ACUSON SEQUOIA<sup>™</sup> 512 ULTRASOUND SYSTEMS ACUSON SEQUOIA<sup>™</sup> C512 ECHOCARDIOGRAPHY SYSTEMS ACUSON SEQUOIA<sup>™</sup> C256 ECHOCARDIOGRAPHY SYSTEMS

### **User Manual**

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Welcome	<ul> <li>Thank you for choosing the ACUSON Sequoia 512 Ultrasound System, Sequoia C512 Echocardiography System, or Sequoia C256</li> <li>Echocardiography System. Sequoia systems are specially designed to help you perform radiology, obstetrics, gynecology, cardiac, and/or vascular exams. They offer a wide range of standard and optional operating modes and transducer formats. This manual explains all standard and optional features. Your system may not have all of these features installed.</li> <li>Sequoia systems have an exceptional record of dependability and our customer service network is ready to respond to your individual needs.</li> </ul>			
How to Use this Manual	This <i>User Manual</i> explains how to use your Sequoia system to perform typical exams. Siemens recommends that you read this manual before you begin using the system. Refer to it whenever you have questions about system operation. Each chapter covers one mode of operation or feature, so you can quickly turn to the information you want.			
Other Manuals	This manual is part of a set that also includes:			
	• A <i>Safety Manual</i> , which provides important safety information for all Sequoia systems. Be sure to read the <i>Safety Manual</i> before using the system.			
	• A <i>Transducer Specifications Manual</i> , which provides a list of available transducers, power values, and approved disinfecting and sterilizing solutions.			
	• An <i>Administrator Manual</i> , which contains detailed instructions for system setup and reference information useful for customizing your system.			
	A Service Manual is also available for purchase from Siemens.			
Contacting Siemens	For additional information about the Sequoia system, contact the Siemer Uptime Service Center.			

# **Key Conventions** This manual uses several special symbols to refer to the controls on the system or to indicate a procedure. The following table shows the symbols and their descriptions:

SYMBOL	DESCRIPTION
<b>♦</b>	A diamond-shaped bullet indicates steps to follow to perform a procedure.
CALC	Terms in bold, uppercase font represent a key, knob, switch, or toggle control on the system's keyboard. The example at left represents the <b>CALC</b> key.
CODE + DATA	Plus signs (+) used in this way mean to hold down the <b>CODE</b> key and press the indicated key (in this case, the <b>DATA</b> key).
[LEFT]	Terms in brackets represent a soft key.
[GROUP]	Italicized terms in brackets represent soft keys that have a label that changes as you press it, to represent a current setting or choice.

Siemens provides special alphanumeric keys and annotation terms for labeling images in different languages. This manual uses English labels for all keys and annotation terms. To convert your system to another language, contact the Siemens Uptime Service Center.

**Intended Usage** The Sequoia platform is intended for use in the following applications:

- General Imaging
- Radiology and Cardiology for Fetal
- Abdominal, Intraoperative (abdominal and neurological)
- Pediatrics, Small Organs (breast, testes, thyroid, penis and prostate)
- Neonatal/Adult Cephalic
- Transcranial, Cardiac (adult and pediatric)
- Transesophageal
- Transrectal
- Transvaginal (OB/GYN, Pelvic, Urology)
- Peripheral Vessel Vascular
- Musculo-skeletal (Superficial and Conventional)

The Sequoia platform also provides for the measurement of anatomical structures and for analysis packages that provide information that is used for clinical diagnosis purposes.

# SYSTEM BASICS

System Basics introduces you to the basic components of your Sequoia system. It includes the following chapters:

Chapter 1	Introduction	3
Chapter 2	System Controls 2	3

### CHAPTER 1

### INTRODUCTION

#### Safety

Sequoia System Components For information on safety issues regarding Sequoia systems, see the *Safety Manual*.

The Sequoia system is equipped with either a flat panel monitor or a cathode ray tube monitor.

Sequoia System with Flat Panel Monitor

- 1 Monitor and Speakers
- 2 DVD/CD Drive
- **3** MO Disk Drive
- 4 Transducer Holders
- **5** Cable Holder
- 6 Storage Compartment
- 7 Wheel Lock/Steering Controller
- 8 Footswitch Connector (hidden)
- **9** MP Transducer Ports (3)
- **10** MP Storage Port
- 11 Control Panel/ Keyboard
- **12** Power Button
- 13 USB Port
- **14** Soft Keys (4)
- **15** Monitor Controls



#### Sequoia System with Cathode Ray Tube Monitor

- **1** Monitor and Speakers
- 2 Monitor Controls
- **3** MO Disk Drive
- 4 Transducer Holders
- **5** Cable Holder
- 6 Storage Compartment
- 7 Wheel Lock/Steering Controller
- 8 Footswitch Connector
- **9** MP Transducer Ports
- **10** MP Storage Port
- **11** Control Panel/Keyboard
- **12** Power Button
- **13** Soft Keys (4)



#### Imaging Modes

The Sequoia system displays ultrasound information in several imaging modes. The modes available to you depend on the options installed on your system and the transducer that you are using.

MODE	DESCRIPTION
2-D MODE	The system displays a two-dimensional image of the tissues that lie within the scan plane. For example, you can use 2-D imaging mode to observe organs such as the heart and peripheral vasculature. Because the system displays 2-D images in real-time, you can observe organs in motion. See Chapter 9 for more information on 2-D mode.
SPECTRAL DOPPLER MODE	Spectral Doppler capabilities allow you to monitor the flow of blood through vessels or within the heart. You can display Doppler information either by itself or simultaneously with the 2-D image. See Chapter 15 for information on Spectral Doppler mode.
COLOR DOPPLER IMAGING MODE	Color Doppler imaging allows real-time spatial visualization of blood flow patterns in the heart and discrete vessels. It also provides Doppler shift information related to moving cardiac tissue. There are several imaging options you can use within Color Doppler mode. See Chapter 10 for more information on Color Doppler Mode. Subsequent chapters provide details about different Color Doppler options.
HIGH FRAME RATE TISSUE DOPPLER	High frame rate Tissue Doppler (HTD)
M-MODE	In M-mode the system displays a graphic representation of a line of interest (within the 2-D image) and displays a graph that shows how that line changes over time. Use M-mode to document cardiac function and precisely measure chamber dimensions. See Chapter 16 for more information on M-mode.
COLOR M-MODE	Color M-mode displays M-mode together with Color Doppler mode. Color M-mode displays timing information from the Color Doppler display, and supports the display characteristics and features of standard M-mode. For more information, see Chapter 17.

#### Perspective Advanced Display Option

You can use the Perspective display option to enhance the imaging capabilities of your Sequoia system beyond traditional, 2-D ultrasound applications. The Perspective display option provides the following features for advanced imaging:

- FreeStyle Extended-Field-of-View (EFOV) imaging pieces together a series of 2-D frames to create a single, extended 2-D image.
- FreeStyle compounding is an extension of FreeStyle Extended-Fieldof-View (EFOV) in that it uses the same FreeStyle clip, but compounds more of the image during EFOV reconstruction. This results in improved contrast resolution and artifact reduction.
- Color FreeStyle dynamic CDI is an extension of FreeStyle Extended-Field-of-View (EFOV) in that it uses the same FreeStyle clip, providing dynamic and static Color Doppler and 2-D reconstructions over the cardiac cycle.
- 3-D and Color 3-D Surface Rendering constructs a three-dimensional (3-D) surface rendering of a fetus or other anatomy surrounded by or filled with fluid.
- 3-D Multi Planar Reconstruction simultaneously constructs a cube of echo information, a cross-section of which can be viewed in any of three orthogonal planes.
- Color 3-D Multi-Planar Reconstruction used with the Echoscan Interface provides exchange of data between the Sequoia system and the external Echoscan system for 3-D cardiac reconstruction imaging.
- Perspective Annotation provides the ability to add text to Perspective reviews.
- Axius Auto-Tracking Contrast Quantification (Axius ACQ) is an optional feature that measures the progression of contrast agent enhancement in conditions such as coronary artery disease, tumor neovasculature, and liver metastases.
- Axius Edge Assisted Ejection Fraction provides assisted border detection that is used to automate measurements for left ventricular volume, ejection fraction, stroke volume, and cardiac output. Using Axius Edge Assisted EF, you can perform left ventricular End Diastole (ED) and End Systole (ES) measurements on A4CH or A2CH views.
- Axius Quantitative Strain Rate Imaging technology (Axius QSI<sup>TM</sup>) is an optional feature that measures the tissue contraction and relaxation (strain) and its rate of contraction and relaxation (strain rate) for assessment of myocardial deformation. The system computes strain and strain rate from tissue Doppler velocity information in the clip.
- *four*Sight TEE View acquires and displays 3-D volume datasets on the ultrasound system. *four*Sight TEE View can facilitate evaluation of cardiac diseases such as valvular disease and detection of embolic sources.

	The Perspective display option is available during real-time 2-D imaging. For each feature, the Perspective display option adds specific functions to capture clips and process them, resulting in enhanced images.			
	The Perspective display option adds a proprietary, dedicated computer in the peripheral bay of your Sequoia system. The Sequoia system uses the computer to process the ultrasound information and render images in different formats. Your Siemens Customer Engineer installs the computer as part of the Perspective display option installation and integrates it into the Sequoia system. Do not disconnect the computer or install additional hardware or software on to it. Doing so will void your warranty.			
IMPORTANT:	The dedicated computer must be powered from one of the isolated accessory outlets on the Sequoia system.			
Workflow Aids	When using Clip Save on Select, Save on Capture, In-Progress Store, and Perspective display option clip functions, be sure to create specific Exam Presets to ensure correct clip protocol.			
	Use In-progress store only after modifying the clip protocol within Exam Presets. Failure to do so may result in clip deletion or network suspension.			
	Using In-process transfer of studies to a network PACS while simultaneously using Perspective display option may slow the network study transfer. For more details see "Customizing AEGIS System Protocols" and "System Requirements and Efficiency" in the <i>Administrator Manual</i> .			
Data Field Settings	Upon entering or exiting the Perspective display option, the default Data Field settings for 2-D parameters are:			
	• <b>0</b> for Persistence			
	• + for Mix (Mix displays when using Color Doppler)			
	These parameters display in the data field. For all other Color Doppler parameters, the Sequoia system retains the last parameter values when exiting and then re-entering the Perspective display option. The same is true for exiting and re-entering the imaging mode.			

Power On/Off Procedure	The system power button is located on the left side of the system above the keyboard. For additional information on the proper power on/off procedure, see the <i>Safety Manual</i> .		
	When powering on the system:		
	<ul> <li>Make sure the system is plugged into an appropriate wall outlet.</li> </ul>		
	• Make sure the Main On/Off switch on the rear of the system is On.		
	When powering off the system:		
	• Wait for the system shutdown messages to display and disappear before unplugging the system from the wall outlet. (The monitor screen should be completely black.) The system saves data to the internal hard disk during the shutdown procedure.		
	• Wait for the system to finish copying studies from the hard disk to a storage device such as MO disk or optional DVD/CD drive. Powering off or unplugging the system before the copying process is complete may cause loss of data and/or damage to the internal hard disk or storage device.		
IMPORTANT:	Do not use the Main On/Off switch on the rear of the system to turn off the system. If you turn off the system using the Main On/Off switch, data may be lost or corrupted.		

#### Transducer Connections

The Sequoia system is configured with three active MP transducer ports. You must use transducers that are compatible with the connectors on your system. Two of these ports are high-density (one on the left and one on the right). This configuration allows the connection of two highdensity transducers at once. When using the left high-density port, the middle port must be empty. The following table shows valid transducer combinations:

LEFT PORT	MIDDLE PORT	<b>RIGHT PORT</b>
Non-high density	Non-high density	Any
High Density	None	Any

#### • To connect a transducer to the system:

- 1 Insert the transducer connector into one of the active transducer ports. Insert MP transducers with the cable up. The sliding doors that cover the MP transducer port open automatically.
- **2** Rotate the transducer lock handle clockwise to lock the transducer connector in place.
- To disconnect a transducer from the system:
- 1 Rotate the transducer lock handle counterclockwise to unlock the transducer.
- **2** Pull the transducer connector away from the port.
- **3** Properly store the transducer.

