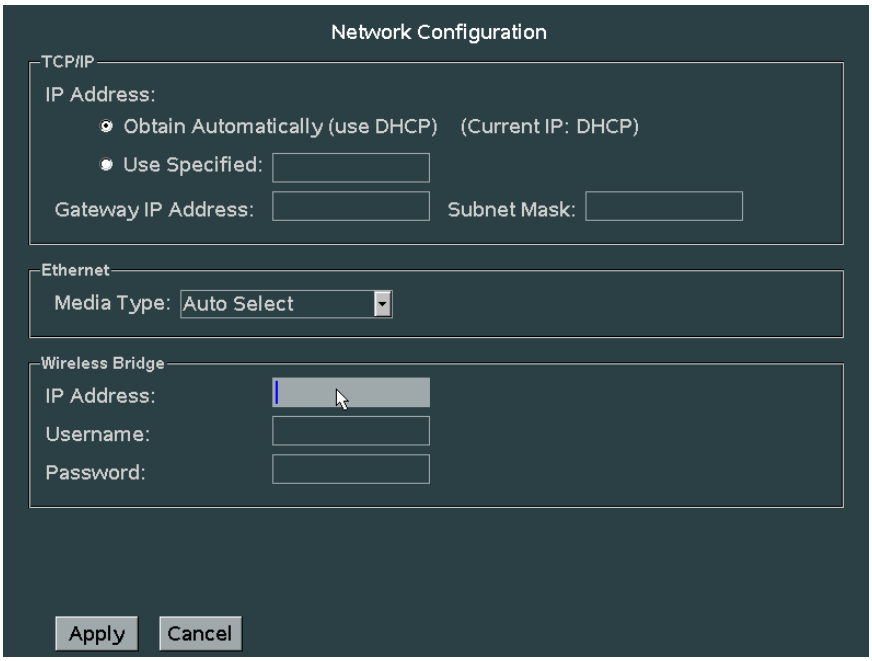

Figure 13-1. Network Configuration Screen

3. Fill in the data fields (see Table 13-1). Use the QWERTY **Tab** key (or **Trackball** and **Set** button) to advance to the next data field.
4. To save and exit, select **Apply**.

Table 13-1. Network Configuration Parameters

Parameter	Description
IP Address	The Internet (TCP/IP) address that is assigned to the Zonare ultrasound system for its identity on the facility's network.
Gateway IP Address	Required TCP/IP parameter for DICOM devices on a network using a gateway.
Subnet Mask	The number of bits (within the IP Address) that will be used for defining the "Network" portion vs. the "Host" portion.
Media Type	Allows for configuring the ultrasound system's network speed and duplex level. Selections include: - Auto Select - 100MB/Full Duplex - 100MB/Half Duplex - 10MB/Full Duplex - 10MB/Half Duplex
Wireless Bridge	For configuring wireless network connectivity. See "Wireless Network Connectivity" below.

Wireless Network Connectivity

ZONARE supports wireless connectivity using the Quatech AirborneDirect Wireless Ethernet Bridge (supported model is the ABDG-ET-DP501-1). This is a plug-and-play wireless networking solution that is compatible with all ZONARE ultrasound systems that support Ethernet connectivity. A special power cable, however, is required to supply power to the Quatech AirborneDirect device from the ZONARE system USB bus for portable operations.

The Quatech AirborneDirect Wireless Ethernet Bridge works with all ZONARE software release revisions; however the 3.5 and subsequent software releases have specific enhancements to provide user feedback for signal strength and wireless connectivity.

The Quatech AirborneDirect Wireless Ethernet Bridge supports WiFi 802.11b/g wireless standards and connects to the ZONARE system through a 10 Base-T network interface. This device supports WEP (64/128 bit) and WPA encryption standards, and LEAP for network authentication (LEAP required the Quatech device to be configured with a static 128 bit key; this is known as “migration mode” and is not recommended for longterm use due to the static WEP key requirement).

Before using it with the ZONARE system, the Quatech AirborneDirect device must be preconfigured for the user's networking environment – SSID, channel, encryption, and correct addressing scheme (DHCP/static).

Static IP addressing is required in order to be able to display the additional wireless status available in the 3.5 and subsequent releases.

When power is applied to a correctly configured Quatech AirborneDirect device that is connected to the Ethernet port on the ZONARE system, it will require 30 to 60 seconds to detect and then associate with the user's wireless network. Once a wireless network connection is established, the ZONARE system will reflect the connection state by showing the network icon in an uncrossed state (see Figure 13-7 on page 13-6).

In the 3.5 and later software releases, the user can obtain additional wireless network status by configuring the **Wireless Bridge** section of the **Network Configuration** screen (Figure 13-1). The information required is the static **IP Address** assigned to the Quatech AirborneDirect device and the **Username** and **Password** for the CLI interface (default is **dpac** for both).

To set up wireless network communication, contact Technical Support (see “ZONARE Contact Information” on page 15-1).

Storage Media

For information on configuring the **Storage Media** screen, see page 11-2.

Location

The **Location** feature allows users to quickly activate network/DICOM functionality when moving the System to different physical locations where the network setup and target DICOM devices use a different set of parameters.

The parameters saved as part of each unique **Location** are:

- **Setup button | System Setup | Archive | Network** settings (local **IP Address**, **Gateway**, **Netmask**)
- **Setup button | System Setup | Archive | DICOM | General** settings (local **AE Title**, etc.)
- **Setup button | System Setup | Archive | Store/Print** settings (targeted devices for **Store/Print** buttons)
- **Setup button | System Setup | Archive | Serial Port** settings (**Calc** report data via USB port)

▶ *To Create a Location*

1. Go to: **Setup button | System Setup | Archive | Location**

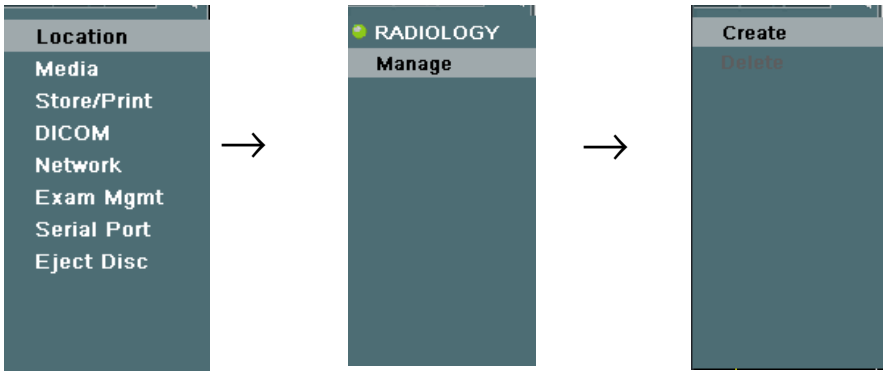

Figure 13-2. Path: Archive | Location | Manage | Create

2. Select the **Manage** option in the menu, and then select **Create** on the next menu (Figure 13-2).
3. The **Location Profile Creation** screen displays. Type the desired **Location** name in the provided window, e.g., **EMERG ROOM**.

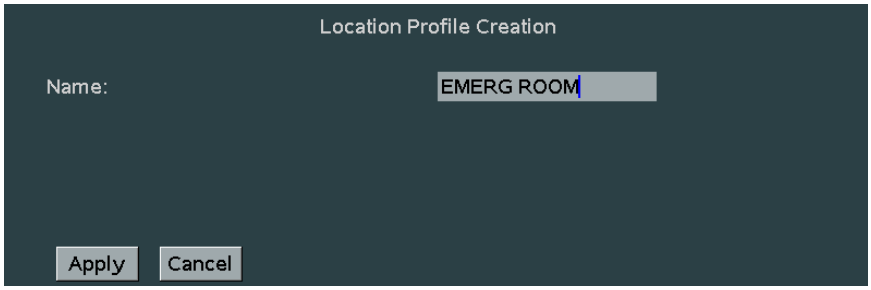

Figure 13-3. Location Profile Creation Screen

4. Click **Apply** to save the new **Location Profile**.
5. The **Location** name now appears in the **Location** submenu.

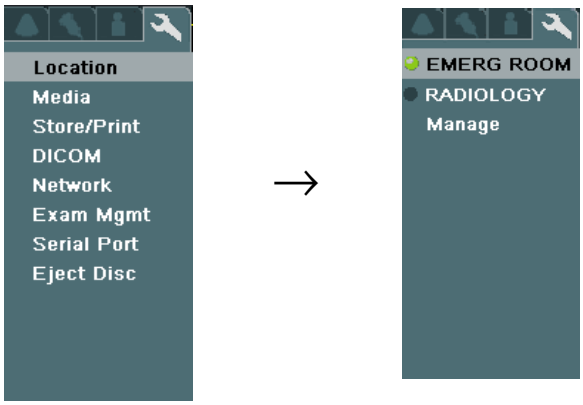

Figure 13-4. Location Menu Item and Submenu with New Location Listed

6. The **Location** name also appears in the **Current Exam** section of the **SmartCart/SmartCart *sp*** Imaging screen.

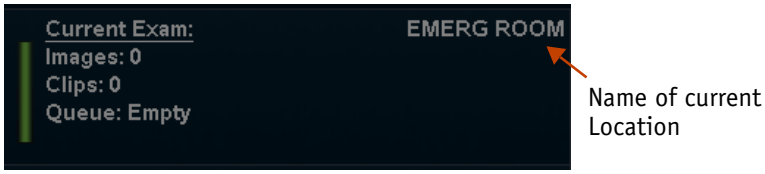

Figure 13-5. Location Name in Current Exam Area of Imaging Screen

NOTE: As an example: When the System is being used in the **EMERG ROOM** rather than **RADIOLOGY**, the user must be sure to select **EMERG ROOM** on the **Location** submenu. The words **EMERG ROOM** will appear to the left of the Imaging screen. If being used in the **RADIOLOGY** department, **RADIOLOGY** must be selected. The word **RADIOLOGY** will appear to the left of the Imaging screen.

DICOM Menu

The menu for configuring DICOM parameters is accessed by selecting: **Setup button | System Setup | Archive | DICOM**

Figure 13-6. DICOM Menu

General

▶ *To Configure General DICOM Parameters*

1. Make sure the System has a live Ethernet connection to the target DICOM devices.

NOTE: DICOM parameters can be configured while disconnected from the Ethernet connection, but testing will not be possible.

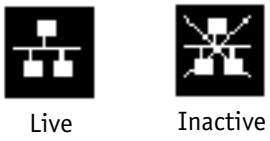

Figure 13-7. Ethernet Connection Icon

NOTE: Ethernet connection icon displays lower right of imaging view (**Scan Engine**) and upper left corner of display if not in full-screen mode (**SmartCart/ SmartCart sp**).

2. Go to: **Setup button | System Setup | Archive | DICOM | General**
3. The **DICOM General Configuration** screen displays.

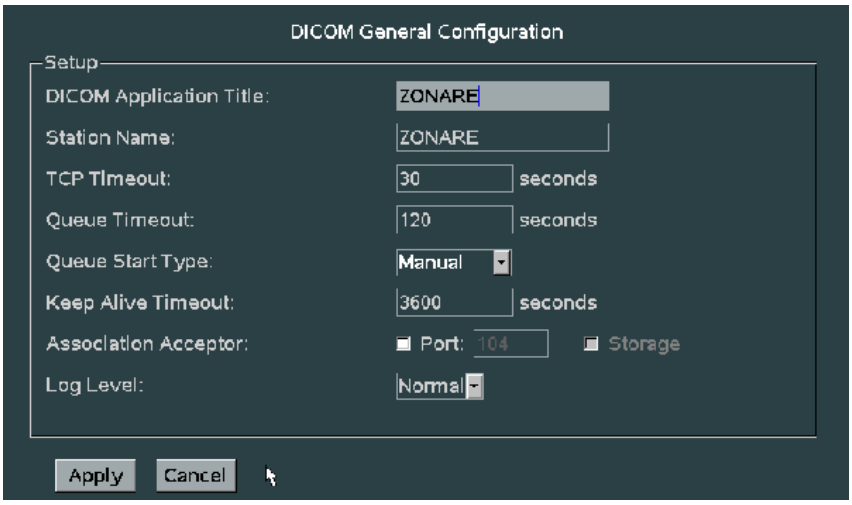

Figure 13-8. DICOM General Configuration Screen

4. Fill in the data fields (see Table 13-2). Use the QWERTY **Tab** key (or **Trackball** and **Set** button) to advance to the next data field.
5. To save and exit, select **Apply**.

Table 13-2. DICOM General Configuration Parameters

Parameter	Description
DICOM Application Title e.g., ZONARE	The official name (AE title) assigned to the ultrasound system by the network administrator.

Table 13-2. DICOM General Configuration Parameters (Continued)

Parameter	Description
Station Name e.g., ZONARE	User-defined name identifying the ultrasound system. Should be provided by the network administrator.
TCP Timeout (sec)	Maximum duration (seconds) of waiting time for completion of TCP transfers over the network. Set according to anticipated network type/speed.
Queue Timeout (sec)	Maximum amount of time a DICOM job will remain active in the queue before it times out.
Queue Start Type	*Automatic*: Attempts to start processing jobs are made immediately upon system startup. *Manual*: User must manually start the queue. Attempts to start processing jobs are not made immediately upon system startup.
Keep Alive Timeout	Duration (seconds) that a DICOM connection will be maintained after completion of the last transfer.
Association Acceptor	Check the **Port** checkbox to enable other DICOM devices to initiate verification of DICOM communication (association) with the ultrasound system. User must be sure to specify the correct port number (default is 104). Default is unchecked. If both the **Port** and **Storage** boxes are checked, the ultrasound system acts as a DICOM storage device.
Log Level	Defines the level of detail displayed in the log. Consult your network administrator.

Printers

Only DICOM-compliant printers can be configured using this procedure. Consult a network administrator to determine if the printer of interest is DICOM-compliant.

NOTE: To set up a local USB printer, see "Setting Up or Adding a Local (USB) Printer" on page 12-5.

▶ *To Configure a DICOM Printer*

1. Make sure the System has a live Ethernet connection to the target DICOM devices (Figure 13-7).

NOTE: DICOM parameters can be configured while disconnected from the Ethernet connection, but testing will not be possible.

2. Go to: **Setup | System Setup | Archive | DICOM | Printer**
3. The **Printer Administration** screen displays (Figure 13-9).

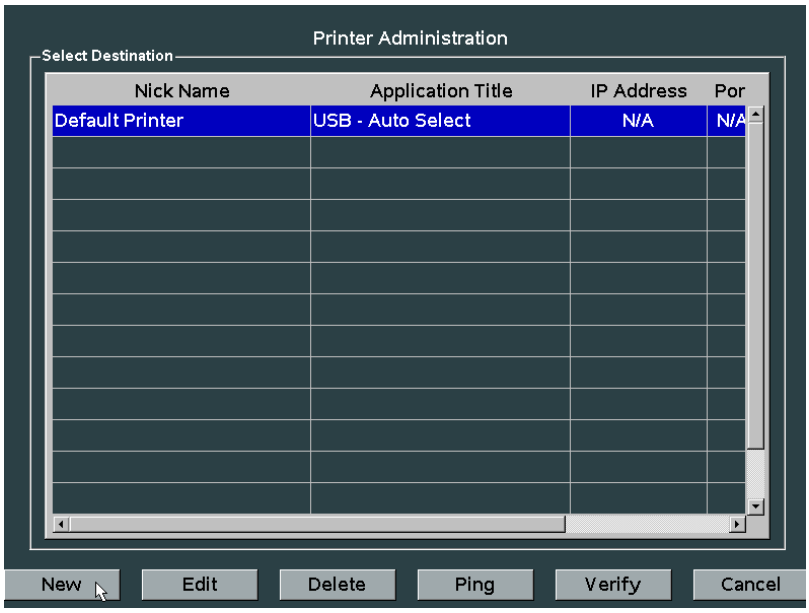

Figure 13-9. Printer Administration Screen

4. Select **New** or **Edit**. The **Printer** screen displays.

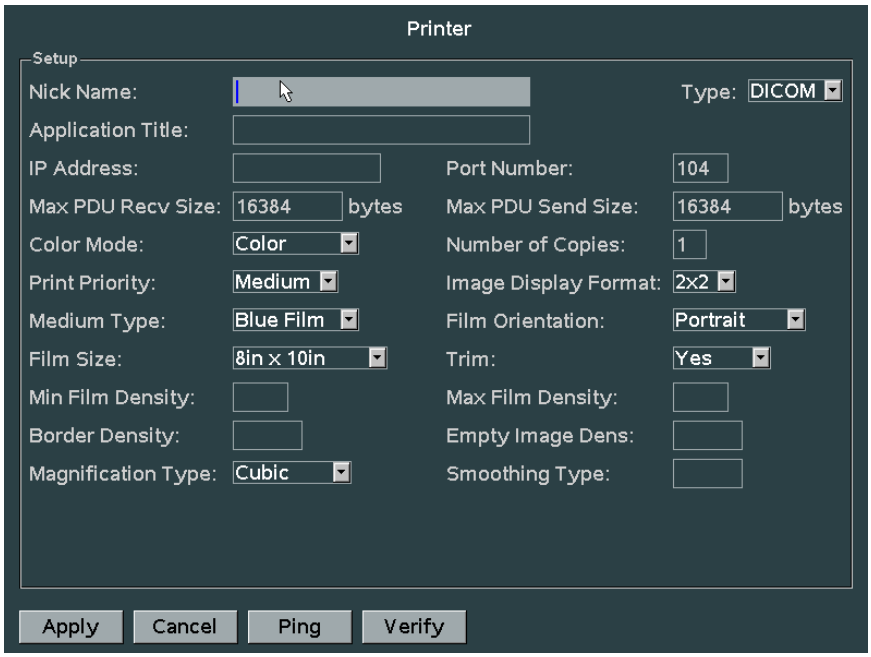

Figure 13-10. Printer Screen

5. Fill in the data fields (Table 13-3). Use the QWERTY **Tab** key (or **Trackball** and **Set** button) to advance to the next data field.
6. Select **Apply** to save the configuration and return to the **Printer Administration** screen.
7. To check the connection:
   a. Select **Ping** on the **Printer Administration** screen.