Switching Transducer Ports	You can connect up to three transducers simultaneously on the Sequoia system.				
	To switch the active transducer port, press XDUCER and press the soft key corresponding to the transducer you want to use.				
	The name of t correspondin correspondin appears tellin	the connected transducer appears in the soft key label g to its position. If there is no transducer connected, the g soft key is blank. If the transducer is invalid, a message g you to remove the transducer.			
Transducer Formats and Characteristics	Siemens transducers for the Sequoia system are optimized for imaging many different areas within the body. It is important to understand their different characteristics. For a listing of transducer specifications, see the <i>Transducer Specifications Manual</i> .				
	There are trar transducers a Internal trans be imaged at may be difficu	nsducers for use both inside and outside the body. External re placed on the skin to view structures beneath the skin. ducers are used inside body cavities to view tissues that can higher frequencies using the intracavity approach, or that ult to observe with an external transducer.			
	Your Sequoia system supports internal transducers for intraoperative, endovaginal, endorectal, and/or transesophageal exams. The distinction between external and internal transducers is important because internal transducers require special preparation and disinfection procedures. Fo more information about transducer care and safety, see the <i>Safety Manua</i> The format of a 2-D image depends on both the pattern of ultrasound waves or scan lines the transducer forms and the shape of the transducer footprint. Depending on how your Sequoia system is configured, the following imaging formats may be available: linear array, Vector wide view imaging array, and high-performance curved array format.				
	FORMAT	DESCRIPTION			
	LINEAR ARRAY	A linear transducer has a medium-to-large footprint that uses parallel ultrasound scan lines that are perpendicular to the face of the transducer to produce a rectangular image. Linear transducers usually have a large footprint, thus they typically produce a wide near field of view.			
	VECTOR WIDE VIEW ARRAY	Vector is Siemens trademark for its proprietary omni-steerable, omni-originating image formation technology. A Vector wide view array transducer forms ultrasound scan lines that can originate from any point on the transducer face and can be steered in any direction. A Vector wide view array transducer has a small footprint for imaging when access is difficult; however, the near field image width is almost as wide as the transducer footprint.			
	CURVED ARRAY	A high-performance curved array transducer forms ultrasound scan lines that are perpendicular to the face of the transducer. Because the face of the transducer is curved, it produces an image with a wider far field than near field.			

#### Changing Transducer Frequency

In 2-D imaging mode, Native Tissue Harmonic Imaging (NTHI) mode, PW Doppler, Color Doppler (CD) imaging mode, M-mode, and Color M-mode, the MultiHertz multiple frequency imaging feature extends the usefulness of several transducers by enabling them to operate at multiple, independent imaging frequencies. This capability on a single transducer provides better 2-D resolution at higher frequencies and better 2-D and CD penetration at lower frequencies. In addition, the lower frequencies provide increased CD velocity scales to reduce aliasing.

For more information on frequency options provided by each transducer, see the *Transducer Specifications Manual*.



#### • To change the imaging frequency, toggle MULTIHZ.

Changing the Transducer Output Power Level

Currently within the United States, the FDA has established guideline ultrasound power limits for various clinical applications. Within the United States, manufacturers may not market diagnostic equipment for routine clinical use in a particular application if it exceeds the relevant guideline levels. For more information about power limits, guideline levels, and power values provided by specific transducers, see the *Transducer Specifications Manual*.

The Exam Preset that you are using determines the default power level. For more information about Exam Presets, see Chapter 4 of the *Administrator Manual*.

#### To change the output power level for the active transducer, turn the power knob clockwise to increase the power level or counterclockwise to decrease the power level.

The current power level always appears in the Output Display monitor, on the keyboard. See "Output Display", next. You can set up the system to also display the power level on the screen. See "Setting up the Output Display" on page 13.

#### **Output Display**

The Sequoia system includes a built-in Output Display system that lets you monitor acoustic output levels for the active transducer and imaging modes during an exam. The Output Display provides an indication of the potential for bioeffects that might be caused by the ultrasound energy being emitted. With this information, you can better control the diagnostic ultrasound equipment and examination to ensure that needed diagnostic information is obtained with minimum risk to the patient. The Output Display system provides the following output measurements:

ABBREVIATION	MEASUREMENT	DESCRIPTION	
МІ	Mechanical Index	If there is more than one active imaging mode, the system displays the highest MI and adds an indicator to show which mode it is from.	
		Indicator	Mode
		MI2d	2-D
		MImm	M-Mode
		MIcd	Color Doppler
		MIpw	Pulsed Wave Spectral Doppler
		MIcw	Continuous Wave or Auxiliary Continuous Wave Spectral Doppler
TIC	Thermal Index, Bone at Surface	Recommended for adult or neonatal cephalic scanning.	
TIB	Thermal Index, Bone at Focus	Recommended for second and third trimester fetal scanning.	
TIS	Thermal Index, Soft Tissue at Surface	Recommended for soft-tissue scanning; may also be used for second and third trimester fetal scanning depending on position of fetus.	
TISF	Thermal Index, Soft Tissue at Focus	Indicates focal region TIS for M-mode, Pulsed Wave Doppler, and Continuous Wave Doppler modes.	

Output Display button. Turn clockwise to increase the transducer output power level or counterclockwise to decrease the output power level.-

When you change the power level, the other acoustic output indices automatically update.



#### Setting up the Output Display

You can choose which output values appear on the Output Display.

• To set up the Output Display, press SETUP and select OUTPUT from the Setup menu.



- 1 For 2-D mode, select the transducer power value or None to display in the first column. MI appears in the third column.
- **2** For M-mode, Color M-mode, Color Doppler, and Spectral Doppler modes, select the output value for each column.
- **3** Press **EXIT** to return to the imaging screen.

Operating Controls That Can Cause a Change in Radiated Field

MODE	CONTROL
B-MODE	Transmit Power, Gain, Depth, Dynamic Range, Transmit Focus location, Transmit Focus number, RES, MultiHertz, SpaceTime, Edge, DELTA, Color DELTA, DGC, Frame Rate, Update, Trigger
M-MODE	Transmit Power, Gain, Depth, Dynamic Range, Transmit Focus location, Transmit Focus number, RES, MultiHertz, SpaceTime, Edge, DELTA, Color DELTA, Frame Rate, Update, Trigger
COLOR DOPPLER	Transmit Power, Gain, Depth, Dynamic Range, Transmit Focus location, RES, MultiHertz, SpaceTime, Edge, Gate, Filter, Scale, Options, Frame Rate, Update, Trigger
SPECTRAL DOPPLER (PWD, CWD)	Transmit Power, Gain, Depth, Dynamic Range, Transmit Focus location, RES, Edge, Gate, Scale, Doppler type, Frame Rate, Update, Trigger

#### Keyboard Adjustments

#### • To adjust the keyboard height position:



Keyboard Button - Depressed

Keyboard Button - Locked

- 1 Press and hold the button on the right keyboard handle.
- **2** Adjust the height of the keyboard by either lifting up or pushing down with the keyboard handle.
- **3** Release the button on the handle when the keyboard is at the desired height.

#### Monitor Adjustments

Each Sequoia system is equipped with either a cathode ray tube monitor or a flat panel monitor.

#### Cathode Ray Tube Monitor

**Adjusting Monitor Position** 

The monitor is equipped with controls that enable you to adjust and lock monitor position.

#### To adjust the position of a cathode ray tube monitor:



- **1** Push the monitor handle in to unlock it.
- **2** Using both hands, swivel the monitor from side to side or up and down.
- **3** When you are done, pull the monitor handle out to lock it.

Adjusting Monitor Settings The cathode ray tube monitor is equipped with controls that enable you to adjust and lock monitor settings for brightness and contrast, and to demagnetize (Degauss) the monitor. Some monitors are equipped with controls that rotate for adjustment; other monitors are equipped with push-button controls.



- To adjust the monitor brightness or contrast (for systems equipped with push-button controls):
  - Press + on the Brightness button to increase monitor brightness.
     Press on the Brightness button to decrease monitor brightness.
     Press the icon on the Brightness button to restore factory settings for brightness.
  - Press + on the Contrast button to increase monitor contrast. Press — on the Contrast button to decrease monitor contrast. Press the icon on the Contrast button to restore factory settings for contrast.
- To lock and unlock monitor settings (for systems equipped with push-button controls):
  - In unlocked mode, press the Degauss button and hold for 10 seconds, or until the onscreen message appears.
     If you power off in locked mode, the system maintains modified monitor settings when you reboot.
  - In locked mode, press the Degauss button and hold for 10 seconds, or until the onscreen message appears.
     If you power off in unlocked mode, the system restores factory preset monitor settings when you reboot.
- To adjust the monitor brightness or contrast (for other systems):
  - Pull out the Brightness control to restore the factory default monitor Brightness setting. You cannot change monitor brightness when the Brightness control is in the out position.
  - Pull out the Contrast control to restore the factory default monitor Contrast setting. You cannot change monitor contrast when the Contrast control is in the out position.
  - Push in and rotate the Brightness control clockwise to increase monitor brightness; counterclockwise to decrease monitor brightness.
  - Push in and rotate the Contrast control clockwise to increase monitor contrast; counterclockwise to decrease monitor contrast.
- To degauss the monitor:
  - Press the Degauss button to demagnetize the monitor.



Degauss

#### Flat Panel Monitor

Adjusting Monitor Position

The monitor is equipped with controls that enable you to adjust and lock monitor position.

The monitor lock controls the side-to-side motion of the monitor.

• To adjust the position of a flat panel monitor:



- 1 Facing the back of the monitor, slide the monitor lock to your right.
- **2** Using both hands, swivel the monitor from side to side or up and down.
- **3** Slide the monitor lock to your left to lock the monitor.

**NOTE:** Ensure the monitor is stationary before you slide the monitor lock.

Adjusting Monitor Settings The flat panel monitor is equipped with controls that enable you to adjust audio level (loudness), brightness, and tint. The controls are beneath the lower front edge of the monitor directly beneath the corresponding icons depicted here.







Increase Audio

ase Decrease Audio

Brightness

Tint

ACUSON Sequoia Systems

- To adjust the monitor audio:
  - Roll the **AUDIO** knob to the left to increase volume.
  - Roll the **AUDIO** knob to the right to decrease volume.

The system restores the default volume level at the next power on.

- To adjust the monitor brightness:
  - Press the left **BRIGHTNESS** button to decrease monitor brightness.
  - Press the right **BRIGHTNESS** button to increase monitor brightness.
  - Press and hold both **BRIGHTNESS** buttons for several seconds to restore factory settings for brightness.

The flat panel monitor has three tint settings, numbered 1 to 3. Tint 1 is the default setting and is most similar in appearance to the system default settings of the cathode ray tube monitor, and is indicated by an asterisk (\*).

#### • To adjust the monitor tint:

• Press the **TINT** button briefly. The system implements the next tint setting in the cycle, 1, 2, or 3.

**NOTE:** You can adjust brightness for each Tint setting.

When you power on the Sequoia system, the flat panel monitor displays the tint setting that was in effect when the system was powered off.

#### Front Media Panel

The Sequoia system front media panel contains the following devices and connectors. Depending upon the accessories and options installed, your system might not include all components described here.



Figure 1-1	Sequoia Disk Box
------------	------------------

	DEVICE	DESCRIPTION	USAGE
1	DVD/CD Drive	Drive for DVD and CD media	Copies studies to DVD or CD for storage. You can copy a study from DVD or CD to the Sequoia hard disk to review the study.
2	MO Drive	Drive for magneto- optical disks	Copies studies to and from an MO disk for storage or review. You can review a study directly from an MO disk without copying the study to the Sequoia hard disk first.
3	Power button	System power button	Powers the system on and off.
4	USB Port	USB port	Exports data to approved USB media. See "Exporting Data" on page 74.

Each DVD/CD drive and MO drive is equipped with a mechanical pinhole ejector. If you cannot eject an external storage disk using standard system controls, gently push an MO disk ejection needle into the hole. The drive mechanism ejects the disk.

#### Wheel Adjustments

Use the foot pedal to adjust the wheel positions when moving the Sequoia system. As you face the system, the three wheel positions are as follows:

SYMBOL	POSITION	WHEEL POSITION
	Pressed forward	Two-wheel pivot position.
		Use for moving the system, especially on an incline.
	Flush	Four-wheel pivot position.
	2	Use for adjusting the system during an exam.
8	Pressed backward	Two front wheels, locked position.

#### Footswitch

You can use the system footswitch to perform frequently performed functions, such as TEQ control or printing. The footswitch settings available to you depend on the options installed on your system. For instructions on setting up footswitch functions, see "Customizing System Setup" and "Customizing the Footswitch" in the *Administrator Manual*.



#### Ultrasound Gel Warmer

The Ultrasound Gel Warmer (UGW) warms the gel used during external ultrasound exams. It takes approximately five minutes to heat a fourth of a bottle of gel (the approximate amount needed for an exam). The gel warmer continues to heat the gel while the ultrasound system is powered on. The UGW holder assembly can be installed in any *standard* transducer holder, but not in *Microcase* transducer holders.

To use the UGW, replace the gel bottle cap with the UGW cap assembly. The UGW cap fits gel bottles with a 38mm outer diameter neck and single-screw thread. Invert the bottle and set into the UGW holder assembly.