- If a low-level network connection has been made, the following message appears:

  ICMP Echo: xx.xx.xx.xx is alive [xx.xx.xx.xx is the IP address of the configured device].

- If a connection has not been made, the following message appears:

  ICMP Echo: xx.xx.xx.xx timed out [xx.xx.xx.xx is the IP address of the configured device].

b. Select **Verify** on the **Printer Administration** screen.

- If a DICOM-level connection has been made, the following message appears:

  Verification of communication succeeded

- If a connection has not been made, the message **Connection failure** displays. If so, repeat this procedure from Step 1 or contact your network/PACS administrator.

8. To exit, press **Enter (Enter/Select** for **SmartCart *sp***) or **Freeze** to return to live imaging.

Table 13-3. Printer Parameters

Parameter	Description
Nickname e.g., ER Room Printer	Informal name to identify the device to users in the department. This name is typically assigned in the department.
Application Title e.g., DICOM_PRINT1	Name assigned to the target DICOM printer by the PACS Admin to identify it on the DICOM network.
IP Address	TCP/IP network IP address assigned by the IT Admin, to the target DICOM printer.
Port Number	TCP/IP port number assigned by the PACS Admin, for use by the DICOM printer device. Default port value is 104.
Max PDU Receive/Send Size	Size (in bytes) of the basic data packets (PDU) that will be transferred during receive and transmit operations (default is 16384 = 16K).
Min/Max Film Density	Printer density control: Minimum/Maximum density of images on film. Value entered is expressed in hundredths of OD (optical density). A value entered of 150,corresponds to 1.5 OD. Typical acceptable values for laser printers are 0-399.

Network Storage

▶ *To Configure a DICOM Network Storage Destination*

1. Make sure the System has a live Ethernet connection to the target DICOM devices (Figure 13-7).

NOTE: DICOM parameters can be configured while disconnected from the Ethernet connection, but testing will not be possible.

2. Go to: **Setup | System Setup | Archive | DICOM | Network Store**
3. The **DICOM Network Storage Administration** screen displays.

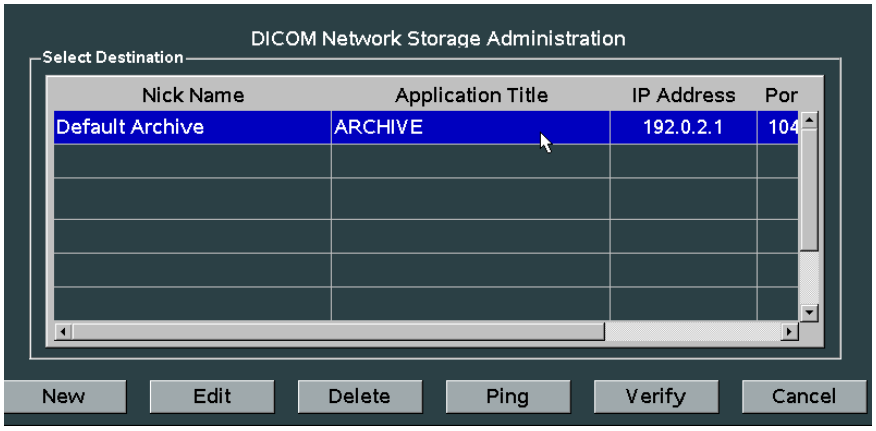

Figure 13-11. DICOM Network Storage Administration Screen

4. Click **New** or **Edit** to display the **DICOM Network Storage Destination** screen.

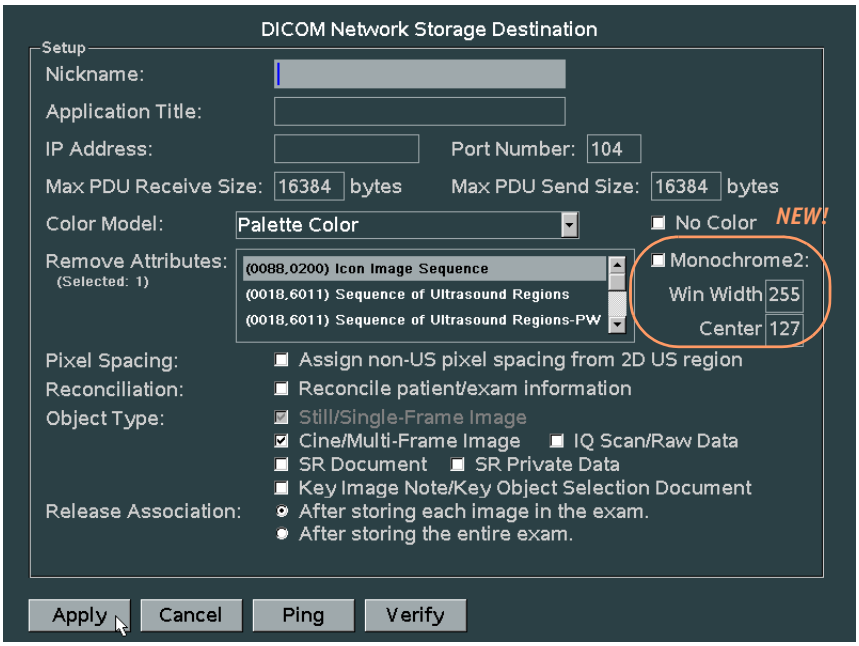

Figure 13-12. DICOM Network Storage Destination Screen

5. Fill in the data fields (see Table 13-4). Use the QWERTY **Tab** key (or **Trackball** and **Set** button) to advance to the next data field.
6. Select **Apply** to save the configuration and return to the **DICOM Network Storage Administration** screen (Figure 13-11).
7. To check the connection:
   a. Select **Ping**.
      - If a low-level network connection has been made, the following message appears:

        ICMP Echo: xx.xx.xx.xx is alive [xx.xx.xx.xx is the IP address of the configured device].

      - If a connection has not been made, the following message appears:

        ICMP Echo: xx.xx.xx.xx timed out [xx.xx.xx.xx is the IP address of the configured device].

   b. Select **Verify**.
      - If a DICOM-level connection has been made, the following message appears:

        Verification of communication succeeded

      - If a connection has not been made, the message **Connection failure** displays. If so, repeat this procedure from Step 1 or contact your network/PACS administrator.
8. To exit, press **Enter (Enter/Select** for **SmartCart *sp***) or **Freeze**.

NOTE: For information about **IQ Scan Data** and storing **IQ Scan Data**, see page 11-10.

Table 13-4. DICOM Network Storage Destination Parameters

Parameter	Description
Nickname e.g., Storage Server	Informal name to identify the device to users in the department. This name is typically assigned in the department.
DICOM Application Title e.g., PACS_STORE1	Name assigned to the target DICOM Storage device by the PACS Admin to identify it on the DICOM network.
IP Address	TCP/IP network IP address assigned by the IT Admin, to the target DICOM Storage device.
Port Number	TCP/IP port number assigned by the PACS Admin, for use by the DICOM Storage device. Default port value is 104.
Max PDU Receive/Send Size	Size (in bytes) of the basic data packets (PDU) that will be transferred during receive and transmit operations (default is 16384 = 16K).

Table 13-4. DICOM Network Storage Destination Parameters (Continued)

Parameter	Description
Color Model (Photometric Interpretation)	Method to be used by the DICOM receiving device for interpreting the different bit level values within transferred images. Selections: ▪ Palette Color ▪ True Color (RGB) - Color by Pixel ▪ True Color (RGB) - Color by Plane ▪ Grayscale (MONOCHROME2)
No Color Checkbox	Default is unchecked. ▪ If box is checked and all images to be stored contain no color (e.g., B-Mode images), images are stored as Grayscale (Monochrome2). ▪ If box is checked and images to be stored include no-color and color images, no-color (B-mode only) images are stored as Grayscale (Monochrome2) and all color images are stored as the configured Color Model. ▪ If box is not checked, images are stored as the configured Color Model even if images contain no color.
Monochrome2: *New!*	▪ If you select **Grayscale (MONOCHROME2)**, you may need to check **Monochrome2:** box and change values to accommodate your DICOM system. You can change values for **Win Width** and **Center**, though not advised. Defaults are **Width 255** and **Center 127**. *This option is not needed for typical system use.*
Remove Attributes	List of attributes associated with Images. Highlight the attributes you wish to remove.
Pixel Spacing	Adds ability to assign pixel spacing (DICOM tags 0028, 0030) to ultrasound images sent to PACS by assigning non-US (ultrasound) pixel spacing from the 2D ultrasound region. This is required by some multi-modality PACS systems that are not able to use US region calibration data to measure in millimeters versus pixels.

Table 13-4. DICOM Network Storage Destination Parameters (Continued)

Parameter	Description
Reconciliation	For exams ***not yet*** sent to PACS. Makes the patient/study data in all images in a series the same during network storage. The data is taken from the most recent image stored. Required settings or state: ▪ Reconciliation checkbox is checked. ▪ Image Transfer Mode on **Store/Print** setup is **Exam Completed**. ▪ Storage device is mapped to one or more of **Store1/Store2/Print**. ▪ Images are stored to media and network destination via configured **Store1/Store2/Print** button. ▪ Network connection is available.
Reconciliation (continued)	Other information: ▪ The default is unchecked. ▪ If no network connection, the following message appears on the screen when **End Exam** is pressed: **Storage job not enqueued because reconciliation is enabled and no network present**. ▪ No effect when storing from archive.
Object Type	▪ Select the type of 'object' that will be sent over the DICOM network connection to a PACS storage device. **NOTE:** Installation sites with DICOM PACS storage devices that do not accept clips *must* be configured for still image store only. ▪ For **SR Private Data**, the default is *unchecked*. For most users, this is the correct setting. If box is checked, raw calculations data in XML format is appended to structured report files, increasing file size and requiring more system memory. *This option is not needed for typical system usage*. See "User Customizable Worksheets" on page 9-7. ▪ For information about **IQ Scan Data** and storing **IQ Scan Data**, see page 11-10. ▪ For information about **SR Document**, see "DICOM Structured Reports" below. ▪ For information about **Key Images**, see "Key Images" on page 11-26.
Release Association	Specifies when to release the communication link between the ultrasound system and the DICOM storage device.

DICOM Structured Reports

IMPORTANT: The configuration required for storing **DICOM Structured Reports** has changed in this software release. If you have previously configured **DICOM Structured Reports** on your system, you must reconfigure them as described in this section.

Structured reports in DICOM format for **OB/GYN, Vascular**, and **Cardiac** exams can be stored to a PACS storage device. These reports conform to DICOM standards. See the *DICOM Conformance Statement* (www.zonare.com/service/downloads) for specific information about the structure of these reports.

▶ *To Configure DICOM Structured Reports*

1. On **DICOM Network Storage Destination** screen (Figure 13-12), check boxes for **SR Document** *and* **SR Private Data** under **Object Type** heading.
   

   Click **Apply**.
2. On Figure 11-4, "Image Store/Print Buttons Screen," on page 11-6, select the storage destination in the **Reports** drop-down box. Click **Apply**.

NOTE: If exporting to CD/DVD or USB, go to Figure 11-10, "Archive Exam Export Options Screen," on page 11-24, and check boxes for **Include DICOM structured report (if possible)** *and* **SR Private Data** under **DICOM Export Options** heading.


Click **Apply**.

MPPS

The setup of the MPPS (Modality Performed Procedure Step) manager can be configured using this procedure. Consult your network administrator to obtain all IP and DICOM parameters specific to the network that the ultrasound system is connected to.

1. Make sure the System has a live Ethernet connection to the target DICOM devices (Figure 13-7).

NOTE: DICOM parameters can be configured while disconnected from the Ethernet connection, but testing will not be possible.

2. Go to: S**etup button | System Setup | Archive | DICOM | MPPS**
3. The **DICOM MPPS Administration** screen displays (Figure 13-13).

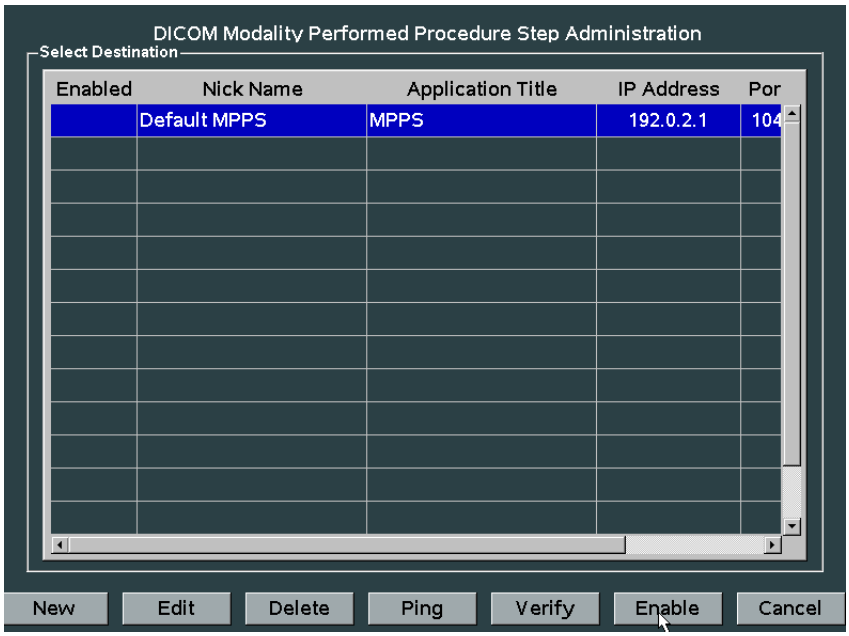

Figure 13-13. DICOM MPPS Administration Screen

4. Select **New** or **Edit**. The **DICOM MPPS Destination** screen displays.

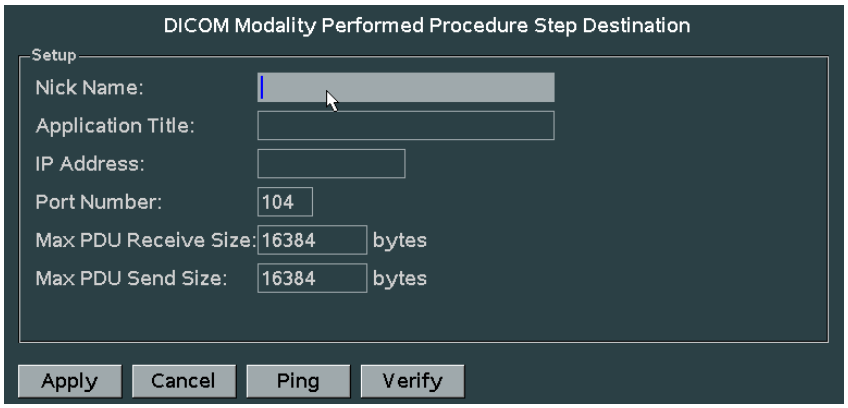

Figure 13-14. DICOM MPPS Destination Screen

5. Fill in the data fields (see Table 13-5). Use the QWERTY **Tab** key (or **Trackball** and **Set** button) to advance to the next data field.
6. To check the connection:
   a. Select **Ping**.
      - If a low-level network connection has been made, the following message appears:

        ICMP Echo: xx.xx.xx.xx is alive [xx.xx.xx.xx is the IP address of the configured device].

      - If a connection has not been made, the following message appears:

ICMP Echo: xx.xx.xx.xx timed out [xx.xx.xx.xx is the IP address of the configured device].

b. Select **Verify**.

- If a DICOM-level connection has been made, the following message appears:

  Verification of communication succeeded

- If a connection has not been made, the message **Connection failure** displays. If so, repeat this procedure from Step 1 or contact your network/PACS administrator.

7. To enable the **Destination**, go to the **DICOM MPPS Administration** screen (Figure 13-13), select the **Destination** and click **Enable**
8. To exit, press **Enter** (**Enter/Select** for **SmartCart *sp***) or **Freeze.**

Table 13-5. DICOM MPPS Destination Parameters

Parameter	Description
Nickname e.g., MPPS Server	Informal name to identify the device to users in the department. This name is typically assigned in the department.
Application Title e.g., MPPS_1	Name assigned to the target DICOM MPPS Server device by the PACS Admin to identify it on the DICOM network.
IP Address	TCP/IP network IP address assigned by the IT Admin, to the target DICOM MPPS Server device.
Port Number	TCP/IP port number assigned by the PACS Admin, for use by the DICOM MPPS Server device. Default port value is 104.
Max PDU Receive/Send Size	Size (in bytes) of the basic data packets (PDU) that will be transferred during receive and transmit operations (default is 16384 = 16K).

DICOM Worklist

If a DICOM **Worklist** application is installed on the network, a list of scheduled exams can be delivered to the ZONARE ultrasound system on demand. One or more worklists can be configured, but only one can be designated as the active worklist at any given time. The worklist can be configured to specify a date range and other criteria.