**NOTE:** A qualified Siemens representative must install the gel warmer before use.



**NOTE:** The UGW cap assembly is reusable. Do not dispose of the cap when the ultrasound gel bottle is empty. Remove it and install it on the next bottle.

	•	To install the UGW cap assembly:
	1	Remove the plastic cap from a compatible ultrasound gel bottle.
	2	Securely screw the UGW cap onto the ultrasound gel bottle.
	3	Invert the gel bottle, and insert it into the UGW holder assembly.
	•	To confirm UGW operation:
	1	Ensure that the gel warmer cap is securely attached and that no gel is leaking from the bottle.
	2	Power on the ultrasound system.
	3	Ensure that the light on the UGW holder assembly illuminates.
	4	Ensure that the UGW heats the gel.
	•	To clean or sanitize the UGW:
	1	Unplug the low voltage transformer from the Sequoia accessory outlets.
	2	Clean the system transducer holders, UGW holder assembly, and UGW cap assembly with a cloth dampened with mild soap and water, isopropyl alcohol, or a sanitizing solution.
Safety	For <i>Safe</i> Star with	information on safety issues regarding Sequoia products, see the <i>ty Manual</i> . The UGW is classified in accordance with the IEC 60601-1, ndard for Medical Electrical Equipment and is a Class I accessory hout an applied part. It is suitable for continuous operation.
WARNING!	Tł fla	ne ultrasound gel warmer is not suitable for use in the presence of any ammable anesthetic mixtures.
WARNING!	Tł vc	ne ultrasound gel warmer is intended for use with the supplied low oltage transformer only.
CAUTION!	Do	o not drip any liquid into the system or onto the keyboard.

# SYSTEM CONTROLS

You use the controls on the keyboard and objects on the display to customize an image, take measurements, make notes, record images, and so on. This section explains basic techniques for using the keyboard and controls.

#### Keyboards

The controls on the keyboard are grouped by function to make it easier for you to find the control you need.



Code KeysTo access some functions that appear in black on an alphanumeric key,<br/>press the CODE key and then press the alphanumeric function key. There<br/>are two CODE keys, one at each side of the alphanumeric function<br/>keypad.

When this guide describes how to use a function that requires you to press the **CODE** key, it instructs you to press **CODE** + the alphanumeric key. For example, press **CODE** + **DATA POS**.

**Soft Keys** The four unlabeled keys immediately below the screen are soft keys. They correspond to soft key menus that appear at the bottom of the screen. The labels and functions of the soft keys change depending on the function you are using. To select a menu option, press the corresponding soft key. When there are no options to select, no soft key menu is displayed. This manual displays soft keys in brackets, for example: **[MODIFY]**.





There are two types of toggling soft keys:

- One type toggles between two or more options in the soft key label. Press the soft key until the option you want is highlighted.
- The other type of soft key displays only the active option. Press the soft key until the one you want appears.

In most cases, you can remove a soft key menu by pressing **RETURN**.

#### Trackball

You use the trackball to move a pointer and other objects on the display. Roll the trackball in the direction that you want to move the pointer.

#### To change the trackball's function, toggle PRIORITY until the function you want is active.

The **SELECT KEYS** on either side of the trackball are like mouse buttons. You click them to select objects, choose items from menus, and so on. You can also double click (click quickly twice) to access other functions.



When you see the single-click icon (() in a soft key label (for example, [()END TRACE]), you can select that menu item by clicking either SELECT KEY once. If you see the double click icon ((()), you can select that item by quickly clicking either SELECT KEY twice.

#### Pop-up Menus

Some functions display a pop-up menu that contains a list of choices. Unlike toggling soft keys, a highlighted item is only active when it is selected.

CONTROL	USE
TRACKBALL	Roll up or down until the item you want is highlighted.
[SELECT]	Press to select the item and remove the menu.
[HIDE MENU] RETURN	Press either key to remove a menu without choosing an item. Or, press the key that activated the menu.

#### Select Keys

#### Dialog Boxes

Dialog boxes contain pop-up menus, option buttons, and command buttons that you use to customize a function.



#### Moving the Data Display Box

The system uses a data display box to display on-screen information from measurements and calculations. You can move the data display box, and save its location.

- To move the data display box, press CODE + DATA POS.
- 1 Use the trackball to move the box to the desired location or press the first soft key to cycle quickly between five different preset locations and growth directions.
- 2 To choose the number of lines of information to be displayed, press [8 LINES/12 LINES] to select either 8 or 12 lines.
- **3** To lock the data display box into place, press **[SET POSITION]**.
- 4 To exit, press [EXIT].

### **Editing Text** There are two different formats for entering text with the alphanumeric keys on the Sequoia system.

- Text fields that you can edit appear shaded. Text fields appear in dialog boxes, several reports, and the Begin-End page.
- In the annotation function, you can make notes directly on an ultrasound image.

Use these controls for editing text. Chapter 6 describes additional controls for annotating images.

CONTROL	USE
CURSOR	Shows the current type-in point. This is where any text that you type appears.
SPACE BAR	Press to move the cursor to the right within a text field.
RETURN TAB	Press or use the trackball to move the cursor between text fields or to the next line.
HOME	Moves the cursor to its home position, usually the upper-left corner of the display or upper-most text field. For information about setting the <b>HOME</b> position, see "Text Function" on page 49.
BACKSPACE	Press to erase the character before the cursor.
CODE+CAPS LOCK	Press to switch between typing uppercase or lowercase letters. The system default is uppercase.
SHIFT	Hold down while pressing an alphanumeric key to override the <b>CAPS LOCK</b> setting for that keystroke.
[DELETE]	Press to delete the current value in a report field and replace it with the default value.

#### Using the System Stop Watch

You can use the stop watch function to time events during any live imaging mode. Upon starting the stop watch, the start time and an elapsed timer are displayed in the data display box as shown.



Entering Cine or Freeze modes changes the time stamp display as shown.

Stop watch Start Time -	12:47:26 pm	01:27	_Stop watch Capture Time
		02:19	<ul> <li>Elapsed timer</li> </ul>

The elapsed timer continues counting but is now displayed below the stop watch stop time. The elapsed timer is always highlighted.

#### • To start the stop watch, press STOP WATCH.

1 Use the following soft keys with the stop watch.

CONTROL	USE
[EXIT]	Exits the stop watch function. Removes the time stamp and stop watch soft key menu.
[RESET]	Resets the elapsed time field to 00:00 and removes the time stamp.
[START TIMER]	Starts the stop watch and displays a time stamp that shows the system time when started and the elapsed time. While the elapsed timer is counting, this soft key label changes to <b>[STOP TIMER]</b> .
[STOP TIMER]	Stops timing and leaves the time stamp on the screen. While the elapsed timer is stopped, the soft key label changes to <b>[START TIMER]</b> .
FREEZE AND CINE	Freezes the image display and displays the elapsed timer if the stop watch was running upon entering Cine or Freeze. When frozen, scroll through the captured frames to replay the time stamp as it was captured with the image.
	Press GAIN/FR2/RUN or CINE again to return to real-time imaging.

**2** Press **[EXIT]** or **STOP WATCH** to leave the stop watch function.
### **BASIC EXAM OPERATIONS**

Basic Exam Operations describes features you use while performing an exam. It includes the following chapters:

Chapter 3	Studies
Chapter 4	ECG and Physio Module
Chapter 5	Presets
Chapter 6	Annotating Images
Chapter 7	Freeze and Cine Functions
Chapter 8	Data Management

**Beginning a Study** A study is the collection of patient information, calculation data, and stored images and clips for a specific patient and exam. Studies are stored on the system's internal hard disk and can be copied to various storage devices. See "CALC to MO" on page 67, "Copying Studies to DVD/CD" on page 69, "Exporting Data" on page 74.

You typically begin a study by recording information about the patient such as the patient's name and an identification (ID) number on the patient demographic page. The patient demographic page can also contain additional patient information, such as the patient's age, height, and weight. You can customize the patient demographic page to contain the type of patient information you want to record. See "Setup Menu" on page 443 for more information.

During a study you can store images and clips (series of images) using the system's onboard AEGIS digital image and data management software. Ending a study clears patient information and sets up the system to begin a new study. You can review or restart completed studies later using the system's AEGIS software or a storage device. Calculation data is stored with a study when the study is stored to an MO disk or on a DICOM server. When an exam is restarted, the calculation information may be reviewed and updated. For more information about AEGIS software, see Chapter 8.

Your system has an optional DICOM worklist feature that speeds the process of entering patient information on the patient demographic page and eliminates costly errors. The worklist feature enables the Sequoia system to communicate with a Hospital Information System (HIS) or Radiology Information System (RIS) to obtain a list of patients scheduled for ultrasound exams. The Sequoia system retrieves this information from a DICOM worklist server that is part of the HIS or RIS. (If your system has this optional feature, your Siemens Customer Engineer configures your system to connect to the worklist server.)

### Entering Patient Information

Retrieving Patient Information from the Worklist Server If your system has the DICOM worklist option, you can retrieve patient information on a DICOM worklist server. If your system does not have the DICOM worklist option or if information for the current patient is not stored on the worklist server, you can enter patient information manually.

- To retrieve patient information from the worklist server into a new study on a Sequoia system (with DICOM worklist function):
- 1 Press **BEGIN/END** to display the patient demographic page.
- **2** To retrieve a complete list of the day's scheduled studies, leave all patient information fields blank, and press **[QUERY]**. The day's scheduled studies appear on the Scheduled Studies page.
- **3** To restrict the list by patient name, type the first few letters of the **PATIENT NAME** field.

Enter the patient name in this format: Last, First, Middle, Suffix, Prefix. Use commas to separate the different components of the name. (You can omit or include spaces before or after commas; the system ignores them.)

#### 4 Press [QUERY].

If there is one match, the patient demographic page fills with the patient information. If there is more than one match, the Scheduled Studies page appears. The Scheduled Studies page lists all scheduled patients who matched the information you entered.

	Scheduled Studies 23 Jul 99 12:35 pm						
Patient Access	Name [			De	Patient ID ate		— Filter Fields
	Patient Name MATICHUK CHRIS GREENE WADE		Accession 000001055 000001056	Study Type URE T URE T	Date 23 Jul 99 11:03 23 Jul 99 11:03	<u> </u>	— Patient List
					Save		
	Query	Select		Clear Filter	Prior	•	

**5** Use the following controls to locate the patient you want on the Scheduled Studies page.

CONTROL	USE
STUDY LIST	Click a study to select it.
	Click one of the column headings at the top of the list ( <b>Patient Name, Accession, Study Type</b> , or <b>Date</b> ) to sort the list by that column.
[SELECT]	Press <b>[SELECT]</b> to load patient information for the selected study.

CONTROL	USE
Patient Name and Accession	Enter text in any of these fields to filter the study list to display only studies that match that text. Leave a field blank to match all studies.
fields	Enter the patient name using the format <b>Last</b> , <b>First</b> , <b>Middle</b> , <b>Suffix</b> . For example, <b>Smith</b> , <b>Marvin</b> , <b>E</b> , <b>Jr</b> . (You can omit or include spaces before or after commas; the system ignores spaces.)
	You can enter partial names to retrieve a list of patients whose names match the characters you enter. For example, a patient name of <b>Sm</b> , <b>M</b> matches all patients whose last name begins with Sm and first name begins with M. These might include <b>Smith</b> , <b>Mickey</b> , <b>Smith</b> , <b>Michelle</b> , and <b>Smythe</b> , <b>Maureen</b> .
Date field	Select <b>Today</b> or a date range from the pop-up menu. ( <b>Week</b> means <b>Today</b> plus the three previous days and the three next days. <b>3 Days</b> means yesterday, today, and tomorrow.) Your selection filters the list to display only studies that fall within the date(s) you specify.
[QUERY]	Updates the patient list based on information in the filter fields.
[PRIOR]	Returns to the patient demographic page, without transferring patient information.
[CLEAR FILTER]	Clears all current filters.
[SAVE]	Saves the list of patients (and their information) to the Sequoia system's hard drive.
	Saving the patient list is useful if you intend to perform portable exams, where the Sequoia system will not be connected to your network. You can also configure the Sequoia system to store the day's scheduled studies on its internal hard disk. For more information, see your Administrator.
	If your system is set up to automatically store the day's studies, pressing <b>[SAVE]</b> overwrites the previously stored studies for the current day.

**NOTE:** Selecting a patient with a Study Type name that is not in the system's Study Type displays an "Unknown Study Type" message. If you see this message, you need to add the Study Type to your system. See your *Administrator Manual* for instructions.

#### Entering Patient Information Manually

Enter the patient name in this format: Last, First, Middle, Suffix, Prefix. Use commas to separate the different components of the name. (You can omit or include spaces before or after commas; the system ignores them.)