▶ *To Configure DICOM Worklist*

1. Make sure the System has a live Ethernet connection to the target DICOM devices (Figure 13-7).

NOTE: DICOM parameters can be configured while disconnected from the Ethernet connection, but testing will not be possible.

Go to: **Setup button | System Setup | Archive | DICOM | Worklist**

2. The **DICOM Modality Worklist Administration** screen displays (Figure 13-15).

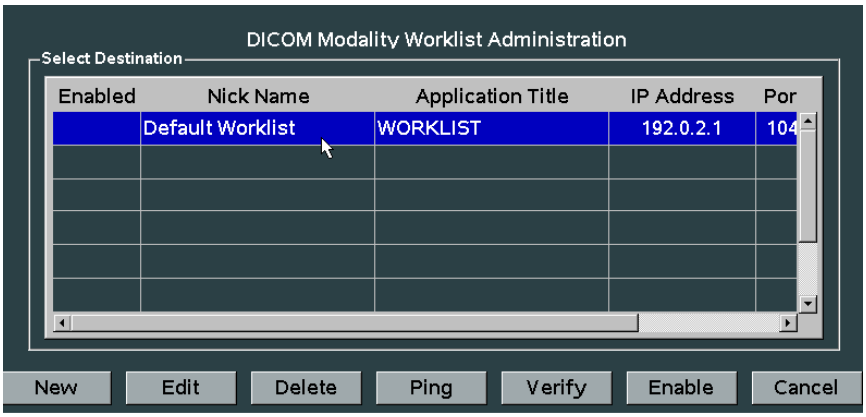

Figure 13-15. DICOM Modality Worklist Administration Screen

3. Select **New** or **Edit**. The **DICOM Modality Worklist Server** screen displays.

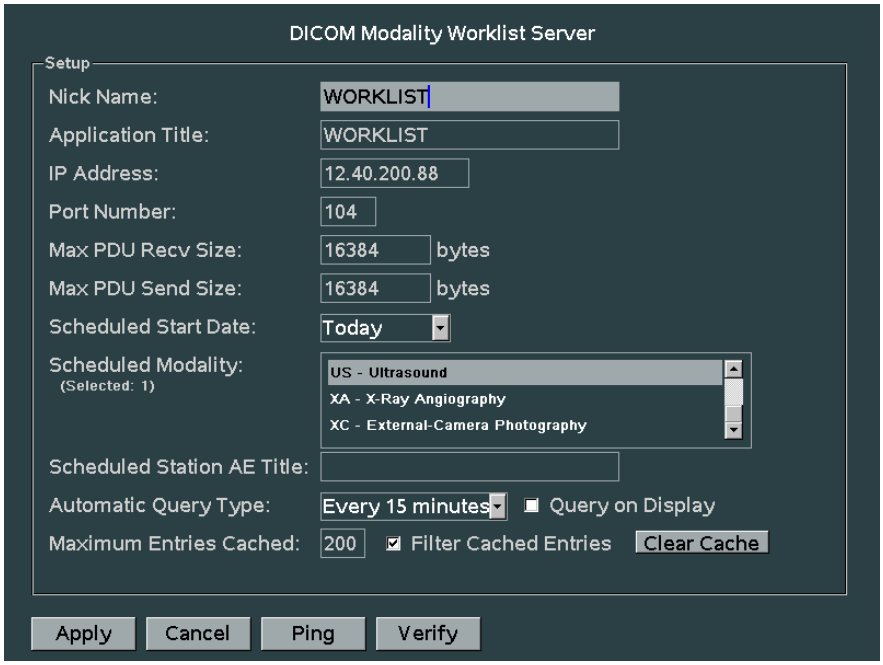

Figure 13-16. DICOM Modality Worklist Server Screen

4. Fill in the data fields (see Table 13-6). Use the QWERTY **Tab** key (or **Trackball** and **Set** button) to advance to the next data field.
5. Select **Apply** to save the configuration and return to the **DICOM Modality Worklist Administration** screen.
6. To check the connection:
   a. Select **Ping**.

- If a low-level network connection has been made, the following message appears:

  ICMP Echo: xx.xx.xx.xx is alive [xx.xx.xx.xx is the IP address of the configured device].

- If a connection has not been made, the following message appears:

  ICMP Echo: xx.xx.xx.xx timed out [xx.xx.xx.xx is the IP address of the configured device].

b. Select **Verify**.

- If a DICOM-level connection has been made, the following message appears:

  Verification of communication succeeded

- If a connection has not been made, the message **Connection failure** displays. If so, repeat this procedure from Step 1 or contact your network/PACS administrator.

7. To enable the **Worklist**, go to the **DICOM Modality Worklist Administration** screen (Figure 13-15), select the **Worklist**, and click **Enable.**
8. To exit, press **Enter** (**Enter/Select** for **SmartCart *sp***) or **Freeze** to return to live imaging.

Table 13-6. DICOM Worklist Server Parameters

Parameter	Description
Nickname e.g., Worklist Server	Informal name to identify the device to users in the department. This name is typically assigned in the department.
Application Title e.g., WORK_1	Name assigned to the target DICOM Worklist Server device by the PACS Admin to identify it on the DICOM network.
IP Address	TCP/IP network IP address assigned by the IT Admin to the target DICOM Worklist Server device.
Port Number	TCP/IP port number assigned by the PACS Admin for use by the DICOM Worklist Server device. Default port value is 104.
Max PDU Receive/Send Size	Size (in bytes) of the basic data packets (PDU) that will be transferred during receive and transmit operations (default is 16384 = 16K).

Table 13-6. DICOM Worklist Server Parameters (Continued)

Parameter	Description
Scheduled Modality	Filters the Worklist by modality (US, CT, MRI, etc.). Set according to department requirements. US: Show entries for ***ultrasound*** exams only. Additional modality filter (limit) settings: AU, BI, CD, CR, CT, DD, DG, DX, ECG, EPS, ES, FID, GM, HC, HD, IO, IVUA, KO, LS, MG, MR, NM, OP, OT, PR, PT, PX, REG, RF, RG, RTDOSE, RTIMAGE, RTPLAN, RTRECORD, RWV, SM, SMR, SR, ST, TG, US, XA, XC
Scheduled Station AE Title	Filters the Worklist by scheduled station Application Entity (AE) title. Set according to department requirements.
Automatic Query Type	Select the time interval from the drop-down box.
Query on Display	Check to perform query immediately and display those results.

Store/Print Buttons

The **Store** and **Print** buttons on the **SmartCart/SmartCart *sp*** and **Scan Engine** must be configured in order to send ultrasound data and images to DICOM storage and print devices.

NOTE: For information on configuring the **Store** and **Print** buttons to print and store to local devices, see page 11-8.

NOTE: For information about **IQ Scan Data** and storing **IQ Scan Data**, see page 11-10.

▶ *To Configure Store/Print Buttons for DICOM Storage*

1. Make sure System has a live Ethernet connection to target DICOM devices (Figure 13-7).
2. Go to: **Setup button | System Setup | Archive | Store/Print**
3. The **Image Store/Print Buttons** screen displays (see page 11-6).
4. Locate the appropriate button configuration section on the screen:
   - **Store/Store 1**
   - **Print**
5. Place the arrow over the box to the left of **Network Storage** and press **Set** to check the box.
6. Next, place the cursor over the drop-down menu arrow to the right of **Network Storage**. Press **Set** to open the list of all configured archive devices.
7. Highlight the preferred device and select **Set**. The nickname of the selected device displays in the data field.

To Configure Store/Print Buttons for DICOM Printing

1. Locate the appropriate button configuration section on the **Image Store/Print Buttons** screen:
   - **Store/Store 1**
   - **Print**
2. Place the cursor over the box to the left of the desired entry, then press **Set** to check the box.
3. Place the arrow over the box to the left of **Network/USB Printer** and press **Set** to check the box.
4. Next, place the cursor over the drop-down menu arrow to the right of **Network/USB Printer**. Press **Set** to open the list of all configured printers.
5. Highlight the preferred printer and select **Set**. The nickname of the selected printer displays in the data field.

To Configure Image Transfer Mode

1. Access the **Image Store/Print Buttons** screen (see page 11-6).
2. For **Image Transfer Mode**, select:
   - **Exam in Progress** (sends each image to storage destination or printer when **Store/Print** button is pressed)

   Or
   - **End Exam** (sends all saved images upon **End of Exam**)
3. Click **Apply** to save and exit.

WARNING: Once all DICOM parameters have been configured, back up the System as described in "To Back Up System" on page 14-10. This will save you from having to redefine the DICOM parameters you just set. Then power OFF and reboot the ZONARE ultrasound system to initialize the new configuration.

FTP Storage *New!*

▶ *Setup*

1. Go to **System Setup | Archive | FTP | FTP Store**. The **FTP Storage Administration** screen displays.

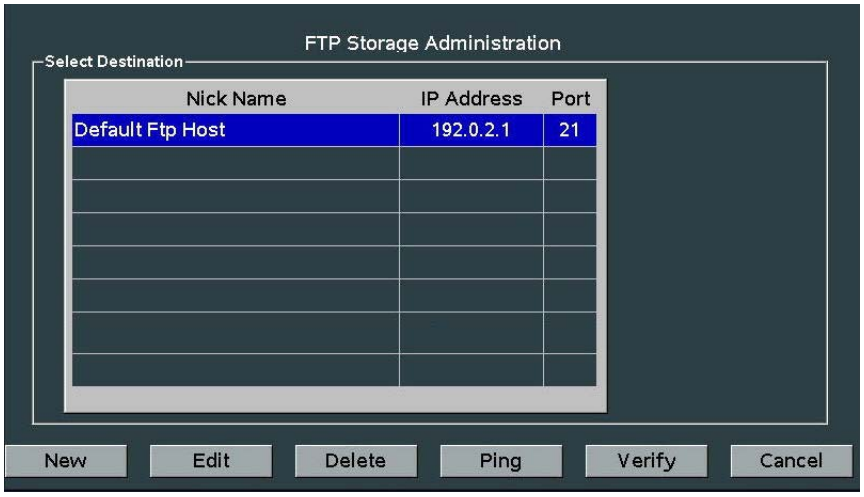

Figure 13-17. FTP Storage Administration Screen

2. Select **Default Ftp Host** and click **Edit**.

   OR

   Click **New** to configure another FTP destination.

3. The **FTP Storage Destination** screen displays.

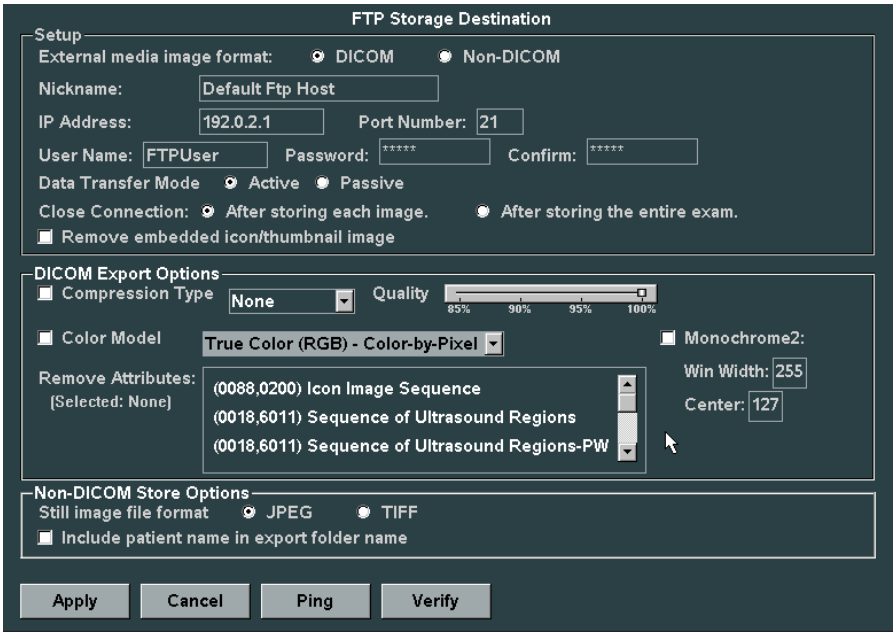

Figure 13-18. FTP Storage Destination Screen

4. Fill in the data fields (Table 13-7) and click **Apply**. The system returns to the **FTP Storage Administration** screen (Figure 13-17).
5. To check the connection:
   a. Select **Ping** on the **FTP Storage Administration** screen.
      - If a low-level network connection has been made, the following message appears:

        ICMP Echo: xx.xx.xx.xx is alive [xx.xx.xx.xx is the IP address of the configured device].

      - If a connection has not been made, the following message appears:

        ICMP Echo: xx.xx.xx.xx timed out [xx.xx.xx.xx is the IP address of the configured device].

   b. Select **Verify** on the **FTP Storage Administration** screen.
      - If connection has been made, the following message appears:

        Verification of communication succeeded

      - If connection has not been made, message **Connection failure** displays. If so, repeat procedure from Step 1 or contact your network/PACS administrator.
6. To exit, press **Enter (Enter/Select** for **SmartCart *sp***) or **Freeze** to return to live imaging.

Table 13-7. FTP Storage Destination Parameters

Parameter	Description
Setup	
External media image format	■ **DICOM** or **Non-DICOM** Select desired format.
Nickname e.g., Default Ftp Host	■ Informal name to identify site to users in department. This name is typically assigned by department.
IP Address	■ Network IP address assigned by IT Admin for target location.
Port Number	■ Port number assigned by FTP Admin for target location. Default port is **21**.
User Name	■ Fill in as required
Password	■ Fill in
Confirm	■ Fill in
Data Transfer Mode	■ Select **Active** or **Passive**
Close Connection	■ Select desired option
Remove embedded icon/thumbnail image	■ Check box to remove
DICOM Export Options	
Compression Type	■ Check box. Then select desired compression type from drop-down box (see "Compression Settings" on page 11-3).

Table 13-7. FTP Storage Destination Parameters (Continued)

Parameter	Description
Quality	■ Move slider to select compression quality (see "Compression Settings" on page 11-3).
Color Model	■ To change **Color Model**, check box. Then select desired type from drop-down box: choices are True Color (RGB) - Color-by-Pixel; Color (RGB) - Color-by-Plane; Grayscale (MONOCHROME2).
Monochrome2	■ If you select **Grayscale (MONOCHROME2)**, you may need to check **Monochrome2:** box and change values to accommodate your DICOM system. You can change values for **Win Width** and **Center**, though not advised. Defaults are **Width 255** and **Center 127**. *This option is not needed for typical system use.*
Remove Attributes	■ Default is non selected. Remove listed attributes as desired.
Non-DICOM Export Options	
Still image file format	■ Select **JPEG** or **TIFF**
Include patient name in export folder name	■ Check if desired

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14

User Maintenance

This chapter describes the maintenance, care, and service that should be performed to maintain the **Scan Engine** and **SmartCart/SmartCart *sp*** workstations in proper operation.

These operations include:

- Calibrating the Touchscreen on the **Scan Engine**
- Navigating User Diagnostics settings
- Backing-up and restoring user presets and system settings
- Upgrading software on the **Scan Engine**
- Caring for the System

WARNING: Shock hazards exist if the AC power connection for the **SmartCart/SmartCart *sp*** or AC adapter are not properly grounded. Equipment must be connected to a “hospital grade” receptacle. Do not remove the grounding wire.

- The **SmartCart/SmartCart *sp*** enclosures contain no operator-serviceable components.
  - To avoid electrical shock, do not remove covers.
  - As with any other electrical equipment, always use care when operating this instrument.
  - For servicing, contact Technical Support only. Failure to do so may void your warranty or service contract coverage.
- To safely use and maintain the **SmartCart/SmartCart sp**:
  - To avoid electrical shock, always disconnect the AC power before cleaning any part of the SmartCart/SmartCart sp.
  - Do not immerse the transducer past the cleaning/disinfection level depth specified in “Cleaning and Disinfecting Transducers” on page 14-21. Do not immerse the transducer for longer than specified cleaning/disinfecting time.

Do not use any transducer that has been immersed beyond the specified maximum immersion depth or has been soaked longer than specified time.

- The battery has a safe-smart device. Do not disassemble or alter the battery.
- Charge the battery at room temperature.
- Do not short-circuit battery by directly connecting the positive and negative terminals with metal objects.
- Do not heat or discard the battery in a fire.
- Do not expose the battery to temperatures above 120°F (50°C).
- Do not charge the battery near a heat source.
- Do not leave the battery in direct sunlight.
- Recharge the battery only with a Zonare battery charger.
- Do not use a damaged battery.
- Inspect the battery for damage before charging or placing the battery in the **Scan Engine**.
- Do not connect the battery to an electrical power outlet.

CAUTION: Do not excessively twist or bend the cables; this may cause failure.

- Improper cleaning or disinfection of any part of the **SmartCart/SmartCart *sp*** or **Scan Engine** may cause permanent damage. Follow the cleaning and disinfection instructions.
- Do not use solvents or abrasives to clean any part of the **SmartCart/ SmartCart *sp*** or **Scan Engine**.
- Do not spill liquid on the **SmartCart/SmartCart *sp*** or **Scan Engine**.
- Do not immerse the battery in water or allow it to get wet.
- Do not put the battery into a microwave oven or pressurized container.
- Use only ZONARE batteries.
- Store the battery between 32°F and 120°F (0°C and 50°C).
- If the battery leaks, emits odors, emits heat, or is deformed or discolored in any way, immediately remove it from the **Scan Engine** and stop using the battery.

Scan Engine Touchscreen Calibration

The **Touchscreen** on the **Scan Engine** LCD Display rarely requires calibration. Normally the only time **Touchscreen** calibration is required is immediately following a complete main system software upgrade on the **Scan Engine**. If **Restore System** is done following the upgrade, calibration will be restored.

Touchscreen Calibration Procedure

u To Calibrate the Touchscreen

1. Undock the **Scan Engine** from the **SmartCart/SmartCart sp**. Press the release lever to flip open the LCD Display for viewing.
2. Remove the **Touchscreen** stylus from its storage area in the groove on the top-right edge of the plastic display cover on the **Scan Engine**.
3. Power on the **Scan Engine** and allow it to fully boot.
4. Using the **Tab** key, tab to the **Tools** tab.
5. Using **Menu Control**, highlight **System Setup** and press the **Select** button to activate.
6. Using **Menu Control**, highlight the **Touchscreen** selection from the menu, and press the **Select** button to begin the Touchscreen calibration process.

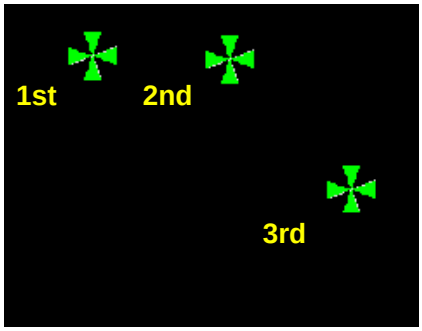

Figure 14-1. Touchscreen Calibration Screen

7. Place the tip of the stylus in the center of the first green target crosshair that appears on the display, and lightly press-and-hold until the crosshair moves to second location.
8. Repeat the press-and-hold of the stylus in the center of the 2nd green target crosshair that now appears on the display.
9. Repeat the process for the 3rd (and final) green target crosshair.

NOTE: The stylus should be held stationary (not bounced), with a single contact point made (and held) in the center of the green crosshair during Touchscreen calibration. Failure to do so may result in the calibration process returning a **User failed to calibrate the touchscreen, please retry** error message. If this happens, repeat the Touchscreen calibration procedure while observing this required stylus contact technique.

User Diagnostics Panel

The **User Diagnostics Panel** screen (Figure 14-2) allows access to important system information and product support processes:

- Checking of system software revision level
- Checking **Scan Engine** serial number
- Checking revision levels of major PC boards in **Scan Engine**

- Capturing of system status to **LOG** files
- Capturing current image screen and storing as a *.bmp file
- Transferring the contents of the internal LOG directory (via an internet connection) to ZONARE's FTP site
- Checking (over the internet) for availability of **Software** and **Firmware** (cart) **Updates** from remote ZONARE FTP site
- Remote (over the Internet) downloadable **Software** and **Firmware** (cart) **Updates** from the ZONARE FTP site

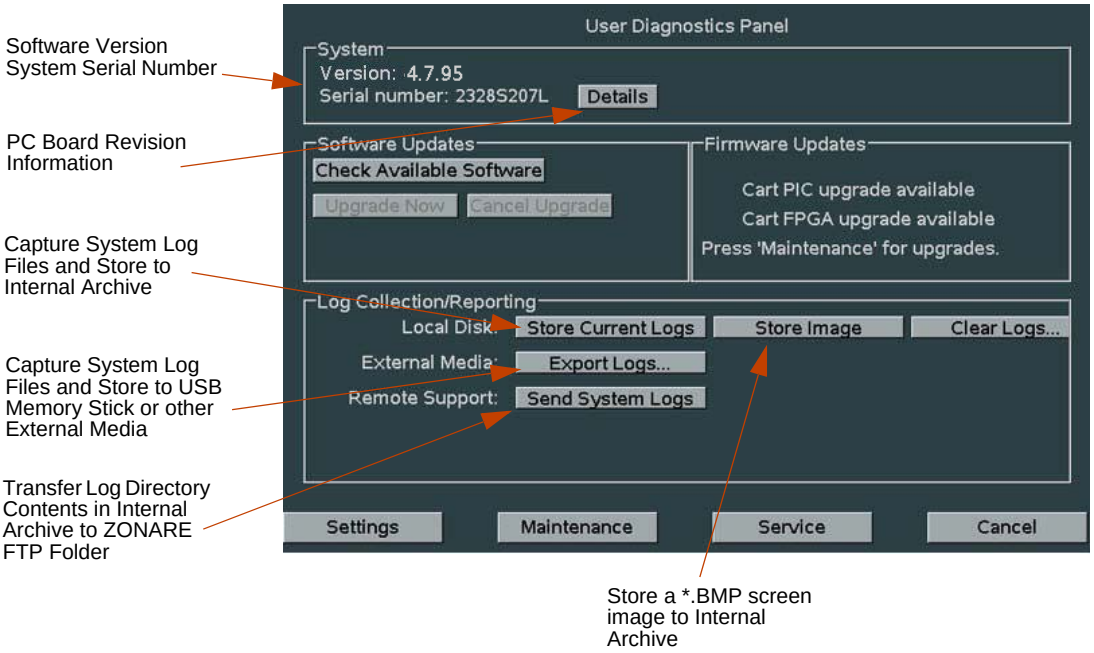

Figure 14-2. User Diagnostics Panel

▶ *To Access the User Diagnostics Panel*

SmartCart/SmartCart *sp*	While viewing an imaging display, press the **Service** key on the QWERTY keyboard: ▪ Single short press activates the **User Diagnostics Panel** ▪ Long press (1 sec) will **Store Current Logs**; system beeps as logs are stored ▪ Press **Service** key again to return to imaging
Scan Engine	Go to: **Tools | System Setup | Diagnostics**

NOTE: The majority of the functions offered in the **User Diagnostics Panel** involve the use of an Internet connection between the **SmartCart/SmartCart *sp*** and ZONARE's network server for the purpose of uploading or downloading of files. Performing any of these procedures will require contacting ZONARE Technical Support to receive specific information on IP address and log-in used to make the connection.

Settings

▶ *To Access the Settings Screen*

1. Click **Settings** on the **User Diagnostics Panel** (Figure 14-2).

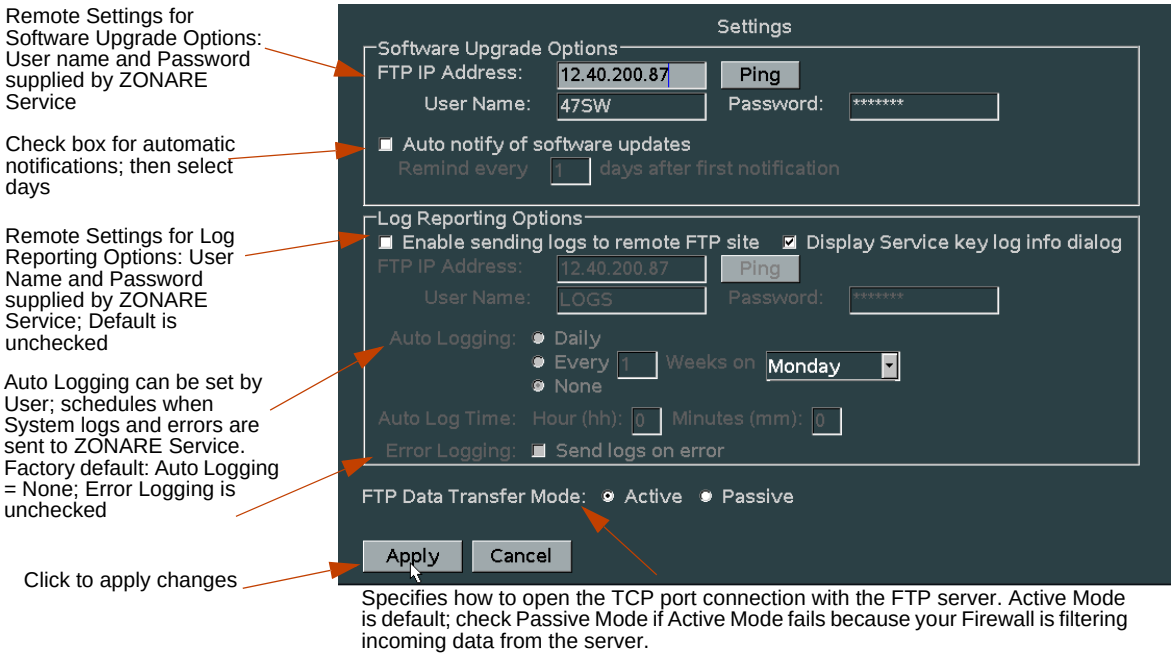

Figure 14-3. User Diagnostics Panel | Settings Screen

Maintenance

▶ *To Access the Maintenance Screen*

1. Click **Maintenance** on the **User Diagnostics Panel** (Figure 14-2).

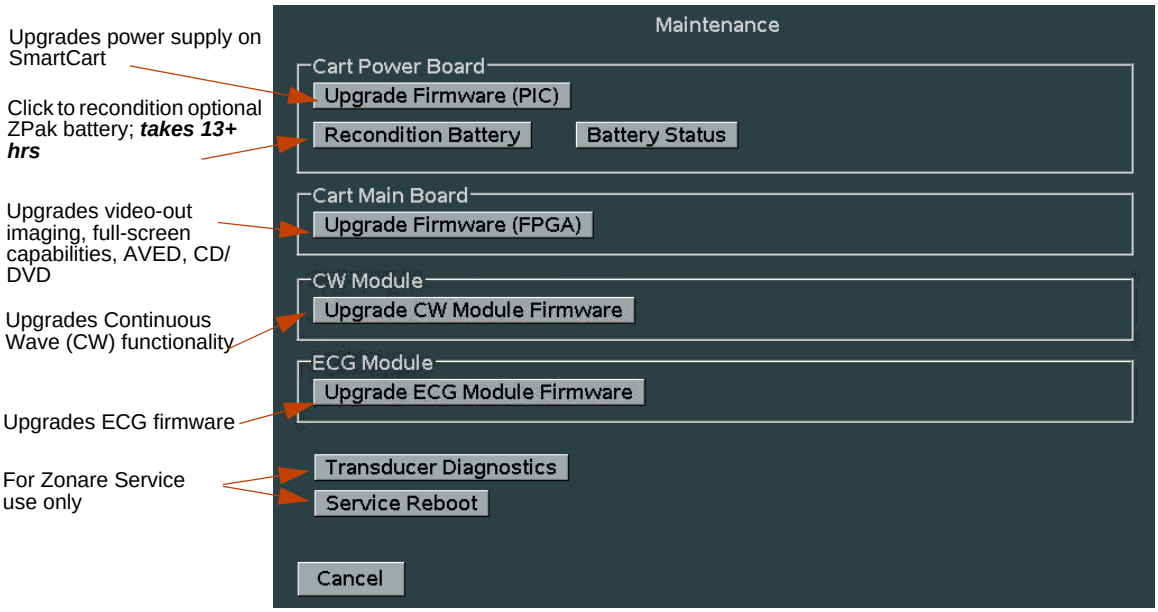

Figure 14-4. User Diagnostics Panel | Maintenance Screen

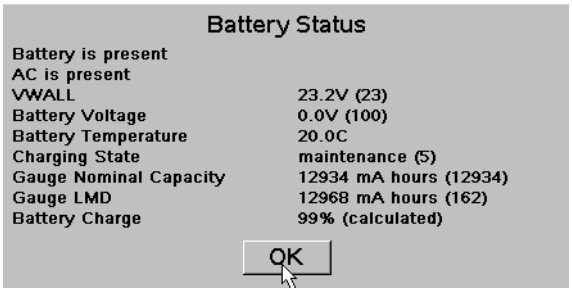

Figure 14-5. ZPak Battery Status Message; Click OK to close

Preset Mgmt/System Setup: Backup/Restore

The **SmartCart/SmartCart *sp*** has two different categories of customized parameters that can be created from customer-specific settings that are configured by the Operator. These two categories are:

- (Exam) Preset Mgmt
- System Setup

The (Exam) **Preset Mgmt** category consists of customized image setup parameters (depth, frequency, etc.) that can be created for each transducer for each mode of operation. These customized user presets allow for a one-time setup of commonly used configurations and control settings by the Operator.

The **System Setup** category of configurable settings includes parameters such as institution name, date/time, DICOM settings, function and mode key assignments, and calcs.

To protect these customized parameters, the operator should save them on a regular basis whenever changes have been made to removable media (e.g., USB Memory Stick). The removable media can then be used to instantly restore the **SmartCart/SmartCart *sp*** to its complete previous operating configuration in the case of a post-software upgrade or **Scan Engine** replacement.

NOTE: You can create or modify (Exam) **Presets**. Simply make the imaging changes to the (Exam) **Preset**. Go to the (Exam) **Presets** tab and scroll down to **Preset Mgmt**. Choose **Create** or **Modify** to make the new **Preset**.

Presets

▶ *To Backup Presets*

1. Power on **SmartCart/SmartCart *sp*** or **Scan Engine** and allow to fully boot.
2. Insert USB stick for backup/restore into the USB port at the rear of the **SmartCart/SmartCart *sp*** or **Scan Engine**.
3. A popup window will appear saying **Install media detected. Do you wish to install new software? S**elect **No** and press **Set** button.

4. Press **Setup** button. The **Setup** menu displays:

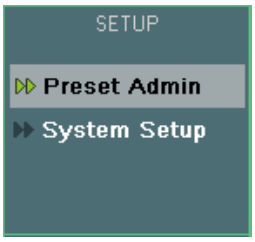

Figure 14-6. Setup Button Menu

5. Highlight and select **Preset Admin**.

Figure 14-7. Preset Admin Menu

6. Highlight and select **Backup Presets**. If a **Backup** file already exists, the system displays the following message:

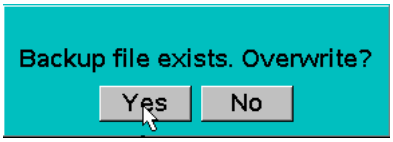

Figure 14-8. Overwrite Prompt

NOTE: If no USB stick is present, the following message displays:

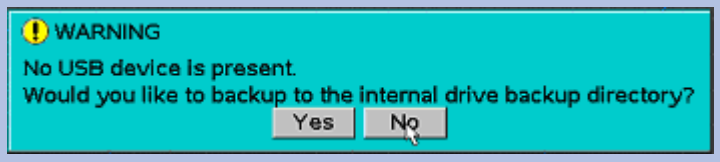

Figure 14-9. USB Prompt

Click **No**. Insert USB stick and go back to **Step 6** above. Or click **Yes** to backup to internal backup directory (not recommended).

7. Select **Yes** to proceed with backup. (Selecting **No** will abort the backup).

8. System displays **Full Backup in Progress** as **Backup** proceeds.

To Restore Presets

1. Highlight and select **Restore Presets** (Figure 14-7). The following menu displays with three options:

Figure 14-10. Restore Presets Menu

2. Select **All** to restore all previously stored user-created **Presets**. The **Restore Configuration** screen displays:

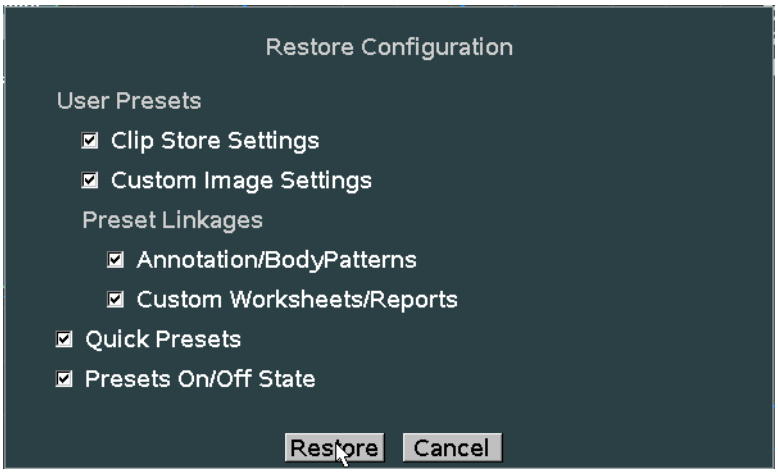

Figure 14-11. Presets Restore Configuration Screen

a. Default is all options checked. Click **Restore** to begin restoring. The following message will display:

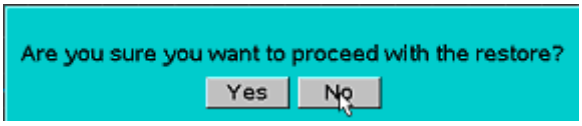

Figure 14-12. Confirmation Prompt

b. Select **Yes**. If you select **No**, the restore is aborted.

c. System displays Restoring presets. This will take several minutes ... as **Restore** proceeds.

NOTE: If desired, *uncheck* the options you do ***not*** want to **Restore**. If so, the following message displays when you click **Restore**.

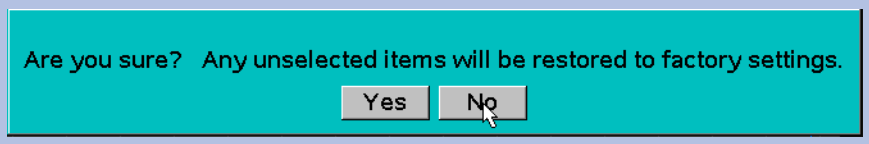

Figure 14-13. Preset Restore Prompt

Select **Yes** to proceed with restore. (Selecting **No** will abort the restore).

3. Select **Exam Type** (Figure 14-10) to *individually* select **Presets** to be restored based on transducer and exam type.