#### To enter patient information for a new study on systems without the DICOM worklist function:

1 Press **BEGIN END** to display the patient demographic page.

Ŷ	Patient Demograp	hic Page	10 Feb 99 12:56 pm
Patient Name 📗		Patient ID	
	Category Acuson	$\nabla$	
Study Type	Cardiae $ abla V$	Exam Preset Cardiac	$\nabla$
Age Sex Height Weight BSA BP Sonographer	Image: marked state	ħ	
Comments:			
Restart List	Begin Imaging		iect M.O.

- **2** Enter the patient name and/or ID.
- **3** Choose a Study Type from the pop-up menu. The Study Type determines the default Exam Preset and which patient demographic fields appear.
- 4 If desired, choose a different Exam Preset from the pop-up menu.
- **5** Enter patient information as described in "Patient Information Fields" on page 36.

Press **RETURN** to move the cursor between patient information fields.

**6** Press **[BEGIN IMAGING]** to return to the image screen and begin the exam.

If you did not select a Study Type on the patient demographic page, the Exam Presets pop-up menu appears. Select an Exam Preset to begin imaging.

Changing Patient	٠	To change patient information during a study:		
Information During a	1	Press BEGIN END.		
Study	2	Press [MODIFY STUDY].		
	3	Change patient information as described in "Patient Information Fields" on page 36.		
	4	Press <b>[RESUME STUDY]</b> to return to the image screen and continue the exam.		
Ending a Study	٠	To end a study and return to the patient demographic page:		
	1	Press BEGIN END.		
	2	Press [START NEW PT].		
IMPORTANT: Restarting a Study	Depending on how your system is set up to save images and clips, a study may delete unsaved images and clips. For information on saving images, see Chapter 8. For information on setting up your system to save images and clips, see "AEGIS Software Setup" on page 446.			
	car bee	perform the same functions within a restarted study as if it had not en closed.		
	٠	To restart a study:		
	1	Press BEGIN END.		
	2	Press <b>[START NEW PT]</b> to display the patient demographic page for a new study.		
		Press [RESTART LIST] to display the list of available studies.		
	4	Select a study and press [RESTART].		
	5	When the patient demographic page appears, press <b>[BEGIN IMAGING]</b> .		
		<b>NOTE:</b> You can restart studies stored on the system's internal hard disk. You cannot restart studies from other ultrasound systems.		

### Patient Information Fields

The Study Type defines the fields that can appear in the patient demographic page. For instructions on customizing the page, see Chapter 41. The following table describes all possible fields.

HEADING	USE
PATIENT NAME PT. NAME - PREFIX PT. NAME - SUFFIX	Patient's name
PATIENT ID	Other identifier (for example, case number)
STUDY TYPE	Type of study
EXAM PRESET	Default exam preset
ACCESSION	Accession Number
SSN	Social Security Number
DOB	Date of Birth uses the following formats:
	<day> <separator> <month> <separator> <year></year></separator></month></separator></day>
	DAY – d or dd
	MONTH – m or mm
	YEAR – y, yy, or yyyy
	SEPARATOR – dash (-) or slash (/)
	Special – ddmmyy (no separators)
AGE	Patient's age
GA AT BIRTH	Gestational age at birth (weeks)
SEX	Patient's sex
HEIGHT	Patient's height
WEIGHT	Patient's weight
BSA	Body Surface Area
BP	Patient's blood pressure
LMP	Patient's last menstrual period
EDD	Estimated delivery date
GRAV/PARA/ABOR	Patient's OB history
GESTATIONS	Gestation number
DIAG. PHYSICIAN	Diagnosing physician's name
REF. PHYSICIAN	Referring physician's name
SONOGRAPHER	Sonographer's initials
INDICATION	Indication for exam
MACHINE ID	Ultrasound system ID number
COMMENTS	Any additional comments
CUSTOM FIELD 1	Additional field
CUSTOM FIELD 2	Additional field

## ECG AND PHYSIO MODULE

The ECG module consists of several physiologic channels and a DC Input channel. The physiologic channels, or patient connections, include ECG, phono (heartsounds), respiration, and pulse. Each physiologic trace displays the conditioned input from a physiologic transducer as a waveform on the Sequoia system display.

The Siemens ECG electrodes and leads and the Siemens ECG module have been designed and qualified to AAMI Standard ANSI/AAMI ES1-1993, "Safe current limits for electromedical apparatus." The standard suggests that any other equipment designed and qualified to this standard may be used safely with our ECG equipment. However, many electrosurgical devices do not meet this standard and could pose a substantial hazard to the patient. Consult your surgical equipment operation manual before using the ECG module in conjunction with electrosurgery or diathermy equipment. Siemens has not tested or verified the operation of the ECG module with electrosurgery or diathermy devices.

Use of electrosurgery or diathermy equipment in conjunction with the ECG module may cause noise in the ultrasound image.

For ECG and Physio module safety considerations, see your *Safety Manual*.



Using the ECG Module With Electrosurgery Devices The following table describes the use of each physiologic monitoring channel.

	CHANNEL	USE	
	DC-A	Preconditioned ECG trace or other physiologic DC Input	
	ECG	ECG trace	
	PHONO	Heartsounds trace	
	RESP	Respiration trace	
	PULSE	Pulse trace	
Triggers	<ul> <li>If you are displaying an ECG, you can mark trigger points along the trace. These points determine the update interval for the 2-D or CD image. For details, see "Triggered Images" on page 95.</li> <li><b>NOTE:</b> When using ECG with triggers enabled, the system applies the current trigger setting values as defined by the current Exam Presets. For more information see "ACUSON Exam Presets" on page 44.</li> </ul>		
Connecting PhysioThe ECG, phono, respiration, and pulse transducersTransducersmatching sockets on the Sequoia system.		ono, respiration, and pulse transducers fit only in the kets on the Sequoia system.	
	To connect a transducer to the system, orient the keyed portions of the connectors to match the complementary areas of the sockets and insert.		
	To remove a transducer, pull back the collar that covers the transducer connector and remove from the socket.		

### Using ECG or Physio Traces An ECG trace appears automatically whenever you are using a cardiac Exam Preset. To display an ECG or physiologic trace: Connect a physio transducer or ECG cable to the appropriate socket. Press PHYSIO MGMT to display the pop-up menu.

- **3** Display a trace by highlighting it and pressing **[ON/OFF]**.
- **4** Use the following keys with ECG or Physio traces.

WARNING!Use [STANDARD QRS] to display human patient ECG traces. Do not use<br/>[QRS 1 (>300)] or [QRS 2 (>800)] to display human patient ECG traces<br/>because [QRS 1 (>300)] and [QRS 2 (>800)] are settings that are<br/>optimized to for small animal ECG traces. The [QRS 1 (>300)] or<br/>[QRS 2 (>800)] settings may cause the system to report incorrect heart<br/>rate measurements.

CONTROL	USE
GAIN	Turn clockwise to increase gain or counterclockwise to decrease gain.
	If more than one trace is displayed, you must select it first. See <b>WAVFORM</b> control below.
MARK	Press to mark a physiologic trace at a particular point in time.
POSITION	Turn clockwise to move the baseline up or counterclockwise to move the baseline down.
	If more than one trace is displayed, you must select it first. See <b>WAVFORM</b> control below.
RESET	Resets the baseline of a selected trace.
	Use when the baseline deviates from horizontal (baseline), usually due to physical characteristics of the patient.
SWEEP	Press up to increase or down to decrease the sweep speed for all displayed traces.
WAVFORM	Selects a trace. Press up or down until the caret (>) appears to the left of the trace you want to select.
	<b>WAVFORM</b> selects traces in the order in which they appear in the physio management pop-up menu.

CONTROL	USE
[SET QRS SOURCE]	Press to select the channel you want to use as the heart rate source. (QRS) appears next to the name of the channel currently used.
[FILTER ↑] [FILTER ↓]	Press to cycle up or down through the filter settings.
[STANDARD QRS] <sup>1</sup>	Default setting. <b>[STANDARD QRS]</b> is the only ECG trace setting available for human patients.
	Use for patients who have heart rates below 300 beats per minute.
	Heart rate information displays in the form "HR=XXX bpm," where XXX is the number of beats per minute.
[QRS 1 (>300)] <sup>1</sup>	Use for small animals that have heart rates between 300 and 799 beats per minute.
	Highlighted heart rate information displays in the form "HI HR 1=XXX bpm," where XXX is the number of beats per minute.
[QRS 2 (>800)] <sup>1</sup>	Use for small animals that have heart rates between 800 and 999 beats per minute.
	Highlighted heart rate information displays in the form "HI HR 2=XXX bpm," where XXX is the number of beats per minute.

1. Requires software version 10.0 or higher.

Choosing aThe phono channel has six heartsounds filters that you can use to filterHeartsounds Filterheartsounds information for a specific clinical application.

FILTER (HZ)	HIGH- PASS FILTER	LOW- PASS FILTER	ADDITIONAL GAIN	USE
50-100	50 Hz	100 Hz	10 dB	Low-pitched heartsounds such as gallops
100–200	100 Hz	200 Hz	14 dB	Low-pitched murmurs, Mitral Stenosis (MS), gallops, first and second heart sounds, and mid-frequency systolic murmurs
100–1000	100 Hz	1000 Hz	14 dB	Higher-pitched heartsounds such as aortic insufficiency, mild mitral regurgitation sounds, closely timed sounds, and systolic ejection murmurs
200–1000	200 Hz	1000 Hz	20 dB	Higher-pitched heartsounds such as aortic insufficiency, mild mitral regurgitation sounds, closely timed sounds, and systolic ejection murmurs
400–1000	800 Hz	1000 Hz	26 dB	Higher-pitched heartsounds such as aortic insufficiency, mild mitral regurgitation sounds, closely timed sounds, and systolic ejection murmurs
30–1000	30 Hz	1000 Hz	0 dB	Greatest range of heartsounds

Chapter 4 - ECG and Physio Module

#### Setting Default Exam Presets Overview

Presets store image and format parameters for specific exam types. Use Presets to quickly recall optimum parameters for particular exam type, image type, or imaging mode. Presets Setup allows customization of:

- Image Presets A collection of system parameters for each imaging mode that affect the look of the image. Image Presets represent the imaging goal rather the clinical application or anatomy.
- Exam Presets A collection of Image Presets, also including screen format and system setup information. An Exam Preset typically contains several Image Presets for each imaging mode.
- Categories A collection of Study Types, Exam Presets, and Image Presets. It also includes a default Study Type and its default Exam Presets. See "Customizing System Setup" of the *Administrator Manual* for information on defining Study Types.

Use Presets Setup to create, modify, or delete Exam Presets. For more information on Presets setup, see the "Presets" chapter in the *Administrator Manual*.

### ACUSON Exam Presets

Your ACUSON Sequoia system includes all or a subset of the following ACUSON **G** Exam Presets. ACUSON **G** Exam Presets cannot be modified, but can be used as a base to create new presets with modification capabilities.

GENERAL IMAGING
<b>Abdomen</b>
Abdomen Difficult
<b>G</b> Breast
<b>■</b> Carotid
<b>G</b> ER
<b>G</b> EV
<b>T</b> Fetal Heart
■ Murine <sup>1</sup>
Musculoskeletal
<b>¶</b> NeoAbd
<b>■</b> NeoHead
ПOB
<b>Q</b> PV Artery
PV Vein
<b>P</b> elvic
<b>T</b> TCI
TCI Orb
<b>T</b> esticle
<b>T</b> hyroid

1. For small animal use only.

#### Recalling Exam Presets

### Recalling Image Presets

- To recall an Exam Preset, use one of the following methods:
- 1 When starting an exam, select the Study Type from the pop-up menu on the **BEGIN END** patient demographic page. The Study Type recalls a default Exam Preset. Choose a different Exam Preset from the Exam Preset pop-up menu.
- **2** During an exam, press **EXAM PRESETS** and select the Exam Preset from the pop-up menu.
- To recall an Image Preset, use either of the following methods:
- 1 Turn the **IMAGE** knob clockwise or counterclockwise to cycle through the available Image Presets.

Turning the knob shows the result of the selection changes on the image immediately, and the name of the Image Preset selection displays in the data field.

2 Press the IMAGE knob to display the Image Preset menu, then turn the IMAGE knob to make a selection. Press the IMAGE knob to activate the selection.

Delete Cate	gary Category: Acuson	Create Category
↑ Move  ↓  Add Break	Exam Presets aExercise Stress aPharm Stress 4 aCV Carotid aCV Artery aCV Vein aAbdomen* Show Disabled Presets *Power-up Delete	Image Presets for highlighted Exam Preset: Mode 2-D NTHI Soft NTHI Detail NTHI Detail NTHI General Penetration High Contrast General Detail Soft * Default Set Default Detat
New Exam F	Preset	New Image Preset
Abdomen	Store	NTHI General Store
Show Less	<ul> <li>Use Transducer Specific Settings</li> </ul>	⊒ Link MultiHz on Store Exit
Exit	Prior	Hide Menu

#### 

#### • To modify settings for an Exam or Image Preset:

- **1** Recall the Exam or Image Preset for modification.
- **2** Change any system or image optimization parameters as appropriate.
- **3** Press **SETUP** and select **PRESETS** from the Setup menu.
- **4** To save changes to the Exam Preset, click the **STORE** button below the Exam Preset list.