Figure 14-14. Restore Presets | Exam Type Screen

a. Select **Transducer** and exam types in **Categories** box and click **Apply**. The following message displays:

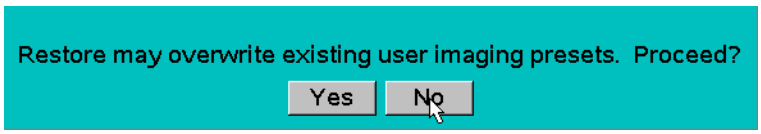

Figure 14-15. Overwrite Prompt

b. Select **Yes**. (Selecting **No** aborts the restore.) The system restores the **Preset**. You may select another transducer/exam to restore or click **Cancel** to return to imaging.

4. Select **Single Preset** (Figure 14-10) to select individual **Presets** to be restored.

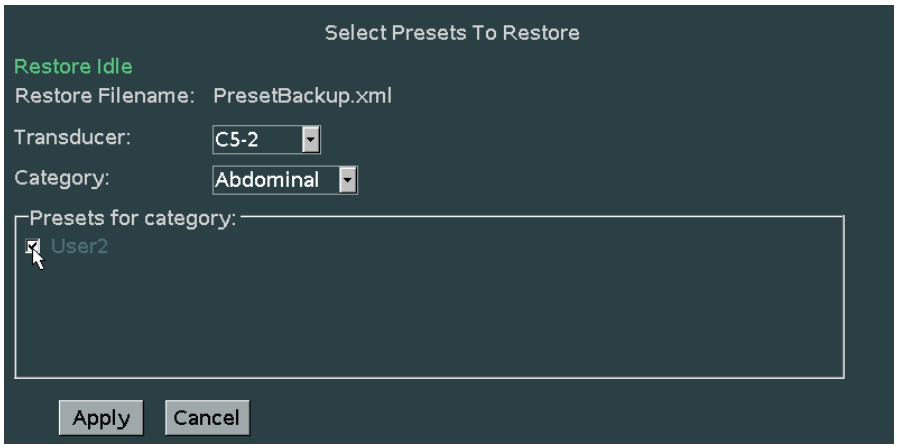

Figure 14-16. Restore Presets | Single Preset Screen

a. Select **Transducer**, exam type (**Category**), and user-created **Preset**, e.g. **User2** in the figure. Click **Apply**. The following message displays:

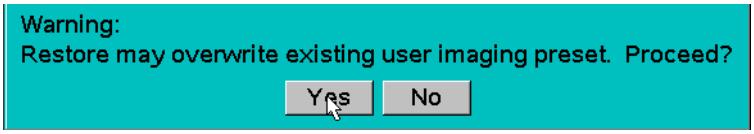

Figure 14-17. Overwrite Prompt

b. Select **Yes**. (Selecting **No** aborts the restore.) The system restores the **Preset**. You may select another transducer/exam to restore or click **Cancel** to return to imaging.

System

▶ *To Back Up System*

1. Power on the **SmartCart/SmartCart *sp*** or **Scan Engine** and allow it to fully boot.
2. Insert USB stick for backup/restore into USB port at rear of **SmartCart/ SmartCart *sp*** or **Scan Engine**.
3. A popup window will appear saying **Install media detected. Do you wish to install new software? S**elect **No** and press the **Set** button.
4. Press **Setup** button.
5. Highlight and select **Preset Admin** (see Figure 14-6).
6. Highlight and select **Backup System** (see Figure 14-7). The **Backup Configuration** screen displays.

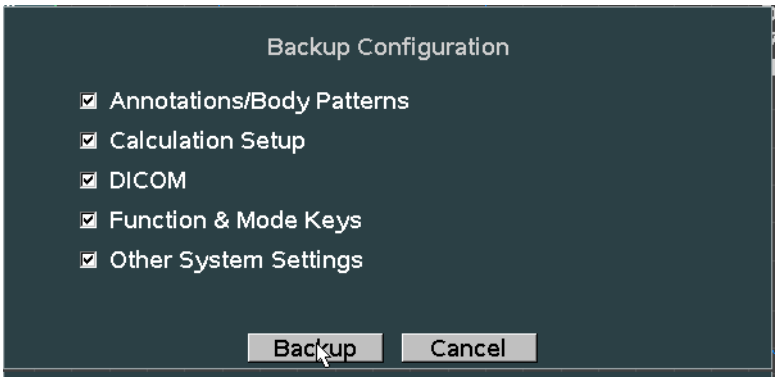

Figure 14-18. Backup Configuration Screen

7. All options are checked (default). Click **Backup** to begin backup. The following message will display:

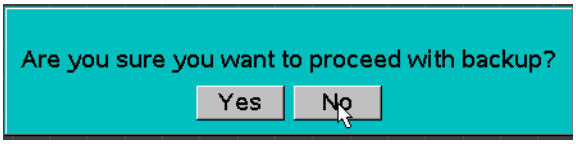

Figure 14-19. Confirmation Prompt

8. Select **Yes** to proceed. (If you select **No**, the backup aborts.)
9. System displays **Full Backup in Progress** as **Backup** proceeds.

NOTE: If desired, *uncheck* the options you do ***not*** want to **Backup** (Figure 14-18). If so, the system displays **Partial Backup in Progress** after you click **Backup** and as backup proceeds.

▶ *To Restore System Setup*

1. Power on the **SmartCart/SmartCart *sp*** or **Scan Engine** and allow it to fully boot.
2. Install USB stick containing previously backed up **System Setup** parameters into USB port at rear of **SmartCart/SmartCart *sp*** or **Scan Engine**.
3. A popup window will appear saying **Install media detected. Do you wish to install new software? S**elect **No** and press the **Set** button.
4. Press **Setup** button.
5. Highlight and select **Preset Admin** (Figure 14-6).
6. Highlight and select **Restore System** (Figure 14-7). The Restore Configuration screen displays:

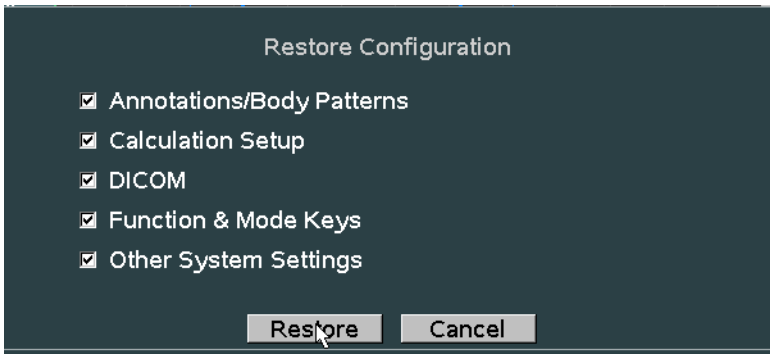

Figure 14-20. System Restore Configuration Screen

7. All options are checked (default). Click **Restore** to begin restore. The following message displays:

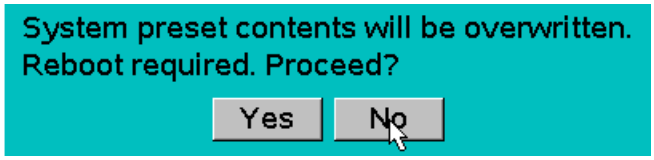

Figure 14-21. Overwrite Confirmation

8. Click **Yes** to proceed. (If you select **No**, the restore aborts.) The system displays **Full Restore in Progress** as **Restore** proceeds.

NOTE: If desired, *uncheck* the options you do ***not*** want to **Restore** (Figure 14-20). If so, the system displays **Partial Restore in Progress** after you click **Restore** and as restore proceeds.

Factory Presets

▶ *To Restore Factory Presets*

NOTE: Factory **Presets** are automatically stored on the Scan Engine and can be disabled (see page 7-8) but not erased or deleted.

1. Power on the **SmartCart/SmartCart *sp*** or **Scan Engine** and allow it to fully boot.
2. Press **Setup** button.
3. Highlight and select **Preset Admin** (Figure 14-6).
4. Highlight and select **Restore Factory** (Figure 14-7). The following menu displays with three options:

Figure 14-22. Restore Factory Menu

5. Select **All** to restore all factory Presets. The following message displays:

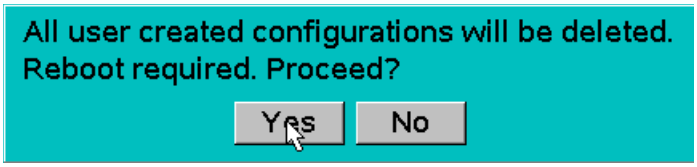

Figure 14-23. Confirmation Screen

   a. Click **Yes**. (If you select **No**, the restore is aborted.)
   b. The following message displays:

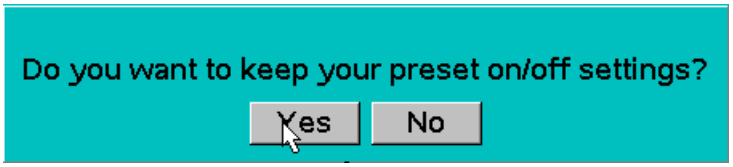

Figure 14-24. Preset Settings On/Off Screen

   c. Click **Yes** to keep your presets visible in system menus. (If you select **No**, the restore proceeds without keeping **preset on/off settings**.) The system will restore factory presets and shut down. You will need to reboot.

6. Select **Image Presets** to restore image factory presets only. The following message displays:

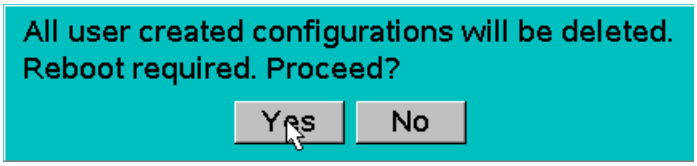

Figure 14-25. Confirmation Screen

   a. Click **Yes**. (If you select **No**, the restore is aborted.)
   b. The following message displays:

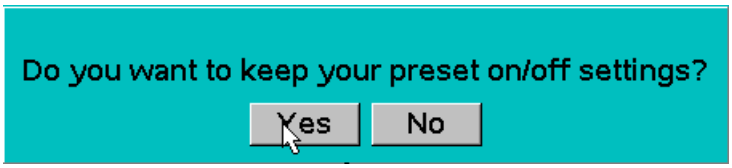

Figure 14-26. Preset Settings On/Off Screen

c. Click **Yes** to keep your presets visible in system menus. (If you select **No**, the restore proceeds without keeping **preset on/off settings**.) The system will restore factory presets and shut down. You will need to reboot.

7. Select **User Configs** to delete user configurations and restore factory presets. The following message displays:

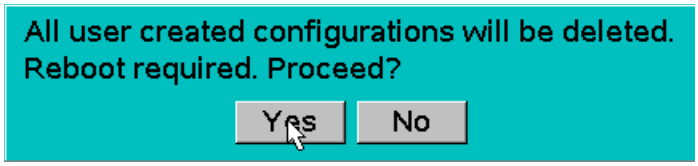

Figure 14-27. Confirmation Screen

d. Click **Yes** to proceed. (If you select **No**, the restore aborts.) The system will delete user configurations, restore factory presets, and shut down. You will need to reboot.

Software Upgrade/Installation

Periodically, ZONARE will release new software for your system. The upgrade procedure is very easy to perform and can be done by the user. Total installation time is approximately 15 minutes.

The method for accessing system software upgrades for installation at a User site is directly dependent upon the network and computer equipment present at the site. The different options are:

Best Option (fastest):

- Direct FTP download (over the Internet) of system software to an installed removable media via a network connection on the **SmartCart/SmartCart sp**.

2nd Best Option:

- Local laptop/PC FTP site download (over the Internet) of system software to a locally installed removable media.

Basic Option (slowest):

- Ground shipment of removable media, preloaded with system software installer files, to the User site.

To check on the latest software revision level that is currently available, please contact ZONARE Technical Support:

- 1-877-913-9663 (USA and Canada)

- 1-650-316-3199

Verifying Current System Software Revision

▶ *To Verify Current Software Revision*

The software revision is displayed in the top left corner of the **User Diagnostics Panel** (Figure 14-2). The software level is indicated by a series of digits, for example, **4.7.95**.

You can access the **User Diagnostics Panel**:

- Quickly press the Service key on the QWERTY keyboard to display the **User Diagnostics Panel**.

  OR

- Go to **Setup button | System Setup | Diagnostics** to display the **User Diagnostics Panel**.
- Using **Menu Control** on the Scan Engine, tab to **Tools | System Setup | Diagnostics** to display the **User Diagnostics Panel.**

System Software Installation

u To Install System Software (Scan Engine)

1. Verify that the **Scan Engine** is powered OFF.
2. Undock (remove) the **Scan Engine** from the cart.

NOTE: Make sure the battery pack in the **Scan Engine** has a minimum of 50% charge capacity *before* beginning this software upgrade procedure.

CAUTION: If the battery charge is too low, either replace the existing battery with a properly charged one or dock the **Scan Engine** in the cart for approximately 1 hour to recharge the battery to an adequate standalone use level.

NOTE: The **Scan Engine** may also be connected to the AC Power Pack.

3. Press the green power button (at the left rear of the **Scan Engine**) to power ON the unit.

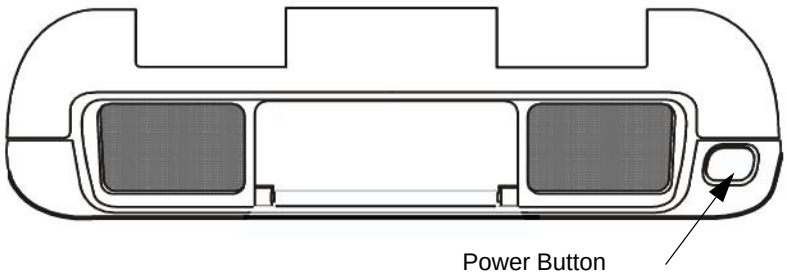

Figure 14-28. Scan Engine Power Button

4. Allow the **Scan Engine** to complete a normal boot (start) operation (approximately 25 seconds).
5. Open the rear access door on the **Scan Engine** and insert the removable media (USB Memory Stick) into the connector, pressing lightly to ensure that it is seated.

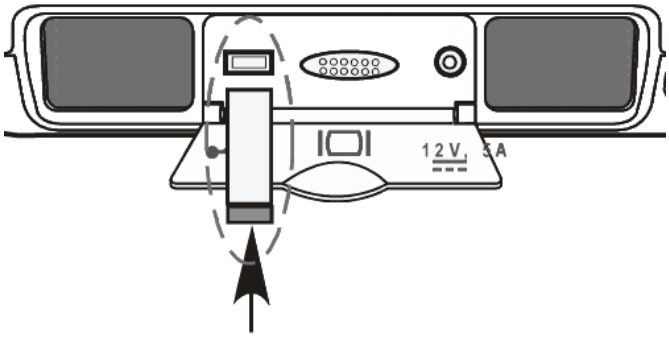

Figure 14-29. Insert Removable Media

6. A software installation dialog box will display on the LCD display:

   Install media detected. Do you wish to install new software: Yes/No

7. To begin the software installation, press the **Select** button on the **Scan Engine** for each of the two (2) dialog boxes that are sequentially displayed.

NOTE: If the software revision of the removable media is the same as the current version in the **Scan Engine** and you want to cancel, select **No**. If you want to cancel for any other reason, press the **Back** key and then manually remove the removable media.

8. The software install process is as follows:

   - System license verification
   - Software file transfer (download)
   - Software validation

   The complete software downloading sequence will take approximately 5 minutes.

9. At the completion of successful software installation, a dialog box displays on the LCD screen, instructing the user to remove the removable media and press any key to reboot the **Scan Engine**.
10. Remove the removable media from the **Scan Engine**.
11. Press any key on the System and it will reboot and begin normal operation.

▶ *To Install System Software (SmartCart/SmartCart sp)*

IMPORTANT: System software for the SmartCart/SmartCart sp must be installed with the Scan Engine docked on the SmartCart/SmartCart sp.

1. Dock the Scan Engine on the SmartCart/SmartCart sp (see "Docking/Undocking Scan Engine/Scan Module" on page 2-9).
2. Power ON the SmartCart/SmartCart sp (see "Powering ON/OFF" on page 2-10).
3. Insert the removable media (USB Memory Stick) into a USB port on the rear of the SmartCart/SmartCart sp, pressing lightly to ensure that it is seated.
4. A software installation dialog box will display on the LCD display:

Install media detected. Do you wish to install new software: Yes/No

5. To begin the software installation, press the **Select** button on the **Scan Engine** for each of the two (2) dialog boxes that are sequentially displayed.

NOTE: If the software revision of the removable media is the same as the current version and you want to cancel, select **No**. If you want to cancel for any other reason, press the **Back** key and then manually remove the removable media.

6. The software install process is as follows:
   - System license verification
   - Software file transfer (download)
   - Software validation

   The complete software downloading sequence will take approximately 5 minutes.

7. At the completion of successful software installation, a dialog box displays on the LCD screen, instructing the user to remove the removable media and press any key to reboot.
   - Remove the removable media from the **SmartCart/SmartCart sp**.
   - Press any key on the System to reboot and begin normal operation.

Basic System Care

SmartCart/ SmartCart *sp* Backup ZPak Battery (optional)

The **SmartCart/SmartCart *sp*** may be ordered with an optional ZPak battery that can power the **SmartCart/SmartCart *sp*** for up to 3 hours on a full charge. The battery will allow the entire **SmartCart/SmartCart *sp*** to be operated in normal use without connection to AC power.

The battery is mounted at the base of the **SmartCart/SmartCart *sp*** and is automatically kept charged from the DC power supplies within the System. The battery is charged (as needed) whenever the **SmartCart/SmartCart *sp*** is connected to AC power.

Checking the Battery (Scan Engine)

The **Scan Engine** contains a rechargeable battery. The charge on this battery is automatically maintained if the **Scan Engine** is docked on a **SmartCart/SmartCart *sp*** that remains connected to an active power receptacle with the circuit breaker (located at the rear of the **SmartCart/SmartCart sp**) in the ON position.

u To Check the Battery

1. Ensure that the **SmartCart/SmartCart *sp*** has been connected to an active power receptacle for at least 4 hours with the **Scan Engine** docked.

NOTE: Scanning during the battery charge will increase the amount of time for charging.

2. Remove the **Scan Engine** from the **SmartCart/SmartCart sp**. If a transducer is installed, remove it and store properly.

3. Press the **Power** button on the **Scan Engine**, and then immediately make note of the battery charge LED indicators (located on the lower left side of the **Scan Engine**; see Figure 4-4 on page 4-5). All four battery LED indicators are lit when the battery is fully charged. The four LED indicators are illuminated in 25% increments:
   - 4 LEDs = 76-100% charge
   - 3 LEDs = 51-75% charge
   - 2 LEDs = 26-50% charge
   - 1 LED = 0-25% charge
4. If you are certain the battery is fully charged (as described above) and the **Scan Engine** does not perform accordingly, replace the battery or contact ZONARE Technical Support for assistance. There are no user remedies for battery insufficiency problems other than maintaining a full charge.

Battery Charging (Scan Engine)

For optimum performance, the battery packs should be maintained in a charged state. Battery charging occurs when the **SmartCart/SmartCart *sp*** is connected to an active power receptacle, the battery pack is inserted into the **Scan Engine**, and the **Scan Engine** is stored in a docked condition on the **SmartCart/SmartCart sp**.

Remote charging and recalibrating (resetting of the charge fuel gauge) of the battery pack is done using the ZONARE 2-Bay Battery Charger unit (Part # Z311: for 110V or #Z312: for 220V).

Battery Maintenance (Scan Engine)

The battery is a spill-proof maintenance-free sealed battery. There are no user actions for battery maintenance other than maintaining a charged state.

Typical battery life is one to two years when the battery is maintained in a charged state. Leaving the battery in an uncharged state reduces its life. Using the Zonare 2-Bay Battery Charger's "Recalibrate" (*recondition*) cycle on a scheduled basis will help maintain optimum efficiency and performance of the batteries.

CAUTION: If the **SmartCart/SmartCart *sp*** will be stored in a location where power cannot be supplied (to maintain the battery in a charged state) for more than five days, the battery should be removed from the **Scan Engine** to help prevent potentially hazardous conditions as a result of the battery deteriorating.

WARNING: To protect the **Scan Engine** battery from potential thermal damage, the System monitors the temperature of the battery at all times. If the battery is detected as exceeding the maximum safe operating temperature, a warning message will appear on the **SmartCart/SmartCart *sp*** display.

NOTE: The Operator should immediately complete all active operations in preparation for the System automatically initiating a power-down sequence.

Internal Storage Media Maintenance

The **Scan Engine** internal storage media should not be used for long-term storage of studies and patient information. Studies should be deleted from the storage media on a regular basis (daily or weekly) as part of normal User maintenance on the **Scan Engine**.

A **Low Storage** warning will appear when “free” storage falls below a minimum threshold. When you see this warning, immediately export studies to a permanent storage media (USB Memory Stick) and then delete those studies from the internal storage media. If using the SmartCart/SmartCart sp, you can export the exams to the cart’s internal hard drive.

If “free” storage reaches zero, the system will automatically create space by deleting the oldest study.

LCD Display Cleaning (SmartCart/ SmartCart sp)

WARNING: Take care not to damage or scratch the glass or LCD panel. Do not apply pressure on the glass or LCD panel. Do not apply or spray liquid directly to the glass, panel, or cabinet as excess liquid may cause damage to internal electronics. Apply the liquid to the cleaning cloth.

WARNING: Do NOT use any of the following:

- Lye or cleaning solutions containing lye
- Acid
- Detergents with fluoride
- Detergents with ammonia
- Detergents with abrasives
- Steel wool
- Sponge with abrasives
- Cloth with thread made of steel
- Other coarse tools

▶ *To Clean the Front Glass*

1. Before cleaning, turn off the AC circuit breaker on the **SmartCart/SmartCart *sp*** to remove all power from the unit.
2. Clean the glass using a soft cotton cloth lightly moistened with a watery solution or a mild commercial glass-cleaning product suited for coated glass surfaces.
3. Wipe dry with a clean, dry, soft, lint-free cloth

▶ *To Clean the External Case*

1. Before cleaning, turn off the AC circuit breaker on the **SmartCart/SmartCart *sp*** to remove all power from the unit.
2. Wipe the **SmartCart/SmartCart *sp*** surfaces with a safe disinfectant solution such as Sani-Cloth Plus or isopropyl 50% alcohol and follow the disinfectant label instructions for use.
3. Repeat with water only.
4. Wipe dry with a clean, dry, soft cloth.

WARNING: Do not expose the external case of the LCD Display to any of the following agents:

- Cidex
- Betadine

General SmartCart/ SmartCart *sp* Exterior Surface Cleaning

- Do not use disinfectants (such as gluteraldahyde or hydrogen peroxide) or acetone to clean any surfaces on the **SmartCart/SmartCart *sp*** or their accessories.
- Before cleaning, turn off the AC circuit breaker on the **SmartCart/SmartCart *sp*** to remove all power from the unit, and remove the battery from the **Scan Engine**.
- Wipe the **SmartCart/SmartCart *sp*** surfaces with a safe disinfectant solution such as Sani-Cloth Plus or isopropyl 50% alcohol and follow the disinfectant label instructions for use.
- Do not autoclave, immerse, or attempt to sterilize the LCD display or transducers.
- Do not spill or spray liquid directly on the control panel, LCD display, battery charger, AC power adapter, or transducer connector.
- Using soap and water or a mild disinfectant, gently wipe the surfaces of the **SmartCart/SmartCart *sp*** with a moistened cloth.
- After each use, remove and dispose of any use cover/sheath. Wipe off any excess gel from the transducer and clean it properly.
- Air-dry the **SmartCart/SmartCart *sp***.

WARNING: To avoid electrical shock before cleaning the **SmartCart/SmartCart sp**, turn off the AC circuit breaker at the rear of the **SmartCart/SmartCart *sp*** and remove the battery from the **Scan Engine**. Always use protective eyewear and clothing when cleaning or disinfecting the **SmartCart/SmartCart *sp***.

- The level of disinfection required for the **SmartCart/SmartCart *sp*** is dictated by the type of exposure the **SmartCart/SmartCart *sp*** came in contact with.
- If premixed disinfection solution is used, observe the solution expiration date to ensure that the solution has not expired.

CAUTION: Do not allow the disinfectant to contact metal surfaces. Use a soft cloth and warm soapy water to remove any disinfectant that remains on metal surfaces.

Transducer Maintenance

NOTE: This section describes maintenance procedures for all ZONARE transducers except the P8-3TEE transducer. For the P8-3TEE transducer, see page 6-14.

Regularly check transducers for signs of wear or damage.

WARNING: Bent, broken, or missing pins on the transducer connector may cause poor image quality, including possible mirror image artifact. Be sure to check pins before connecting transducer to the ZONARE ultrasound system. If pins are bent, broken, or missing, do not use the transducer and call ZONARE Technical Support.

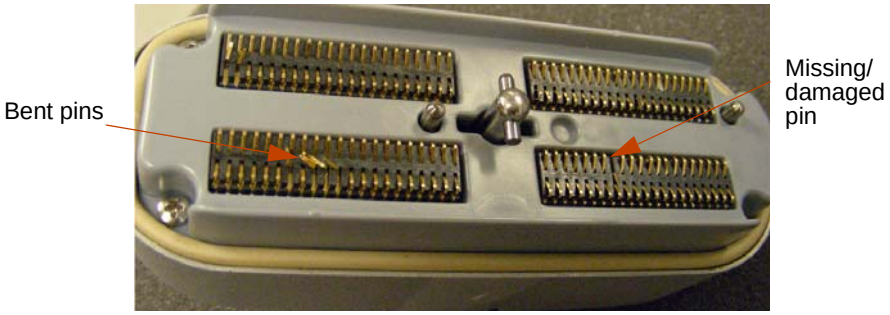

Figure 14-30. Bent, Broken, or Missing Pins on Transducer

Inspecting Transducers

Inspect transducers at least weekly for the following problems.

- Inspect each transducer for signs of wear or damage:
  - Cracks in case or transducer face
  - Cuts or gouges on any part of the transducer, including transducer face, case, cable, and connector
  - Buckling or bulging of the lens material on the transducer face
  - Damage to the transducer connector, including bent, broken, or missing pins

WARNING: Immediately replace a transducer that exhibits any of the above damage symptoms.

Verifying Imaging Performance

Verify transducers for proper imaging performance at least weekly.

- Scan yourself or a tissue-equivalent phantom with each transducer.
- Verify uniform image quality. Look for signs of drop-out (dark columns in the image area).

Cleaning and Disinfecting Transducers

Refer to page 6-14 for cleaning and disinfecting procedures for the P8-3 TEE transducer.

Refer to “ZONARE Transducers Cleaning and Disinfection” (Q00066) for cleaning and disinfecting procedures for all other transducers.

System Mechanical & Visual Inspection

Verifying System Display

1. Verify the Display is securely mounted to the system.
2. Turn Display left and then right. Verify Display moves freely in both directions.
3. Tilt Display up and then down. Verify Display moves freely in both directions.

Verifying System Controls

1. Hold the release button. Raise and lower the system Control Panel.
2. Verify the Control Panel moves up, down, and locks when button released.
3. If control panel drifts after releasing the button, an adjustment of the control cable may be required. Contact Technical Support.

Verifying Wheel & Brake Operation

1. Check the wheels and wheel brake for damage.
2. Verify brake operation. Engage the brake on each wheel by pressing it down. The two front wheels should lock in position. Pressing the brakes a second time should release them.
3. If the brakes fail to work correctly, contact ZONARE Technical Support.

Verifying Cable & Peripheral Connectivity

With all System power disconnected, verify the following:

1. Check the AC power cord for damage or excessive wear.
2. Verify peripherals are securely attached.
3. Verify peripheral cabling is properly connected.
4. If defects found, correct or replace defective item.

System Functionality

Verifying System Controls

1. Verify operation and backlighting of all Control Panel buttons.
2. If a button fails to light, contact Technical Support to order replacement part.

Verifying System Operation

1. Power ON the System.
2. Verify the System completes the boot sequence and the monitor displays the image screen within 30 seconds.
3. Record the System software version found on the User Diagnostics Panel (Figure 14-2).
4. Verify the System recognizes all transducers when connected.
5. Verify the Trackball functions smoothly.
6. Check the operation of B-mode, M-mode, Color.
7. Check the operation of PW Doppler mode. Invert the waveform and verify that sound is audible from both speakers.

Verifying Peripherals

B/W and Color Printer

1. Acquire the desired ultrasound image on the **SmartCart/SmartCart *sp***.
2. Press the **Freeze** button to obtain a static image.
3. Press the **Print** button to trigger a print of the current onscreen image to the Sony UP-D897MD B/W printer, Olympus P-11 Digital Color Printer, or Sony UP-D25MD Color Printer.
4. If print quality is less than optimal, clean the print head and test again.
5. If necessary, adjust printer settings. Consult the printer manual for more instructions on settings.

Print Reports

1. Generate the desired **Report** page information on the **SmartCart/SmartCart *sp***.
2. Select the **Print** function in the **Report** page menu to trigger a print of the current **Report** pages to the unmounted external postscript printer.
3. If necessary, adjust printer settings. Consult the printer manual for more instructions on settings.

Shipping and Storage

The environmental conditions required for shipping and/or storage are not the same as for normal operation. Refer to Chapter 16 “Specifications.”

To prevent fire or shock hazard, do not expose the **SmartCart/SmartCart *sp*** to moisture or rain. If it is necessary to transport the cart through precipitation, place a protective cover over it. If moisture gets into the **SmartCart/SmartCart sp**, allow the cart to dry thoroughly before plugging the power cord into an electrical outlet.

Do not expose the **SmartCart/SmartCart *sp*** to extremely high temperatures because damage may result. Avoid storing the **SmartCart/SmartCart *sp*** in a hot environment. Refer to Chapter 16 “Specifications,” for allowable operating and storage environmental information.

Avoid sudden changes in temperature because condensation can form on the internal parts of the **SmartCart/SmartCart sp**. If the **SmartCart/SmartCart *sp*** has been moved between environments with extremes of temperature and/or humidity, allow the cart to rest for at least 30 minutes in a controlled environment before using. Refer to Chapter 16 “Specifications,” for acceptable storage and operating temperatures.

Handle and transport the **SmartCart/SmartCart *sp*** gently. Do not expose cart to rough movements or vibrations, which may damage the cart.

When the **SmartCart/SmartCart *sp*** is not in use, be certain to leave the power cord connected to an active power receptacle (and the circuit breaker turned ON for the **SmartCart/SmartCart sp**) to keep the **Scan Engine** charged.

Disposal

The **SmartCart/SmartCart *sp*** contain lead solder on the circuitry and storage batteries. Follow applicable hospital and/or local regulations to dispose of batteries and electronics properly. No special precautions need to be taken except those that are usual for disposal of electrical and electronic equipment of this type.

For instructions on proper disposal methods for the following consumable items, refer to the directions packaged with them.

WARNING: Transducer covers may be contaminated and must be handled accordingly.

WARNING: Do not heat or discard batteries in a fire.

15

Troubleshooting

ZONARE Contact Information

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User Troubleshooting Procedures

Before calling ZONARE Technical Support, please perform the following troubleshooting procedures on the affected component(s). Do not remove any of the System covers. Only controls and other hardware located on the outside of the system are user serviceable. Trained ZONARE service personnel should be the only people to attend to problems that require access to the system's internal electronic devices.

Image Trouble-shooting Techniques

Diagnostic ultrasound is a technique-dependent imaging modality. To obtain the best possible patient care from any ultrasound equipment, the system ***must*** be operated by individuals (users) who have sufficient training in ultrasound image acquisition and interpretation. Users ***must*** become familiar with each of their imaging systems as lack of knowledge could result in compromised patient care.

- Always make sure appropriate transducer is used for study being performed
- Always make sure active preset is appropriate for study being performed
- Know how to recognize acoustic artifacts in image
- Consult AIUM recommended protocols & equipment specifications:

  - Abdominal
  - Abdominal Aorta
  - Breast
  - Documentation
  - Extracranial
  - Extremity Arteries
  - Fast
  - Hip
  - Musculoskeletal
  - Neonatal Spine
  - Obstetric
  - Pelvis
  - Peripheral Arterial
  - Peripheral Venous
  - Post Dialysis Access
  - Pre Dialysis Access
  - Prostate
  - Scrotal
  - Shoulder
  - Sono Hysterography
  - Thyroid
  - Transcranial

Image too soft or hazy

- Increase **Edge** setting
- Decrease **Persistence** setting

Image too much contrast

- Increase **Dynamic Range** setting
- Decrease **Map** setting
- Use **Compounding** mode

Image grainy

- Decrease **Edge** setting
- Increase **Frequency**
- Increase **Persistence** setting
- Use **Compounding** mode

Insufficient resolution

- Increase **Frequency**
- **Zoom** to area of interest
- Use **Optimize** sound speed correction (**ZST**)
- Use a higher frequency transducer for the application

Insufficient penetration

- Decrease **Frequency**
- Use a lower frequency transducer for the application

Lost part of image

- Make sure gel covers complete face of transducer
- Make sure transducer is in complete contact with patient
- If a transducer cover is used, remove air bubbles between cover and transducer face

No (or poor quality) B-Mode Image

- Make sure the brightness and/or contrast settings for the LCD Display have not been altered from proper settings. For information about LCD Display settings, see page 2-6.

NOTE: To ensure the quality of the grayscale resolution of the LCD Display, use the grayscale test pattern (via the **Diagnostic** menu) available on the **SmartCart/ SmartCart sp**. Ensure that all shades can be visualized, making small adjustments to brightness and contrast from factory defaults, as required, to see all intensities.

- Adjust the B-Mode **Gain** control.
- In the onscreen menu, adjust the **A Output** (acoustic power) level.

- In the onscreen menu under the **Preset** tab, select one of the factory default settings (**General**, etc.) to determine possible maladjustment of user presets.
- Ensure an adequate supply of acoustic coupling gel and good patient/transducer contact.
- Switch to a different transducer to determine if the problem is transducer-specific.

▶ *No (or poor quality) Color mode image or PW Doppler*

- Make sure the brightness and/or contrast settings for the LCD Display have not been altered from proper settings. For information about LCD Display settings, see page 2-6.

NOTE: To ensure the quality of the grayscale resolution of the LCD Display, use the grayscale test pattern (via the **Diagnostic** menu) available on the **SmartCart/ SmartCart sp**. Ensure that all shades can be visualized, making small adjustments to brightness and contrast from factory defaults, as required, to see all intensities.