After modification, the active preset displays in the Preset Setup menu with highlighted text.

- **5** To save changes to the Image Preset, click the **STORE** button below the Image Preset list.
- **6** To display advanced settings that allow movement and grouping of presets in menus, click the **SHOW MORE** button. The result is shown below.

	Delete Category	Category: Acuson	Create Category	
Click the arrows to move the highlighted preset up or down in the list. Click the Add Break button to create a separation between presets.	Exam Pre- aExercise aPharm S aCV Carv aCV Carv aCV Arte aCV Vein  aCV Vein  aCV Vein  aCV Carv	sets e Stress Stress 4 otid ery en* isobled Presets	Image Presets for highlighted Exam Preset: Mode 2-D NTHI Soft NTHI Detail <u>NTHI General</u> Penetration High Contrast General Detail Soft	ire Move Ir⇒
	* Power-u	ıp	* Default	
		Delete	Set Default Dele	te
	New Exam Preset		New Image Preset	
	Abdomen	Store	NTHI General Stor	` <del>©</del>
	Show Less	Use Transducer Specific Settings	Link MultiHz on	Store
	101011 2033			Exit

- 7 To allow presets to have transducer-specific values, click USE TRANSDUCER SPECIFIC SETTINGS before storing the preset.
- **8** In the confirmation dialog box, click **OVERWRITE** to store the current settings for the Exam Preset or press **CANCEL** to cancel.
- **9** To change the default Image Preset for the Exam Preset, select the Image Preset and click the **SET DEFAULT** button under the Image Preset list.
- 10 Press [EXIT].

Creating a New Preset	The new Exam Preset immediately appears in the Exam Preset list and becomes the active Exam Preset. The new Exam Preset automatically associates with the active Category.
	Change the order in which Exam or Image Presets appear in menus. (Default placement of a new preset is one row below the current Preset selection.) In addition, insert a break between Exam Presets to create a visual separation. This break allows for grouping cluster exams together. For more information on creating new Presets, see "Presets" in the <i>Administrator Manual</i> .
Setting Default Exam Presets	Set default Exam Presets for a study when setting up study types. For more information see "Presets" in the <i>Administrator Manual</i> for "Transesophageal Transducers".

Chapter 5 - Presets

### **ANNOTATING IMAGES**

**Text Function** The text function is your basic tool for labeling images. In the text function, you can enter text anywhere on the screen. The text function displays a single cursor to show where text you type will appear. The cursor appears as a green "I-beam" to indicate the start of a new text block, or a white straight line to indicate editing within an existing text block.

• To enter the text function:

#### 1 Press TEXT or TEXT START (SPACE BAR).

- **2** Use standard text editing techniques and the keys in the following table when you are editing (annotating) text in images.
- **3** When you finish, press **TEXT** to leave the text function.

KEY	FUNCTION	
[HOME]	Places the cursor in your default starting position for typing. (See <b>[HOME SET]</b> ).	
	Defines the home position.	
[HOME SET]	Move the cursor where you want the home position to be and press <b>[HOME SET]</b> .	
[DELETE WORD]	Press to remove highlighted text and any trailing space to the right.	
[TEXT 1&2]	Selects a text layer. Your choices are:	
	[TEXT 1]Add, change, or delete text in TEXT 1[TEXT 2]Add, change, or delete text in TEXT 2[TEXT 1&2]Add, change, or delete text in TEXT 1while viewing both TEXT 1 and TEXT 2	
	Click the trackball <b>SELECT KEY once</b> to highlight a word; <b>twice</b> to select the entire text block. When selected, the text block appears green. Use the trackball to move the text block around the screen.	
TRACKBALL SELECT KEY	The next trackball click places the text block at the new location. The cursor appears at the start of the text block.	
CODE + CLEAR	Removes all the text in a selected text layer.	
ТАВ	Moves between words in a text block.	
TRACKBALL	Moves the cursor.	

Annotation Keys	Annotation keys are shortcut methods that you can use to make notes directly on the display. The six keys to the right of the <b>TEXT START</b> (space bar) key are programmable annotation keys that you can program to represent up to 15 annotation terms each. Programmable annotation keys can be customized to cycle between annotations or display a pop-up menu of annotation options. Annotation keys are available at all times during an exam.
Programming Annotation Keys	You can program an annotation key to change the terms associated with it and change the way it functions: as a pop-up or cycling key.
	You use the Setup function to program annotation keys. See Chapter 41 for more information.
Cycling Annotation Key	To use a cycling annotation key:
	<b>1</b> Press <b>TEXT</b> or <b>TEXT START</b> to enter the text function.
	<b>2</b> Position the text cursor where you want the term to appear.
	<b>3</b> Press the annotation key to display an annotation term at the cursor position.
	<b>4</b> If the term that appears is not the one you want, press the key again until the term you want appears.
Pop-up Menu Annotation Keys	• To use a menu annotation key Press TEXT or TEXT START to enter the text function.
	You can drag an annotation term from the menu to the image, or you can select a position on the image and transfer the annotation term to that position.
	To drag and place the annotation term:
	<b>1</b> Press the annotation key to display the pop-up menu.
	<b>2</b> Select the annotation term on the menu and press <b>[SELECT]</b> .
	<b>3</b> Use the trackball to position the term on the image and press <b>[WRITE]</b> .
	• To transfer the annotation term:
	<b>1</b> Position the cursor where you want the annotation term to appear.
	<b>2</b> Press the annotation key to display a pop-up menu.
	<b>3</b> Select the annotation term on the menu.
	4 Press [WRITE].
	<b>NOTE:</b> If the term is in a position where annotations are not allowed, <b>[WRITE]</b> does not appear.
	<ul> <li>To remove an annotation menu from the screen, press [EXIT MENU].</li> </ul>

### Body Markers The Body Markers feature is available

The Body Markers feature is available only on the ACUSON Sequoia 512 ultrasound system.

A body marker is a graphical representation of the anatomy being examined. The body marker indicator (a line) can point to an area of interest or show the transducer orientation for the exam. You can use a body marker as a shortcut method for identifying the type of exam.



Body markers are grouped by anatomical area. Within each group, there are individual markers that represent different views of the anatomy.

You can customize the body marker selection for your ultrasound system using the Setup function. See Chapter 41 for more information.

#### Using Body Markers

#### • To display a body marker:

#### 1 Press BODY MARKER.

- **2** Press the first soft key until the anatomy group you want appears.
- **3** Use the following keys with the body marker function.

CONTROL	FUNCTION
Second soft key	Press to select a view.
[ <sup>0</sup> XDCR:ROTATE/MOVE]	Highlight <b>ROTATE</b> or <b>MOVE</b> and use the trackball to move or rotate the body marker indicator.
[MOVE MARKER]	Press and move the trackball to move or rotate the body marker.
[MARKER: ROTATE/ MOVE] (OB Group)	Press and use the trackball to move or rotate the OB body markers.

4 To exit the body marker function, press **BODY MARKER**.

#### Available Body Markers

The Sequoia 512 ultrasound system provides the following body markers. See the *Administrator Manual*, "Customizing System Setup" for details.

ANATOMY GROUP	MARKER
ABDOMEN	Supine, RPO, LPO, Rt. Lateral, Lt. Lateral, Prone, Rt. Decubitus, Lt. Decubitus
CHEST	AP, Rt. Oblique, Lt. Oblique, Rt. Lateral, Lt. Lateral, Posterior, Thorax
LIVER	Liver
PANCREAS	Pancreas
KIDNEY	Rt. Kidney, Lt. Kidney
NECK	AP, Transverse Thyroid, Rt. Carotid, Lt. Carotid
HEAD	Lt. Sagittal, Rt. Sagittal, Coronal, Rt. Circle of Willis, Lt. Circle of Willis
BREAST	Right AP, Left AP, Rt. Lateral, Lt. Lateral
PELVIS	AP, Sagittal Uterus, Transverse Uterus, Coronal Uterus
ОВ	Rt. Fetal Lie, Lt. Fetal Lie, AP Fetus
PROSTATE	Cross Section, Lateral
SCROTUM	Transverse, Sagittal
EYE	Eye
ARM	Rt. Upper, Lt. Upper, Rt. Forearm, Lt. Forearm
LEG	Lower, Upper, Rt. Medial, Lt. Medial, Rt. Lateral, Lt. Lateral

### FREEZE AND CINE FUNCTIONS

**Overview** Cine memory stores and displays ultrasound information with no loss of signal quality. Cine memory is constantly updated during image or strip acquisition. You have the following options for stopping an ongoing exam and viewing ultrasound information in Cine memory: • The Freeze function freezes the system at the current 2-D or CD frame or the current point in time in a Spectral Doppler or M-mode strip. • The Extended Freeze function lets you quickly review Cine memory by scrolling back and forth through the available information. Extended Freeze is available in 2-D and CD modes, and Spectral Doppler and M-mode strips. The Cine function gives you increased options for viewing the • information in Cine memory. You can scroll through available information, play a continuous loop, and set margins. **NOTE:** On flat panel monitor systems, Cine scrolling is disabled by default for optimal image quality. See Customizing Strip Modes in your Administrator Manual. Imaging functions that change the content of the live image clear Cine memory, for example, DEPTH and SCALE. Functions that change the presentation of the image do not clear Cine memory. Many of these functions (for example, SIZE, SWEEP, U/D INVERT, and L/R INVERT) can be adjusted while in the Cine function. For information about using an acoustic capture protocol with Cine, see "Storing Clips with Acoustic Capture Protocols" on page 60.

#### Imaging Cine

Cine memory captured from a 2-D or Color Doppler image is called imaging Cine memory. In imaging Cine memory, the data field displays the number of the frame you are reviewing (next to the transducer). Data field parameters that were changed during capture are updated as they change.



**Strip Cine** 

Cine memory captured from strip modes (Spectral Doppler and M-mode) and combined image strip modes is called Strip Cine memory. In Strip Cine memory, the data field initially displays the number of seconds of strip information available for review. As you review Cine memory, the data field displays the current time (in seconds) within the review information.



#### **Using Cine**

There are two Cine modes:

- Cine Browse displays a frozen picture of Cine memory that you can scroll through frame by frame.
- Cine Play plays the contents of Cine memory as a continuous loop. If the trigger function was active when you acquired the Cine memory, you can specify whether to display only triggered frames or all frames. For more information about triggers, see Chapter 9.

#### • To enter Cine, press CINE and use the following keys:

CONTROL [SOFT KEY]	FUNCTION
GAIN/FRZ/RUN	Press to toggle between Cine Play and Cine Browse.
	To view Cine memory frame-by-frame, use the Extended Freeze function. See "Extended Freeze" below.
[SET LEFT] [SET RIGHT]	Use in Cine Browse to adjust margins (review length) for Cine Play.
	Scroll to the frame you want to use as a margin and press the corresponding key: <b>[SET LEFT]</b> for left margin or <b>[SET RIGHT]</b> for right margin.
[CLEAR LEFT]	Use in Cine Browse to clear margins for Cine Play.
[CLEAR RIGHT]	Press to reset the corresponding margin to the first ([CLEAR LEFT]) or last ([CLEAR RIGHT]) frame.
[T1/ALL] (one ECG trigger) [T1/T2/T1&T2/	Use in Cine play, when triggers were active during acquisition, to select whether to display only triggered frames ( <b>T1</b> for a single ECG trigger or <b>T</b> for timed trigger) or all ( <b>ALL</b> ) frames.
(two ECG triggers) [T/ALL] (timed trigger)	When two ECG triggers were active, you can select frames from the first trigger ( <b>T1</b> ), the second trigger ( <b>T2</b> ), both triggers ( <b>T1&amp;T2</b> ), or all frames ( <b>ALL</b> ).
[SPEED ↑] [SPEED ↓]	Press <b>[SPEED</b> $\uparrow$ ] to increase or <b>[SPEED</b> $\downarrow$ ] to decrease the speed of Cine Play.
	Speeds above two times the normal speed do not show the ECG.
[NORMAL]	Press to return to reviewing at the real-time rate.
[←/→]	Press to switch the direction of the Strip Cine display.
[PREV R WAVE]	Press to select the previous R-wave.
	When you store a clip, the system includes the image frames in the selected R-wave only.
	<b>NOTE:</b> This soft key is displayed only when an acoustic capture protocol is selected.

#### **Extended Freeze**

You can quickly access Cine while viewing a frozen image. This feature allows for quick review when you want to select a particular frame for measurements or documentation.

- 1 Press GAIN/FRZ/RUN to freeze the 2-D image or strip image.
- 2 Rotate GAIN/FRZ/RUN to scroll through Cine memory.
- **3** Press **GAIN/FRZ/RUN** to return to the live image.

# **DATA MANAGEMENT**

Overview	Your system supports several methods of capturing, storing, and reviewing ultrasound data:
	• You can print images to system printers. See "Printing Images", next.
	• You can record exams on videotape. See "Video Controls" on page 58.
	• You can store images digitally using AEGIS software. See "AEGIS Software" on page 58.
	• You can copy images from the Sequoia hard drive to a storage device (MO disk drive or optional DVD/CD drive.) See "Study Utilities" on page 65.
	• You can export data to an external personal computer connected to the Sequoia system through the parallel printer port using an RS-232 cable. See "Exporting Data" on page 74.
	• You can export data to removable media connected to the Perspective advanced display option through a USB cable. See "Exporting Data" on page 74.
	• You can review stored images from your PC via the Internet. See "WebPro Software" on page 76.
Printing Images	You can print the information that appears on the screen to a variety of printers and cameras. On the Sequoia system, you can set up a primary and an alternate printer. Use the Setup function to select system printers and system behavior when printing. See Chapter 41.
	• To print the current image on the primary printer, press PRINT.
	<ul> <li>To print the current image on the alternate printer, press CODE + ALT PRINT.</li> </ul>
	To remove the soft key menu before printing press RETURN

To remove the soft key menu before printing, press RETURN.

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#### Video Controls

You can use the system's on-board VCR controls to record exams on videotape. For instructions on taking measurements from videotape, see "Taking Measurements from a Videotaped Exam" on page 236.

CONTROL	DESCRIPTION
VCR RECORD	Begins and pauses recording.
PLAY	Plays back a recorded exam.
PAUSE	Pauses playback. Use the <b>GAIN/FRZ/RUN</b> wheel to step through the videotape frame by frame.
STOP/EJECT	Stops playback or ejects stopped videotape.
SHUTTLE	Lets you search through a videotape by turning the <b>GAIN/FRZ/RUN</b> wheel.
REW	Rewinds the videotape.
FF	Fast forwards the videotape.
VCR CTRL	Resets or changes the tape counter when the tape is not playing. Allows adjustment of brightness, contrast, and color while the tape is playing.

#### **AEGIS Software**

The Sequoia system contains the DIMAQ integrated ultrasound workstation, which runs the on-board AEGIS digital image and data management system software. The on-board AEGIS software allows you to capture and review studies digitally on the Sequoia system local hard disk, and on 3.5-inch magneto-optical (MO) disks.

With the optional DVD/CD drive, you can save studies to DVD or CD for storage and copy stored studies from DVD or CD to the Sequoia hard disk for review. See "Retrieving Studies from a DVD or CD" on page 70.

You can review the stored studies to ensure thoroughness, analyze or compare data, and perform measurements, calculations, and annotations. See "Study Utilities" on page 65.

**NOTE:** Measurements and annotation data are not saved within a study. You can save images that show this data or print them and store the hard copies. Structured reports with calculation data are saved with studies and can be reviewed on MO disk or copied from DVD or CD to the Sequoia hard disk for review.

	The following AEGIS software options are available:
	<ul> <li>Standard, on-board AEGIS software lets you store studies on the system's local hard disk and copy them to a storage device such as MO disk or optional DVD/CD drive.</li> </ul>
	<ul> <li>Optional DICOM software allows for review of studies from a 640 MB MO disk or retrieval of studies from a DVD or CD (with optional DVD/CD drive) for review on the Sequoia system hard disk.</li> </ul>
	<ul> <li>Optional DICOM software lets you store and print studies to networked DICOM servers and printers. The DICOM software supports the DICOM standard.</li> </ul>
	• DICOM software lets you retrieve patient information from a Hospital Information System (HIS) or Radiology Information System (RIS) worklist server (Modality Worklist option), eliminating costly errors.
	• Optional hardware and software let you connect to a Siemens AEGIS network for archiving, printing, and review. Contact your Siemens AEGIS Sales Representative for more information.
Storing Images	You can store live, frozen, Cine, and VCR images, text screens, calculation reports, and the Begin-End page.
	<ul> <li>To store the current image, press IMAGE STORE.</li> </ul>
	Wait for the <b>IMAGE STORE</b> light to turn off before pressing <b>IMAGE STORE</b> again to store another image.
Storing Clips	The on-board AEGIS software allows you to store both clips and images. A clip can be full-screen (full size), condensed (one-quarter size) or a selected region of interest (ROI).
	Clips are stored under either a Staged protocol or a Free-Form protocol. A Staged protocol divides a study into stages, and stages can be divided into views. A stress echo study is an example of a Staged study, in which there are two stages, Rest and Post, each stage including images from several different views of the heart.
	A Free-Form protocol does not divide a study, and allows for straightforward storing and reviewing of clips with different characteristics. You can set up a Free-Form protocol to store 1, 2, 4, 8, or an indefinite number of clips each time you press the <b>CLIP STORE</b> key. You also specify the segments per clip, segment length, and alternate segment length for captured clips. If you are using the system's trigger function, you can capture clips at each trigger point. If you are not using the system's trigger function, but have an ECG displayed, you can capture clips at the R-wave of the heart cycle. The ECG may be displayed outside or captured inside the ROI display box. The advantage to storing the ECG in the ROI display is to compare the ECG wave with the image.
	You use the Setup function to select and configure protocols. See Chapter 41.

Storing Clips with Acoustic Capture Protocols

	1
CONTROL	FUNCTION
CLIP CTRL	Select full-screen clip (FULL) or condensed clip (CON).
ROI	Toggles the ROI on and off.
TRACKBALL	Use to position the ROI box. For an ROI clip, place the ROI box over the area you want to store.
PROTOCOL	Press to display a soft key menu for choosing the protocol type. Press again to exit.
CLIP STORE	Begins storing a clip. If you are storing a clip of indefinite length, press <b>CLIP STORE</b> again to end the clip.
	Wait for the <b>CLIP STORE</b> light to turn off before pressing <b>CLIP STORE</b> again to store another clip.
<b>NOTE: CLIP ST</b> and M-mode str	<b>ORE</b> stores a static image for real-time spectral Doppler ips, frozen images, and full-screen text.
You can enable a current examina all frames to the then store a clip	acoustic capture for an existing protocol used in the ation. You can use an acoustic capture protocol to capture Cine buffer when the frame rate is higher than 30 Hz and of the frames in the Cine buffer.
NOTE: You can	save acoustic capture protocols to exam presets.
For more inform AEGIS Protocol	nation on acoustic capture protocols, see "Customizing s" in the <i>Administrator Manual</i> .

Use these controls to store clips:

**NOTE:** When both AEGIS and Cine settings have been selected, AEGIS capture settings override Cine settings. See "Customizing AEGIS Protocols" in the *Administrator Manual* for more setup information.

- To enable acoustic capture for an existing protocol used in the current examination:
- 1 Press **SETUP** to display the **Setup** pop-up menu and then select **AEGIS** to display the **AEGIS** setup screen.
- 2 Select the protocol type (**Free-form** or **Staged**) of the existing protocol and then select **Define**.

The system displays the dialog box for the selected protocol type.

- **3** Select the existing protocol (capture type) from the **Capture Type Control** section at the top of the dialog box.
- 4 Select the **Cine R-R Capture** check box (located in the **Clip Settings** section at the bottom of the dialog box) that corresponds to the required number of heart cycles (**1**, **2**, or **3**).
- **5** Select **[EXIT]** to exit the Setup function.

	٠	To store a clip using an acoustic capture protocol:
	<b>NOTE:</b> If required, enable acoustic capture for an existing protocol used in the current examination.	
	1	Select an acoustic capture protocol.
	2	Acquire images and then press <b>CINE</b> to display the captured Cine frames.
	3	If another heart cycle within the Cine buffer is required, then select <b>[PREV R WAVE]</b> until the required heart cycle is displayed.
	4	Press GAIN/FRZ/RUN to play the clip.
		The system automatically adjusts the playback speed to allow storage of all captured frames to a clip. The playback speed is displayed as a percentage of full speed on the upper right of the screen when Cine is active.
		<b>NOTE:</b> To ensure that all captured frames are stored, do not adjust playback speed or clip margins before storing clips.
	5	Press <b>CLIP STORE</b> to store the clip.
Time Decimated Capture	Us ov wi Ad	e time decimated capture in non-cardiac applications to show changes er a long period of time without collecting a large number of images thin the clip. See "Customizing AEGIS Software" in the <i>ministrator Manual</i> for setup information.
R-wave Decimated Capture	Us spe a c mu De So:	e R-wave decimated capture to capture one frame per heartbeat at a ecified cardiac phase (when an ECG trace is available). R-wave cimated capture significantly reduces the number of frames required in lip to show "wash-in" of contrast agent (when Burst is enabled in the alti-trigger setting for PrecisionBurst). For an example of how R-wave cimated Capture is used see Chapter 18. See "Customizing AEGIS ftware" in the <i>Administrator Manual</i> for setup information.
Saving Images and Clips	Al are sel	l images must be saved in order to be stored permanently. Static images e saved automatically. You can change AEGIS Software settings to ect how the system saves clips:
	•	Automatically when you store them
	•	Only when you mark them as part of the Select Set during AEGIS review
	See	e Chapter 41 for more information on customizing the AEGIS software.
	Bo ite op	th static images and dynamic clips can be included in a Select Set. The ms in a Select Set appear in the order in which they are selected, as posed to the numeric order in which they were stored.
	Yo the	u specify which images and clips are in the Select Set while reviewing em. See "Reviewing Images" on page 62.

#### **Reviewing Images**

### • To review images in the current exam, press REVIEW and use the following controls:

**NOTE:** To review images from a previous exam, use the Study Utilities function. See "Study Utilities" on page 65.

CONTROL [SOFT KEY]	FUNCTION	
[SHOW PAGING] [HIDE PAGING]	In review mode, displays or hides the paging menu. The paging menu allows you to move up or down through stored images, switch between single-image and quad-image screens, or move to the first (home) or last (end) page.	
	Click on 🖾 to display the paging menu.	
QUAD	Switches between single-image and quad-image formats for review.	
[SHOW: ALL/SELECTED]	Select <b>ALL</b> to display all images or clips in the order they were acquired. Select <b>SELECTED</b> to display only images or clips in the Select Set in the order they were added to the set.	
[TEACHING FILE]	When reviewing a Select Set, enters the Study Pro feature. See "Creating a Teaching File" on page 64.	
[SELECT]	Adds the highlighted image or clip to the Select Set.	
[UNSELECT]	Removes the highlighted image or clip from the Select Set.	
DELETE	Deletes the highlighted image or clip immediately. Press <b>DELETE</b> again to undelete. Images and clips are permanently deleted when the exam is closed.	
SAVE	Toggles the save status of the highlighted clip. Clips that are not marked to be saved are deleted when you end the study or exit Review (if configured in AEGIS setup).	
PAGE	When using AEGIS windows:	
	• Press <b>PAGE</b> up to display the previous page or down to display the next page of images.	
	When not using AEGIS windows:	
	• Press <b>PAGE</b> up to display the previous stage or capture type, or down to display the next stage or capture type.	
HOME	Displays the first page of images, clips, stage, or captures within the current stage.	
END	Displays the last page of images, clips, stage, or captures within the current stage.	
[STAGE/VIEW]	Appears when you are reviewing the Select Set in a staged protocol. Select <b>STAGE</b> to display Select Set images for a particular stage. Select <b>VIEW</b> to display Select Set images for a particular view, across stages.	

CONTROL [SOFT KEY]	FUNCTION
PROTOCOL	Displays a soft key menu for customizing clip display.
	<b>[FULL/MEDIUM/MINIMAL]</b> selects the number of lines of labeling information to display on the clips. <b>[VIEW SELECTION]</b> switches between Explicit View and Implicit View options. Press this soft key and then press a select button to display a pop-up menu with your choices.
	In Explicit View, you have access to every specified label and you can label in random sequences. Thus, you don't need to capture or label in the order specified on the AEGIS setup page.
	Explicit View also allows simultaneous installation of a previously selected clip, and reselection with a newly highlighted clip.
	In Implicit View, the selection of highlighted clips within a single stage assigns view names in the same order as they are specified on the AEGIS setup page.
GAIN/FRZ/RUN	Turn to increase or reduce the speed of the selected clip.
	Press to freeze the selected clip, and then turn to review the clip frame by frame. From the soft key menu that appears, press <b>[SET MARGINS]</b> and then press <b>[SET LEFT]</b> or <b>[SET RIGHT]</b> to set margins for clip playback. Press <b>[CLEAR LEFT]</b> or <b>[CLEAR RIGHT]</b> to clear the margins. Press <b>GAIN/FRZ/RUN</b> again to return to playback.
[SPEED ↑]	Increases the speed of the selected clip.
$[SPEED \downarrow]$	Reduces the speed of the selected clip.