- Make adjustments to the various Doppler controls (**Gain, Filter, Scale**) to attempt to resolve problem.
- Ensure that the scanning angle between the transducer face and the direction of blood flow is optimized.
- In the onscreen menu under the **Preset** tab, select one of the factory default settings (**General**, etc.) to determine possible maladjustment of user presets.
- Ensure there is an adequate supply of acoustic coupling gel and good patient/transducer contact.
- Switch to a different transducer to determine if the problem is transducer-specific.

▶ *No (or poor quality) CW Doppler*

If using the **CW Aux** transducer:

- Disconnect the **CW Aux** connector from the front of the **SmartCart** and then reconnect to ensure electrical continuity.
- Try using a different **CW Aux** transducer.
- Try using a **P4-1c** transducer to perform **CW** mode operation.

If using the **P4-1c** transducer:

- Try using the **CW Aux** transducer.
- Unplug the **P4-1c** connector from the MTP and reconnect to a different port on the MTP.
- Try operating the **P4-1c** transducer in **PW Doppler** mode.
- If system still fails to operate **CW Doppler**, contact ZONARE Technical Support.

▶ *No ECG operation*

- Activate ECG operation by pressing the **ECG** key on the **SmartCart** QWERTY keyboard.

- Check the placement of the ECG pads on the patient and ensure connectivity of all leads.
- Inspect the integrity of the individual ECG lead wires, connections, and attachment at the connector of the main ECG cable harness.
- Disconnect the ECG connector from the front of the **SmartCart** and then reconnect firmly.
- If system still fails to operate ECG, contact ZONARE Technical Support.

Acoustic Artifacts

The transducer adds its own signature to the echo information in the form of beam width effects, axial resolution limitations, and frequency characteristics. The control choices made by the sonographer that affect amplification, signal processing, and echo signal display can lead to significant differences in the displayed appearance of echo data. Following is a brief discussion of acoustic artifacts. An understanding of the physical basis for the production of signals displayed on ultrasound images is helpful in minimizing artifacts on images and interpreting the results of studies.

An artifact is an echo displayed in a different position from its corresponding reflector in the body. Artifacts can also be caused by intervening tissue properties. Artifacts can originate from external noise, reverberations, multi-path reflections, or misadjusted equipment. They can also come from the ultrasonic beam geometry and unusual changes in beam intensity. Artifacts and their manifestations are listed below, and following are some definitions of various artifacts.

- Added objects displayed as speckle, section thickness, reverberation, mirror image, comet tail, or ring down
- Missing objects due to poor resolution
- Incorrect object brightness due to shadowing or enhancement
- Incorrect object location due to refraction, multi-path reflections, side lobes, grating lobes, speed error, or range ambiguity
- Incorrect object size due to poor resolution, refraction, or speed error
- Incorrect object shape due to poor resolution, refraction, or speed error

Acoustic saturation occurs when received signals reach a system's high-amplitude limit. At that point the system becomes unable to distinguish or display signal intensities. At the point of saturation, increased input will not increase output.

Aliasing occurs when the detected Doppler frequency exceeds the Nyquist limit. It is characterized on the spectral display by the Doppler peaks going off the display, top or bottom, and then continuing on the other side of the baseline. On the Color display an immediate change in color from one Nyquist limit to the other is seen.

Comet tail is a form of reverberation artifact produced when two or more strong reflectors are close together and have a high propagation speed. In this case, sound does not travel directly to a reflector and back to the transducer; and a strong linear echo appears at the reflector and extends deeper than the reflector.

Enhancement is an increased relative amplitude of echoes caused by an intervening structure of low attenuation.

Focal enhancement, also known as **focal banding**, is the increased intensity in the focal region that appears as a brightening of the echoes on the display.

Mirror imaging artifact is most commonly seen around the diaphragm; this artifact results from sound reflecting off another reflector and back.

Mirroring is the appearance of artifacts on a spectral display when there is improper separation of forward and reverse signal processing channels. Consequently, strong signals from one channel mirror into the other.

Multi-path positioning and refraction artifacts describe the situation in which the paths to and from a reflector are different. The longer the sound takes traveling to or from a reflector, the greater the axial error in reflector positioning (increased range). Refraction and multi-path positioning errors are normally relatively small and contribute to general degradation of the image rather than to gross errors in object location.

Propagation speed errors occur when the assumed value for propagation speed by the ultrasound system is incorrect. If the actual speed is greater than that assumed, the calculated distance to a reflector is too small, and the reflector will be displayed too far from the transducer. Speed error can cause a structure to be displayed with incorrect size and shape.

Range ambiguity can occur when reflections are received after the next pulse is transmitted. In ultrasound imaging, it is assumed that for each pulse produced, all reflections are received before the next pulse is sent out. The ultrasound system calculates the distance to a reflector from the echo arrival time assuming that all echoes were generated by the last emitted pulse. The maximum depth to be imaged unambiguously by the system determines its maximum pulse repetition frequency.

Reverberation is the continuing reception of a particular signal because of reverberation rather than reflection from a particular acoustic interface. This phenomenon is analogous to the effect created by mirrors positioned on opposite walls when an object, a head for instance, is placed between the mirrors. The image of the head is reflected back and forth infinitely between the two mirrors, creating the optical illusion of multiple heads. Reverberations are easily identifiable, because they are equally spaced on the display screen.

Scattering is the diffuse, low-amplitude sound waves that occur when acoustic energy reflects off tissue interfaces smaller than a wavelength. In diagnostic ultrasound, Doppler signals come primarily from acoustic energy back-scattered from red blood cells.

Shadowing is the reduction in echo amplitude from reflectors that lie behind a strongly reflecting or attenuating structure. This phenomenon occurs when scanning a lesion or structure with an attenuation rate higher than that of the surrounding tissue. The lesion causes a decrease in beam intensity, which results in decreased echo signals from the structures beyond the lesion. Consequently, a dark cloud behind the lesion image forms on the screen. This cloud, or shadow, is useful as a diagnostic clue.

Side lobes (from single-element transducers) and **grating lobes** (from array transducers) cause objects that are not directly in front of the transducer to be displayed incorrectly in lateral position.

Speckle appears as tissue texture close to the transducer but does not correspond to scatterers in tissue. It is produced by ultrasound wave interference and results in general image degradation.

Spectral broadening is a display phenomenon that occurs when the number of energy-bearing Fourier frequency components increases at any given point in time. As a consequence, the spectral display is broadened. Spectral broadening can indicate the disturbed flow caused by a lesion, and therefore it is important diagnostically. However, broadening can also result from interaction between flow and sample volume size, in which case it is an artifact.

Speed of sound artifacts occur if the sound propagation path to a reflector is partially through bone, and the speed of sound is greater than in the average soft tissue. Echo position registration artifacts will be produced. Reflectors appear closer to the transducer than their actual distance because of this greater speed of sound, resulting in a shorter echo transit time than for paths not containing bone.

Power-ON Problems

▶ *SmartCart/SmartCart sp (Docked Scan Engine/Scan Module) Fails To Power ON*

- Ensure the AC power is connected to a wall outlet.
- Ensure the AC power cord is fully seated in the socket on the rear of the cart.
- Ensure the circuit breaker (located in the lower-left of the rear panel) is in the ON (“I” pressed in) position.
- With active AC power applied and a docked **Scan Engine/Scan Module** on the Cart, verify that LEDs located at bottom/rear of **SmartCart/SmartCart *sp*** are in the following condition:
  - LED #1: Flashing (Power Supply “heartbeat” – supply is alive)
  - LED #2: ON (or flashing) if system is equipped with ZPAK battery
    OFF if system does *not* have ZPAK battery
  - LED #3: OFF (always)
  - LED #4 ON, after Cart Power **ON/OFF** button on scanner deck is pressed
  - LED #5: ON (with docked scanner)
- Verify the **Scan Engine/Scan Module** is securely docked on the docking plate of the Cart and then repeat the power-on procedure.
- If the Cart still does not power ON and is equipped with a **Scan Engine**, remove the **Scan Engine** and attempt to operate the **Scan Engine** in standalone mode (powered by its internal battery) to determine if the problem is with the Cart or **Scan Engine**.

NOTE: The **Scan Module** cannot be operated undocked from the Cart.

- If either component fails to start-up after these steps, contact ZONARE Technical Support.

Scan Engine (Undocked) Fails To Power ON

- Remove the battery from the **Scan Engine**, and then press the battery charge status button (on the label side of the battery) to ensure that a charge of greater than 25% is available. If the battery charge is insufficient, replace the battery or dock the **Scan Engine** in the Cart and allow time to recharge the battery.
- Disconnect the transducer from the **Scan Engine** (if attached) and then repeat the attempt at powering ON the unit.
- Dock the **Scan Engine** on the Cart and attempt to power ON the System. If the Cart powers ON, the problem is in the **Scan Engine** battery. Replace the battery.
- If the **Scan Engine** still fails to power ON, contact ZONARE Technical Support.

System Start-Up Problems

Scan Engine (Undocked) Fails To Properly Boot

- Press the Power button on the **Scan Engine** to begin System boot.
- If the **Scan Engine** fails to boots properly, remove the transducer and try again.
- If the **Scan Engine** still fails to boot properly, insert a System software installer USB Memory Stick into the USB port on the rear of the **Scan Engine**, and perform a system software reinstallation process.
- If the **Scan Engine** still fails to complete the boot operation, contact ZONARE Technical Support.

Peripheral Problems

Peripheral(s) Fails To Power ON

- Check to ensure that AC power is applied to the Cart, and that the System is powered ON.
- Check the AC power cord connections to the peripheral.
- Press the power button on the peripheral to ensure it is powered on.
- If the peripheral fails to power ON after these steps, contact ZONARE Technical Support.

Color or B/W Printer Fails to Print

- Verify that the **Freeze** button has been pressed to obtain a static image before pressing the assigned print button (**Print**, etc).
- Check that the printer has paper available.
- Check that the printer has an operational color ribbon cartridge installed (Sony UP-D25MD color printer)
- Ensure that the USB cable is properly connected between the peripheral and the Cart.
- If the printer fails to print after these steps, contact ZONARE Technical Support.

Printer Error Messages

Table 15-1. Sony UP-D897 B&W Printer

Message	Description and Remedy
DOOR	The paper door is open – Close the paper door until it locks securely
EMPTY	No paper is loaded or paper has all been used – Add paper
COOL	The protection circuit that prevents the thermal head from overheating has been activated – Allow the printer to cool; normal printing will resume when message disappears
WAIT	The printer is busy performing internal processing – Wait for processing to complete

Table 15-2. Sony UP-D25MD Color Printer

For error messages, see documentation that came with Sony UP-D25MD Color Printer.

Transducer Problems

▶ *Transducer Not Recognized By System (No B-Mode Imaging)*

- To ensure a positive connection, disconnect the transducer and reconnect it.
- Inspect the metal contact pins on the connection surface of the transducer connector for bending or other damage.
- To determine a problem with the transducer or system, attach a different transducer. t
- Disconnect the transducer. Power OFF the System. Power the System back ON and reattach the transducer to test for functionality.
- Remove the **Scan Engine** from the Cart and repeat the transducer removal/ installation process.
- If system still fails to operate any transducers, contact ZONARE Technical Support.

General Operation Problems

▶ *Function (F1-F4) Key(s) Do Not Operate*

- Using the onscreen menu, go to **Setup button | System Setup | Keys** to access the menu for configuring the function keys.

NOTE: The function keys on the **SmartCart/SmartCart *sp*** can be configured independently from the function keys on the standalone **Scan Engine**.

▶ *Unable to Modify Existing User Preset (Grayed Out)*

- Make sure the desired user **Preset** has been previously (i.e., before attempting to modify it) selected as the active preset.

▶ *Unable to Access DICOM Configuration Menus (Grayed Out)*

- Verify license file (**Z-ONE.dat**) contained on software installer USB Memory Stick used during last software installation is current.
- Reinstall software on the System and test for DICOM functionality at completion.

- If problem continues, call ZONARE Technical Support to verify DICOM option has been purchased for this System.

Hardware Date of Manufacture

ZONARE hardware serial numbers display the date of manufacture in the last three characters. The format is YYM. For example, the serial number **01234C12A** indicates the item was manufactured in January 2012 (YY = 12 = 2012; M = A = January).

Send Log Files to ZONARE

IMPORTANT: If you detect a problem with the system, you can hold down **Service** key on QWERTY keyboard to force system to save log files. *This is the only way for ZONARE to get log files for problems that are not crashes*.

With this new feature, you have the option of entering text to describe the problem to help Zonare engineers analyze the log files.

▶ *To Send Log Files*

NOTE: To disable this function, go to Figure 14-3, "User Diagnostics Panel | Settings Screen," on page 14-5 and uncheck the box for **Display Service key log info dialog**.

1. Press and hold down **Service** key. System automatically stores the logs and then beeps.
2. System will display the following dialog box:

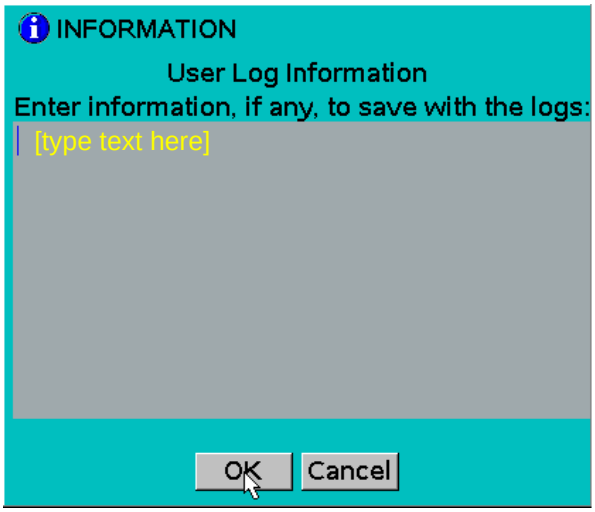

Figure 15-1. User Log Information Screen

3. Type in a brief description of the problem you are having and click **OK**. System will save **ProbDescLog_[datestring].txt** to logs directory with other files, and system will submit FTP job to transfer logs including new **ProbDescLog** file.

NOTE: Go to "Settings" on page 14-5 for information on configuring system to send log files via FTP.

16

Specifications

This chapter provides electrical, connection, physical, environmental, and authorized accessory specifications, including the P8-3TEE transducer.

For other transducer-related specifications, see “Acoustic Output” in the **4.3 Safety Manual**.

Component Specifications

Table 16-1. Specifications - SmartCart/SmartCart *sp* w/Scan Engine

Type	Parameter	Value
Electrical	Power requirements	100 - 240V~, 50 - 60Hz, 6A max
	Power consumption (no peripherals) (max.)	100W (342 BTU/Hr)
	Power consumption (w/ peripherals) (max.)	442W (1512 BTU/Hr)
Environmental (operating)	Cooling requirements	See power consumption above.
	Air temperature	0 - 35^{o}C (32 - 95^{o}F)
	Humidity	15 - 80%, non-condensing
	Pressure	700 - 1060 hPa
Environmental (storage)	Air temperature	-20 - 60^{o}C (-4 - 140^{o}F)
	Humidity	15-90%, noncondensing
	Pressure	500 - 1060 hPa

Table 16-1. Specifications - SmartCart/SmartCart *sp* w/Scan Engine

Type	Parameter	Value
Physical (weight)	SmartCart	65.3 kg (144 lb)
	Scan Engine – (w/battery)	2.5 kg (5.6 lb)
	SmartCart Power Cord	0.6 kg (1.4 lb)
	USB Printer & Bracket	3.4 kg (7.6 lb)
	Battery & Bracket	4.1 kg (9.1 lb)
	MPP, CW, ECG	1.4 kg (3.0 lb)
	Operating Weight Subtotal	*77.4 kg (170.7 lb)*
	Scan Engine Box	1.1 kg (2.4 lb)
	System Shipping Container	41.5 kg (91.6 lb)
	TOTAL SHIPPING WEIGHT	*120.1 KG (264.7 LB)*
Physical (dimensions)	SmartCart – height, max (in operational use)	157.5 cm (62 in)
	SmartCart – height, min (in operational use)	128 cm (50.5 in)
	SmartCart – height, min (display lowered for transport)	104 cm (41 in)
	SmartCart – width	51 cm (20.1 in)
	SmartCart – depth	72 cm (28.2 in)
	Scan Engine – height	7.3 cm (2.9 in)
	Scan Engine – width	25.7 cm (10.1 in)
	Scan Engine – depth	25 cm (9.8 in)
I/O connectors	Ethernet (1 port)	RJ-45 – 10/100BaseT
	USB 2.0 (4 ports)	USB-Type A (VBUS 5.0V, 0.5A max)
	External Video (1 Port)	DVI (Digital Video Interface) on an industry standard HDMI style connector

Table 16-2. Specifications - SmartCart/SmartCart *sp* w/Scan Module

Type	Parameter	Value
Electrical	Power requirements	100 - 240V~, 50 - 60Hz, 6A max
	Power consumption (no peripherals) (max.)	100W (342 BTU/Hr)