### **Creating a Teaching File** The Teaching File feature allows you to combine selected images from multiple patient studies to create a single teaching file study.

- To store images and clips in a teaching file:
- 1 During review (see "Reviewing Images" on page 62 and "Study Utilities" on page 65), press **[SELECT]** to select the images and clips you want to include in the teaching file.
- **2** Press **[SHOW: ALL/SELECTED]** to select **SELECTED** and view the selected images and clips.
- **3** Press **[TEACHING FILE]** to display the Teaching File dialog box.
- **4** Use the following controls, in the Teaching File dialog box, to save the selected images and clips in a teaching file.

CONTROL	FUNCTION
NEW	Creates a new teaching file study that includes the selected images and clips. Enter the name for the new teaching file study in the dialog box that appears.
APPEND	Adds the selected images and clips to an existing teaching file study. Use the trackball to select the teaching file study to which you want to add the images and clips.
CANCEL	Returns to AEGIS review.

#### CONTROL FUNCTION

A Teaching File study sets the Patient Name to be the same as the study name. It has a unique Patient ID, but all other demographic information is left blank. You can use Teaching File studies as you would any other patient studies.

Using the Live Quad	The live quad feature switches the screen to a quad-screen format where
Feature	one image is live and the other three are stored images or clips from the
	current study or a previous one. To enter this function, press <b>QUAD</b> while
	not in review. All of the review functions are available when a stored
	image/clip is highlighted. See "Reviewing Images" on page 62.
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**Printing During Review** Your printing options depend on which AEGIS software you are using.

If your system uses the on-board AEGIS software, press **PRINT** to print the selected images during review. You can also use the Setup function to configure the system to automatically print each image that you store when you press **STORE**, or print all images at once when you exit a study (bulk printing).
# **Study Utilities** The study utilities function lets you perform study management functions, such as:

- Making backup copies of exams using a storage device such as MO drive or optional DVD/CD drive
- Copying CALC data to an MO disk for transfer to your computer using the CALC to MO feature
- Reviewing files on an MO disk
- Copying exams to a DVD or CD
- Retrieving exams from a DVD or CD for review on the Sequoia system hard disk (requires optional DVD/CD drive)
- Remeasurement
- Backing-up to a network server
- Bulk printing of exams

**IMPORTANT:** When the local hard disk becomes full, the oldest studies are automatically deleted. (This method of storing/removing data is often called first-in, first-out.) To set the amount of free hard disk space required before starting a new study, you can customize the Begin page and Study Types. See "System Setup" on page 443.

If you wish to maintain a study archive for future reference, be sure to copy studies to a DICOM server or to a storage device such as MO disk, DVD, or CD (requires optional DVD/CD drive).

â,		Study List for Inter	rnal Hard Dis	k	01 Ju 1:42	n 05 pm
	Select All	Deselect All		Dicom	Message Log	
	Name	ID	Date	Study Type	Size	
	* Daisy Doe * Jane Doe John Doe	S29,111766201 S29,111766196 S29,111766192	01 Jun 05 01 Jun 05 01 Jun 05	Neonatal Ech OB Abdomen	2.8Mb 2.6Mb 2.5Mb	
	(*) These studies hav	re not been copied.				
	Switch Drive:	Internal Hard Disk			Erase	
	Copy to	CD/DVD	=		Review	
	Image					

#### • To access the study utilities function, press STUDY UTIL.

.

	Study List for	Internal Hard [	Disk	14 Apr 98 04:13 pm
Select All	Deselect All	Data		
Name	ID	Date	Study Type	Size
		k		
			Γ	Erase
			Í.	Review
Image	Switch Drive			

For a Sequoia system with cathode ray tube monitor, the Study List screen is displayed as follows:

Use the following controls to perform study management functions.

**NOTE:** Depending upon the accessories and options installed, your system might not have all controls described below.

CONTROL [SOFT KEY]	FUNCTION
[SWITCH DRIVE]	Enables you to select the source from which to display the list of stored studies: Internal Hard Disk, M.O. Disk.
SWITCH DRIVE	Enables you to select the source from which to display the list of stored studies: Internal Hard Disk, M.O. Disk, DVD/CD.
[IMAGE]	Exits the Study List screen and returns to imaging.
[EJECT M.O.]	Displayed when MO disk is in use:
	Ejects the MO disk.
[EJECT DISC]	Displayed when DVD or CD is in use:
	Ejects DVD or CD if the copy to DVD/CD process has not been started. (This process requires the optional DVD/CD drive.)
SELECT ALL	Selects all studies in the list.
DESELECT ALL	Deselects all studies in the list.
ERASE	Erases the selected studies.
PRINT	Prints all images from the selected studies to a DICOM printer. (This feature is called bulk printing and requires the DICOM option.)

CON [SOI	ITROL FT KEY]	FUNCTION	
COF	γ	Copies the selected studies to the selected destination Internal Hard Disk, MO disk, DICOM file server, DVD, or CD. (The DICOM option is required to save to a DICOM file server. The optional DVD/CD drive is required to copy to a DVD or CD.)	
TRA	CKBALL	Use the trackball to move the pointer inside the study list.	
REV	ΊEW	Displays the images and clips for the selected study. (MO Reviews require that the system is set to <b>MO disp</b> for the storage device.)	
		When reviewing a prior study, you can view the All Set or the Select Set (if one was created). You can create a temporary Select Set, take measurements, perform calculations, and create teaching file studies. You cannot change the prior study. The study returns to its original state when you close it.	
FINA	ALIZE	Finalizes the Copy to DVD/CD process. (This process requires the optional DVD/CD drive.)	
		The Sequoia system does not copy exams to finalized	
transi Once	insferred to the MO disk. Ince the Calc data is available on the standard computer, the data can b iported into Notepad, Word, Excel, databases, spreadsheets, reporting		
and o To us equip into v from	other ASCII software applications. use the CALC to MO feature, the standard computer must be ipped with a Magnetic Optical (MO) drive and the ASCII software which you plan to import the calc data. Prior to copying the calc dat n a selected study to MO, the following must be completed:		
<b>1</b> C ir	)pen a study nvolving stu	. (See Chapter 3 for more information dies.)	
<b>2</b> C	Complete a cl	linical Calc exam.	
<b>3</b> E	and the study	<i>y</i> .	
♦ Т	o copy CAL	.C data to an MO disk:	
<b>1</b> P	ress STUDY	<b>UTIL</b> to access the Study List screen.	
<b>2</b> P	lace an MO	disk in the Sequoia system MO drive.	
Т w	he <b>[COPY C/</b> vhen an MO	<b>ALC]</b> soft key is displayed on the Study List screen on disk is inserted in the MO drive.	
<b>3</b> S n	elect <b>M.O. DI</b> o MO disk is	<b>SK</b> from the pop-up menu. <b>M.O. (NA)</b> is displayed who s in Sequoia system MO drive.	

CALC to MO

**4** Select the desired exam to copy. Select **[COPY CALC]**.

One of the following status messages appears:

STATUS MESSAGE	RESULT
COPY CALC DATA	Copying of calc data to MO was successful.
FILE NAME.CSV	The file name is a combination of letters and numbers derived from the patient name and ID. Only the first eight characters of the file name are displayed.
FAILED TO COPY DATA TO MO	Copying of calc data to MO failed.
CAN ONLY COPY TO AN MO	An MO disk is installed in the Sequoia system MO drive, but the pop-up menu selection is not <b>M.O. DISK</b> .

- **5** The status message will remain on the monitor until it is cleared or rewritten by any of the following actions:
  - Entering study utilities.
  - Beginning a new patient.
  - Copying the exam to MO after copying Calc to MO.
- **6** Eject the MO disk from the Sequoia system and insert it into the MO drive of a standard computer.
- 7 Use the appropriate command (Copy, Save, Import, Upload...) to load or open the calc data from the MO disk into the into the desired ASCII software or program.

#### **IMPORTANT:**

**RTANT:** Calc data that has been copied to an MO disk can be overwritten and therefore lost. To avoid potential loss of calc data copied to an MO disk, use the following guidelines:

- Upload the files from the MO disk to a standard computer prior to copying more calc data on to the MO disk.
- Do not copy multiple exams for the same patient onto the same MO disk.

#### Example:

Thomas Anderson has a carotid study that is closed and the calc data is copied to MO. He later has an arterial study done using the same ID number. If the same MO is used, the arterial calc data will overwrite the carotid calc data.

• Do not copy multiple exams where the first eight characters of two different patient names are the same.

#### Example:

Martha <u>Anderson</u> has a carotid study. If her calc data is copied to the same MO as Thomas Anderson, her calc data will overwrite the Thomas Anderson calc data.

<b>Beviewing Studies from</b>	To review a study from an MO Disk:		
an MO Disk	<ol> <li>Press STUDY UTIL to access the Study List screen</li> </ol>		
	Select [SWITCH DRIVE] to view the MO disk		
	3 Select the study to review from the MO disk		
	<ul> <li>Select the <b>REVIEW</b> button on the Study List screen to review patient studies. The system storage device must be set to MO disk.</li> </ul>		
640 MB MO Disk Compatibility	The Sequoia system with optional 640 MB disk drive is compatible with the following 3.5-inch MO disk sizes:		
	128 MB MO disks		
	230 MB MO disks		
	540 MB MO disks		
	640 MB MO disks (requires 640 MB disk drive)		
	e 640 MB drive is compatible with 128 MB, 230 MB, and 540 MB MO sk formats. The 640 MB disk has DICOM format, giving it Work Station 00 compatibility.		
	MO disks formatted by Sequoia systems running "Signature Option Plus" software are not compatible to read and write on systems running earlier versions of Sequoia software. MO disks formatted by systems running "Signature Option" software have read and write compatibility on systems running "Signature Option Plus" software.		
	Use the Setup function to configure AEGIS software for your system. For instructions, see Chapter 41.		
Copying Studies to	Requires optional DVD/CD drive		
DVD/CD	You can copy stored exams, including structured reports, from the Sequoia system hard disk to a DVD or CD for storage. In addition, you can copy exams from DVD or CD to the Sequoia hard disk for review.		
	For information on messages, see "Status and Error Messages" on page 71. For descriptions of icons, see "Icons" on page 73. For a list of approved media, see "DVD/CD Disc Compatibility" on page 73.		
	• To copy exams to DVD or CD:		
	<b>1</b> Insert a DVD or CD into the Sequoia system DVD/CD drive.		
	<b>2</b> Press <b>STUDY UTIL</b> to access the Study List screen.		
	<b>3</b> Select one or more exams from the list.		
	4 Select <b>DVD/CD</b> from the <b>Copy</b> drop-down list.		
	The system displays the <b>"Switching to DVD/CD"</b> message. Wait until the <b>Study List for DVD/CD</b> page is displayed.		
	5 Select Copy.		
	When the copy task is complete, the disc is ejected from the drive.		

- 6 To copy more exams to the DVD or CD, insert the disc into the drive and repeat steps 1 through 5.
- 7 To finalize the disc, insert it into the DVD/CD drive.

The Sequoia system does not copy to finalized discs. If you want to copy more exams, do not finalize the disc until you are done copying to it.

Some standard computers read only finalized discs. If you will use the DVD or CD to load or view data on a standard computer that reads only finalized discs, you must plan your copying sessions accordingly.

#### Select Finalize. 8

**Retrieving Studies from a** To review a study from a DVD or CD, you must first copy the study to the Sequoia system's internal hard disk. The system's maximum local hard disk storage capacity is 2 GB. The storage capacity of approved DVDs is 4.7GB and that of approved CDs is 700MB.

> Use the Study Utilities function (see "Study Utilities" on page 65) to monitor available disk space when copying exams from a DVD or CD to the Sequoia system internal hard disk.

- To retrieve and review a study from DVD or CD:
- Insert a DVD or CD into the Sequoia DVD/CD drive. 1
- 2 Press **STUDY UTIL** to access the Study List screen.
- 3 Select **DVD/CD** from the **SWITCH DRIVE** drop-down list.
  - The system displays the "Switching to DVD/CD ..." message. Wait until the Study List for DVD/CD page is displayed.
- 4 Select the study to review from the Study List screen.
- 5 Select **COPY** to copy the study to the Sequoia internal hard disk.
- Select Internal Hard Disk in the SWITCH DRIVE drop-down list. 6
- 7 Select the study to review.
- 8 Select **REVIEW** on the Study List screen to review patient studies.