Table 16-2. Specifications - SmartCart/SmartCart *sp* w/Scan Module

Type	Parameter	Value
	Power consumption (w/ peripherals) (max.)	442W (1512 BTU/Hr)
Environmental (operating)	Cooling requirements	See power consumption above.
	Air temperature	0 - 35^{o}C (32 - 95^{o}F)
	Humidity	15 - 80%, noncondensing
	Pressure	700 - 1060 hPa
Environmental (storage)	Air temperature	-20 - 60^{o}C (-4 - 140^{o}F)
	Humidity	15 - 90%, noncondensing
	Pressure	500 - 1060 hPa
Physical (weight)	SmartCart	65.3 kg (144 lb)
	Scan Module	1.6 kg (3.5 lb)
	SmartCart Power Cord	0.6 kg (1.4 lb)
	USB Printer & Bracket	3.4 kg (7.6 lb)
	Battery & Bracket	4.1 kg (9.1 lb)
	MPP, CW, ECG	1.4 kg (3.0 lb)
	Operating Weight Subtotal	*76.4 kg (168.5 lb)*
	Scan Module Box	1.1 kg (2.4 lb)
	System Shipping Container	41.5 kg (91.6 lb)
	TOTAL SHIPPING WEIGHT	*119 kg (262.5 lb)*
Physical (dimensions)	SmartCart – height, max (in operational use)	157.5 cm (62 in)
	SmartCart – height, min (in operational use)	128 cm (50.5 in)
	SmartCart – height, min (display lowered for transport)	104 cm (41 in)
	SmartCart – width	51 cm (20.1 in)
	SmartCart – depth	72 cm (28.2 in)
	Scan Module – height	5.4 cm (2.1 in)
	Scan Module – width	22.0 cm (8.7 in)
	Scan Module – depth	25 cm (9.8 in)

Table 16-2. Specifications - SmartCart/SmartCart *sp* w/Scan Module

Type	Parameter	Value
I/O connectors	Ethernet (1 port)	RJ-45 – 10/100BaseT
	USB 2.0 (4 ports)	USB-Type A (VBUS 5.0V, 0.5A max)
	External Video (1 Port)	DVI (Digital Video Interface) on an industry standard HDMI style connector

Table 16-3. Specifications - Battery Charger

Type	Parameter	Value
Electrical	Power requirements	100 - 240V~, 50 - 60Hz, 1.8A max
	Power consumption	72 W (246 BTU/Hr)
Environmental (operating)	Cooling requirements	See power consumption above.
	Air temperature	0 - 40^{o}C (32 - 104^{o}F)
	Humidity	15 - 80%, noncondensing
	Pressure	700 - 1060 hPa
Environmental (storage)	Air temperature	-20 - 60^{o}C (-4 - 140^{o}F)
	Humidity	15 - 90%, noncondensing
	Pressure	50 - 106 kPa
Physical: Charger Bay (weight)		0.45kg (1 lbs.)
Physical: Charger Bay (dimensions)	Height	58 mm (2.3 in)
	Width	124 mm (4.9 in.)
	Depth	175 mm (6.9 in.)
Physical: Power Brick (weight)		270g (10 oz.)
Physical: Power Brick (dimensions)	Height	35 mm (1.3 in)

Table 16-3. Specifications - Battery Charger (Continued)

Type	Parameter	Value
	Width	58 mm (2.3 in.)
	Depth	132 mm (5.2 in.)

Table 16-4. Specifications - AC Power Adapter

Type	Parameter	Value
Electrical	Power requirements	100 - 220V~, 50 - 60Hz, 1.3A max
	Power Consumption	80W (272 BTU/Hr)
Environmental (operating)	Cooling requirements	See power consumption above.
	Air temperature	0 - 70^{o}C (32 - 158^{o}F)
	Humidity	5 - 95%, noncondensing
Environmental (storage)	Air temperature	-40 - 80^{o}C (-40F - 176^{o}F)
Physical (weight)		810g (28.5 oz.)
Physical (dimensions)	Height	50 mm (1.9 in)
	Width	78 mm (3.0 in.)
	Depth	168 mm (6.6 in.)

Table 16-5. Specifications - SmartCart Battery Pack

Type	Parameter	Value
Electrical	Power Rating	15.6V, 16Ah = 250 Wh
	Chemistry	NiMh
Physical (weight)		4Kg (10 lbs.)
Operational	Operating Time Duration (fully charged)	2.5 - 3.0 Hrs.
Physical (dimensions)	Height	75 mm (3 in)

Table 16-5. Specifications - SmartCart Battery Pack (Continued)

Type	Parameter	Value
	Width	260 mm (10 in)
	Depth	355 mm (14 in)

17

Glossary, Abbreviations, and Body Pattern Graphics

This chapter contains a glossary, a list of acronyms, and the **Body Pattern** graphics used in this manual. If you have other questions, call Technical Support (refer to ZONARE Contact Information on page 15-1).

Glossary

This glossary includes an alphabetic listing of terms. The American Institute of Ultrasound in Medicine (AIUM) has published, *Recommended Ultrasound Terminology, Second Edition,* 1997. Refer to it for ultrasound terms not contained in this glossary.

Terms

ALARA As Low As Reasonably Achievable: The guiding principle of ultrasound use, which states that you should keep patient exposure to ultrasound energy as low as reasonably achievable for diagnostic results.

B-Mode (2D) Brightness Mode: A way to display echoes of tissue structures in the body, in a two dimensional format on a video display. Video pixels are assigned a brightness level based on echo signal amplitude.

Clip Store A time sequence (3 seconds - 2 minutes) of live image frames that are captured and stored to internal Storage Media and/or DICOM storage device, for post-study review capability.

Color Mode A Doppler imaging mode used to visualize the presence, velocity, and direction of blood flow in a wide range of flow states.

Curved Array Transducer Identified by the letter C (curved) and a pair of numbers (6-2) = e.g., C6-2. The numbers corresponds to the optimum frequency bandwidth expressed in MHz. The transducer elements are electrically configured to control the characteristics and direction of the acoustic beam.

DDP Data Display Box: The DDP is a reserved space in the bottom-right corner of the image area (on the LCD Display) in which information is displayed about depth of measurement cursor, velocity, and other assorted calculation values.

DICOM Digital Imaging and Communication in Medicine: An industry standard used for the storage and printing of digital imaging and associated measurement data files across a wide spectrum of disciplines in the medical field.

Dual Imaging feature allowing simultaneous display of two different images on the screen, operating in different modalities (i.e. Color Flow and Power Doppler)

FDA Food and Drug Administration: A government agency responsible for ensuring safety to humans in the use of products produced or sold/used in the United States of America.

Harmonics Harmonic imaging: An imaging feature that can be selected on the **z.one *ultra***, which transmits at one frequency and receives at a higher harmonic frequency to reduce noise and clutter and improve resolution.

JPEG Joint Photographic Experts Group: The original name of the committee that wrote the JPEG image file standard, that is designed for compressing either full-color or gray-scale images.

Linear Array Transducer Identified by the letter L (linear) and a pair of numbers (10-5) = e.g., L10-5. The numbers corresponds to the optimum frequency bandwidth expressed in MHz.The transducer elements are electrically configured to control the characteristics and direction of the acoustic beam.

M-Mode Motion Mode: A way to show the motional behavior of cardiac structures (valves, heart wall, etc.). A single beam of ultrasound is transmitted and reflected signals are displayed as dots of varying intensities in a time axis display.

MI Mechanical Index: An indication of the likelihood of mechanical bio effects occurring. The higher the MI value, the greater the likelihood of mechanical bio effects.

MPPS Modality Performed Procedure Step: An advanced DICOM service function. MPPS consists of a network connection between the **z.one *ultra*** and a HIS/RIS management system. The MPPS service allows for defining specific imaging sequences (steps) to be performed on the patient, and transfer of resultant images and data, based upon a specific clinical modality.

NTSC National Television Standards Committee: A video standard format setting used in the United States, and a number of other countries worldwide. See also PAL.

PAL Phase Alternating Line: A video standard format setting used in a number of different countries worldwide. See also NTSC.

Power Doppler A Doppler imaging mode, displayed in a 2D format, using color to visualize the presence and volume of blood flow in a wide range of flow states.

POT Programmed Orientation Text: Palette of pre-created text annotation values (Left/Right, Sag/Cor, Prx/Mid/Dist, etc.) that can be selected by the Operator for quick on-screen annotation on the ultrasound images.

PRF Pulse Repetition Frequency: A measurement of the rate at which ultrasound transmit beams are triggered and sent into the body, in the various operating modalities (PW, Color, B-Scan).

PW Pulsed Wave mode: A Doppler recording of blood flow velocities in a range specific area along the length of the beam.

Retrospective Retrospective imaging: A functional operation on the **z.one *ultra*** where pre-processed image data (from internal Cine memory) is recalled, with the capability to perform extensive image processing (gain, etc.) that is normally reserved only for live images on most other manufacturers ultrasound systems.

ROI Region Of Interest: In Color mode, the targeted area within the B-mode image where acquisition of blood flow information will be targeted. The size, shape and location of this area is selected by the user, and delineated on the display by a green graphical border overlay.

RLE Run-Length Encoding: An industry standard protocol used for compressing of color and black-white image files, to reduce their size for minimizing storage requirements and/or maximizing file transfer rates.

Skinline A location within the B-mode (2D) image, on the display, that corresponds to the skin/transducer interface.

TI Thermal Index: The ratio of total acoustic power to the acoustic power required to raise tissue temperature by 1°C under defined assumptions.

TIB Thermal Index in Bone: Thermal index where the ultrasound beam passes through soft tissue and a focal region in the immediate vicinity of bone.

TIC Thermal Index in Cranial bone: Thermal index where the ultrasound beam passes through bone (in the skull) at the entrance to the body.

TIS Thermal Index in Soft tissue: Thermal index where the ultrasound beam passes through bone at the entrance to the body

Transducer Often commonly referred to as a “probe.” A device that transforms mechanical energy to electrical energy (during transmit cycle), and vice-versa (during the receive cycle). Ultrasound transducers contain piezoelectric elements, which

when excited electrically, emit acoustic energy. When the acoustic energy is transmitted into the body, it travels until it encounters an interface or change in tissue properties. At the interface, an echo is formed that returns to the transducer, where this acoustic energy is transformed into electrical energy, processed, and displayed as anatomical information.

VKB Virtual Keyboard: On the standalone Scan Engine, a graphical representation of a normal alphanumeric keyboard is displayed (when required) for entering text information. A stylus is used on the touchscreen display to make virtual keyboard entries.

z.one *ultra* The ZONARE trademarked name for its full-featured convertible ultrasound product.

Abbreviations

Abbreviation	Meaning
2D	two dimensional
A	artery
A/B	A/B ratio
AC	abdominal circumference (physical); alternating current (electronics)
Accel	acceleration
AD	abdominal diameter
AE	application entity
AFI	amniotic fluid index
AIUM	American Institute of Ultrasound in Medicine
ALARA	As Low As Reasonably Achievable
AoCS	aortic cusp separation
AoR	aortic root
AR	aortic regurgitation
Asc	ascending
AT	acceleration time
ATA	anterior tibial artery
ATV	anterior tibial vein
AV	aortic valve
A wave dur	A wave duration
Axill V	axillary vein
B-mode	2D mode; *aka* Brightness Mode
BPD	biparietal diameter

Abbreviation	Meaning
BOD	biocular distance (diameter); aka IOD (interocular distance - distance between the eyes)
BX	biopsy
CCA	common carotid artery
CD	color doppler
CEREB	cerebellum
CFA	common femoral artery
CFV	common femoral vein
CIA	common iliac artery
Circ	circumference; also circulation, depending on Exam type
CIV	common iliac vein
CRL	crown rump length
CRT	cathode ray tube
dB	decibel
DDB	data display box
Desc Aorta	descending aorta
DGC	depth gain compensation
Diam	diameter
DICOM	Digital Imaging and Communications in Medicine
Dist	distal
Dors Ped	dorsalis pedis
Dors Sten	dorsalis stenosis
Duct Art	ductus arteriosus
Duct Ven	ductus venosus
E/A	E/A ratio
ECA	external carotid artery
ECG	electrocardiogram
EDP	end diastolic pressure
EDV	end diastolic velocity
EIA	external iliac artery
EIV	external iliac vein
EMC	electromechanical compliance
EMI	electromagnetic interference
Endo Thick	endometrial thickness
ESD	electrostatic discharge
ET	ejection time

Abbreviation	Meaning
EV	endovaginal
FA	femoral artery
FV	femoral vein
Fc	center frequency
FIB	fibula
FL	femur length
GS	gestational sac
GSV	greater saphenous vein
GYN	gynecology
HC	head circumference
Heart Circ	heart circulation
HL	humeral length
HR	heart rate
ICA	internal carotid artery
ID	internal dimension
Innom V	innominate vein
Int Jug V	internal jugular vein
IVC	inferior vena cava
IVRT	isovolumic relaxation time
IVS	interventricular septum
Junc	junction
LA	left atrium
Lat	lateral
Lat AntCub V	lateral antecubital vein
LCD	liquid crystal display
Low Basil V	lower basil vein
Low Ceph V	lower cephalic vein
LSV	lesser saphenous vein
LV	left ventricle
LVIDd	left ventricle internal dimension
LVO	left ventricular opacification
LVOT	left ventricle outflow tract
LVPW	left ventricle posterior wall
MCA	middle cerebral artery
MCO	mitral closure to opening
MDD	medical device directive
MI	mechanical index
M-Mode	motion mode

Abbreviation	Meaning
MPA	main pulmonary artery
MPPS	modality performed procedure step
MR	mitral regurgitation
MR Pisa	mitral regurgitation Pisa
MV	mitral valve
MV EF	mitral valve ejection fraction
MV EPPS	mitral valve E-point septal separation
MV EXC	mitral valve excursion
NBL	nasal bone length
NEMA	National Electrical Manufacturers Association
NT	nuchal thickness
NTSC	National Television Standards Committee
OB	obstetrics
OFD	occipital frontal diameter
OT	outflow tract
P	pressure
PA	pulmonary artery
PAL	phase altering line
PD	pulse duration (dynamic) power doppler (operating mode)
Per V	peroneal vein
Peron	peroneal
PFA	profunda femoris artery
PI	pulsatility index
PII	pulse intensity integral
Plac	placenta
Pop	popliteal
Pr	peak rarefactional pressure
PRF	pulse repetition frequency
Prof V	profunda femoris vein
Prx	proximal
PTA	posterior tibial artery
PTV	posterior tibial vein
Pulm	pulmonary
PV	pulmonic valve
PW	pulsed wave
RA	right atrium
RAD	radius

Abbreviation	Meaning
Rad V	radial vein
RI	resistance index
ROI	region of interest
RV	right ventricle
RVIDd	right ventricle internal dimension
RVOT	right ventricle outflow tract
S/D	systolic/diastolic
Sep	septum
SF Junc	saphenofemoral junction
Sino Jct	sino-auricular junction
Sinus Val	sinus valsalva
Sten	stenosis
Subcl	subclavian
SV	doppler sample volume
TDI	tissue doppler imaging
TEI Index	myocardial performance index
TGC	time gain compensation
Thor Circ	thoracic circumference
TI	thermal index
TIB	bone thermal index
TIB	tibia; can also mean bone thermal index
TIC	cranial thermal index
TIS	soft tissue thermal index
TR	tricuspid regurgitation
TTD	trans-thorax diameter
TV	tricuspid valve
Umb A	umbilical artery
Up Basil V	upper basil vein
Up Ceph V	upper cephalic vein
UT	uterus
UT A	uterine artery
V	voltage
V	vein
Vel	velocity
Vert	vertebral
VKB	virtual keyboard
Vmax	maximum velocity
VTI	velocity time interval

Body Pattern Graphics

Body Pattern Graphic	Exam Type(s)	Body Pattern Graphic	Exam Type(s)
 abd_gb	Abdomen Pediatric	 gyn_ute_long	Gynecology
 abd_kidneys	Abdomen Gynecology Pediatric	 gyn_ute_ov	Gynecology
 abd_liver	Abdomen Pediatric	 hrt_4ch	OB Cardiac
 abd_pancreas	Abdomen Pediatric	 hrt_5ch	OB Cardiac
 abd_stomach	Abdomen Pediatric	 hrt_arch	OB Cardiac
 body_arm_back	Vascular	 hrt_ductus	OB Cardiac
 body_arm LT/RT	Vascular	 hrt_shrt_axis	OB Cardiac

Body Pattern Graphic	Exam Type(s)	Body Pattern Graphic	Exam Type(s)
 body_arm_palm	Vascular	 ob_breech	OB
 body_gyn	OB Gynecology	 ob_breech_breech	OB
 body_head_post	Pediatric	 ob_breech_cephalic	OB
 body_head_sag LT/RT	Pediatric	 ob_cephalic	OB
 body_head_top	Pediatric	 ob_cephalic_breech	OB
 body_leg LT/RT	Vascular	 ob_cephalic_cephalic	OB
 body_leg Ant/Post	Vascular	 ob_trans LT/RT	OB
 body_leg_ant_low	Vascular	 ob_LT_LT	OB

Body Pattern Graphic	Exam Type(s)	Body Pattern Graphic	Exam Type(s)
 body_lld	Abdomen Pediatric	 sp_testicles	Small Parts
 body_lpo & _rpo	Abdomen Pediatric	 ob_LT_RT	OB
 body_lpo_up & _rpo_up	Abdomen Pediatric	 ob_RT_LT	OB
 body_male	Abdomen Pediatric	 ob_RT_RT	OB
 body_neck LT/RT	Vascular Small Parts	 sp_breast LT/RT	Small Parts
 body_neck_supine	Vascular Small Parts	 sp_breast2 LT/RT	Small Parts
 body_prone	Abdomen Pediatric	 sp_breast_supine	Small Parts
 body_rld	Abdomen Pediatric	 sp_testicle LT/RT	Small Parts

Body Pattern Graphic	Exam Type(s)	Body Pattern Graphic	Exam Type(s)
 body_supine	Abdomen OB Gynecology Small Parts Pediatric	  vasc_carotid LT/RT	Vascular

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