DVD or CD

#### Status and Error Messages

The Sequoia system displays status and error messages on the lower left, center, and upper right of the screen.

MESSAGE	DESCRIPTION AND ACTIONS		
SWITCHING TO DVD/CD	The Sequoia system is switching to the DVD/CD drive. This process can take several seconds. Wait until the <b>Study List for DVD/CD</b> screen is displayed.		
DVD/CD DRIVE IS NOT AVAILABLE	The system is not responding.		
TRANSFERRING	The system is sending exams to the DVD/CD drive. If you cancel during this stage, no information will be saved to the DVD/CD drive.		
BUILDING DICOMDIR	The system is compiling exams in a DICOM directory prior to burning the DVD or CD. If you cancel during this stage, no information will be saved to the DVD/CD drive.		
INITIALIZING	The system is preparing the disc in the DVD/CD drive for writing. If you cancel during this stage, no information will be saved to the DVD/CD drive.		
WRITING	The system is burning the information onto the DVD or CD. If you cancel during this stage, the disc in the DVD/CD drive will become unusable.		
ABORTING DURING TRANSFER WILL DESULTING OSING	This message is displayed if you select <b>Cancel</b> at any time during transferring, building DICOMDIR, or initializing.		
ALL TRANSFERRED DATA. ARE YOU SURE?	Select <b>Yes</b> to cancel the copy process and return to the Study List screen. No information is saved on the disc in the DVD/CD drive. You can restart the process later using the same disc.		
	Select <b>No</b> to continue the copy process.		
ABORTING DURING WRITE TO	If you select <b>Cancel</b> during the writing phase, this message appears.		
IN AN INVALID DISK. ARE YOU SURE?	Select <b>Yes</b> to cancel the writing process and return to the Study List screen. The disc in the DVD/CD drive will become unusable.		
	Select <b>No</b> to continue the writing process.		
NOT ENOUGH SPACE ON THE DISC TO COPY THESE STUDIES.	The disc in the DVD/CD drive does not have enough space to copy the selected studies. Select <b>OK</b> to clear the message and return to the Study List screen. Select fewer studies or insert a disc with more available space		

MESSAGE	DESCRIPTION AND ACTIONS
INVALID MEDIA. PLEASE INSERT A VALID DISC AND PRESS CONTINUE.	There is no disc in the DVD/CD drive or the disc in the DVD/CD drive is not a supported type. Select <b>Cancel</b> to return to the Study List screen. Or, insert a valid disc into the DVD/CD drive and select <b>Continue</b> .
X OF Y STUDIES SUCCESSFULLY COPIED. STUDIES NOT SUCCESSFULLY COPIED ALREADY EXIST ON DESTINATION DEVICE.	Reports the number of exams that were successfully copied out of the total attempted. The system does not copy exams that are already on the disc in the DVD/CD drive. Select <b>OK</b> to proceed.
OLDER VERSION OF THIS STUDY EXISTS. DO YOU WISH TO OVERWRITE IT?	The last modification time of the study on the DVD or CD is older than the one on the hard disk. Select <b>Overwrite</b> to replace the older exam with the newer version. Select <b>Cancel</b> to cancel the copy process and return to the Study List screen.
STUDY ALREADY EXISTS STUDY NOT COPIED.	A study with the same name, time, and date already exists on the target drive (Sequoia hard disk, DVD, or CD). Select <b>OK</b> to clear the message and return to the Study List screen.

The disc icon is displayed when you select **DVD/CD** drive on the Study List screen.

Indicates the type of media (DVD or CL in the drive         Indicates the drive         Indicates the DVD/CD device (drive) is selected but the drive is empty or contair an unsupported disc type         Indicates the media type (DVD or CD) and amount of free disc space: 25%, 50% 75% with corresponding shading of the icon	ICON	DESCRIPTION
Indicates the DVD/CD device (drive) is selected but the drive is empty or contair an unsupported disc typeIndicates the media type (DVD or CD) and amount of free disc space: 25%, 50% 75% with corresponding shading of the icon	O DVD-R CD-R	Indicates the type of media (DVD or CD) in the drive
DVD-RDVD-RIndicates the media type (DVD or CD) and amount of free disc space: 25%, 50% 75% with corresponding shading of the icon		Indicates the DVD/CD device (drive) is selected but the drive is empty or contains an unsupported disc type
	O O O O O O DVD-R DVD-R	Indicates the media type (DVD or CD) and amount of free disc space: 25%, 50%, 75% with corresponding shading of the icon
Adjacent to the icon, the system display the amount of free space on the disc, for example: "658 MB free"		Adjacent to the icon, the system displays the amount of free space on the disc, for example: "658 MB free"

#### DVD/CD Disc Compatibility

The Sequoia system with optional DVD/CD drive is compatible with the following 12cm single-layer disc formats:

8X DVD-R and CDR by TDK, JVC, VERBATIM, IMATION

Other disc formats might be compatible but have not been tested by Siemens.

Use only 12cm discs. Any other size might damage the DVD/CD drive.

**Exporting Data** When you export data to an external storage device, the ultrasound system sends raw data to the Perspective advanced display option through a USB cable. The Sequoia system automatically assigns a file name that is a compilation of the export date and time.

The following USB devices have been tested with the Sequoia system to complete export tasks:

- ScanDisk 2in1 with 128MB compact card
- ScanDisk 6in1 with 128MB compact card
- NEXDISK 128MB
- LEXAR Media JumpDrive 128MB
- Buslink 128MB BusDrive-On-The-Go
- CompUSA 128MB FlashDrive
- Universal 32MB SmartDrive
- IOMega 100MB USB Zip Drive
- Apacer Handy Steno 512MB 4GB
- Apacer Industrial CF Card 64MB 4GB
- Apacer Industrial Extended Temperature CF Card 64MB 4GB
- Apacer Industrial Standard CF Card 64MB 8GB
- Apacer Industrial CF Card 64 MB 8GB
- SanDisk 256MB flash memory card
- SanDisk 512MB flash memory card

**NOTE:** When using the Perspective Advanced Display option, a hard drive with 2GB storage capacity is recommended. Older systems with 1GB hard drives support approximately 500MB storage capacity.

ASCII File Content

The information that you can expect to see when the calc data has been opened, imported, or uploaded into an ASCII program, is the Demographic page entries and the calc data recorded during the study. The calc data for right atrial pressure is listed as a default value (PRESS ra – 10) unless this value is changed during an exam.

The following text and numbers may display when the calc data is loaded into an ASCII program, but have no significance to the actual calc data:

- **SELECT** followed by numeric values.
- **Status**, **text**, **GOOD** default listing.

**NOTE:** ASCII files on an MO disk will not be displayed on the Sequoia study utilities list.

## Using DICOM Services

Sequoia systems support the DICOM standard for interchanging information with networked print and file servers. If your system is connected to a DICOM printer or file server, you see an additional soft key label when you press **BEGIN END**. The label you see depends on which devices have been configured for your system. For information about configuring DICOM devices, see "Setting Up Network Printers" in the *Administrator Manual*.

[SOFT KEY]	FUNCTION
[PRINT NOW]	Press to force printing before Auto Print takes effect. Enable the Print Now feature by setting DICOM Services Auto Copy to Server to OFF and Auto Print to ON. Access this soft key from an open study.
[PRINT STUDY]	Press to print all stored images for the study to the currently selected DICOM printer.
[COPY TO <server name="">]</server>	Press to copy the study to the selected DICOM server.
[DICOM SERVICES]	Appears only when <u>both</u> a DICOM printer and a server are available. Press to display soft keys where you can choose to print or copy the study.

**NOTE:** To retrieve studies from an HIS or RIS worklist server for review, see "Retrieving Patient Information from the Worklist Server" on page 32.

WebPro Software	The WebPro Web-Based Package is an optional feature that allows you to view ultrasound exams from a stand-alone computer. A standard PC that is outfitted with suitable hardware and software can be transformed into a primary ultrasound review station.		
	A computer must be linked to the ultrasound system via a modem, an ISDN line, or a local intranet in order to use the WebPro Package software. Intranet, ISDN, and modem configuration is your responsibility.		
	Protection against unauthorized access is provided by requiring each user to supply a user name and password to access this feature. The customer is responsible for the overall security of the network to which the ultrasound system and computer are attached through the use of network firewalls or other similar security measures.		
	The host name and IP address will be set by a Siemens service representative or by your hospital network administrator.		
Minimum PC Requirements	The WebPro Package is designed to transform a standard PC into a primary ultrasound review station and, as such, it requires the following minimum computer specifications:		
	• A PC (running Windows 95 or Windows NT 4.0 or greater)		
	• A modem, ISDN line, or a local intranet connection		
	One of these Web browsers:		
	Netscape Communicator, version 4.02 or greater		
	Microsoft Internet Explorer, version 4.0 or greater		
	For best performance, Siemens recommends the following minimum hardware:		
	• For remote access, an ISDN connection or a 56K modem		
	A 200-MHz Pentium Processor with MMX technology		
	• 64 megabytes of RAM		
	• A 4-megabyte video card that supports 24-bit color at 1024 x 768 resolution		
	• A monitor that supports 1024 x 768 resolution		
Recommended Plug-Ins	You need a QuickTime-compatible plug-in (or helper application) to view clips. If you do not have this software, clicking on a clip automatically prompts you to download a QuickTime plug-in from the Internet. If the PC you are using is not connected to the Internet, you will have to install QuickTime yourself. Contact Apple Computer for information on obtaining QuickTime software, or download the QuickTime plug-in from the Internet using a computer that has access to the Internet at the following URL:		

http://www.quicktime.apple.com

**Using WebPro Software** WebProPackage software is factory loaded onto your system when you purchase it. When your Sequoia system arrives, the appropriate network configuration must be completed by a Siemens customer engineer or local site administrator. WebPro Package software is invisible on your ultrasound system. It is accessed from a PC that has been configured to act as a WebPro Package review station.

**NOTE:** The Sequoia system must be left on to use this feature.

For complete instructions, please refer to the on-line Help page that serves as the instruction manual for the WebPro Package. A **HELP** button and a **LOG OUT** button appear on every WebPro Package page.

#### • To log into the WebPro Package:

- 1 From a suitably outfitted PC, start your Web browser and type either of the following in the Location (Netscape Navigator) or Address (Microsoft Internet Explorer) text box:
  - http://IP address

where IP address is the IP address of the ultrasound system

• http://host name

where *host name* is the name assigned to the ultrasound system.

- **2** On the Login page that appears, enter your user name and password.
  - For a first-time login, to set up a name and password, use Admin as the user name and admin as the password.
  - Enter the user name and password as prompted.
  - Select **Add** from the screen options.
  - Log out and then log back in using the user name and password that you set up.
- **3** Once logged in, use the following controls to review images and clips stored in studies:

CONTROL	FUNCTION
SEARCH BUTTON	Displays a list of exams stored on the ultrasound system.
ALL IMAGES BUTTON	Previews all images from the selected study.
SELECT SET BUTTON	Previews only those images included in the select set for the selected study.
PREVIEW IMAGE/CLIP	Displays an image or clip in full size.
LOG OUT BUTTON	Disconnects from the ultrasound system.

You can review an open study that is currently in progress. Use your Web browser's Forward and Back buttons to update the image set as new images and clips are captured.

Chapter 8 - Data Management

Imaging Mo exam. It inc	odes describes imaging modes you can use to perform an ludes the following chapters:
Chapter 9	2-D Imaging Mode81
Chapter 10	Color Doppler Basics
Chapter 11	CDE and CDV103
Chapter 12	Clarify VE 109
Chapter 13	High Resolution Color Flow
Chapter 14	Doppler Tissue Imaging 117
Chapter 15	Cardiology Cadence Contrast Agent Imaging
Chapter 16	General Imaging Cadence Contrast Agent Imaging 137
Chapter 17	Axius Auto-Tracking Contrast Quantification
Chapter 18	Contrast Agent Imaging PrecisionBurst171
Chapter 19	Convergent CPS
Chapter 20	Spectral Doppler Mode
Chapter 21	M-Mode
Chapter 22	Color M-Mode
Chapter 23	FreeStyle Extended Imaging
Chapter 24	3-D Surface Rendering and Multi-Planar Rendering 209



2-D imaging is the basic mode for observing anatomy and determining areas of interest that you may want to examine with other modes. You can display a 2-D image at the same time as you display a spectral Doppler or

# Entering 2-D Mode

## • To enter 2-D mode:

- **1** Turn on the system.
- **2** Connect a transducer.

The system activates and displays 2-D mode.

• To return to 2-D mode from another active mode, press 2D ONLY.

# Image Format Controls

CONTROL	USE
DEPTH	Adjusts the field of view to the penetration selection.
IMAGE WIDTH	Use the trackball <b>SELECT KEYS</b> to adjust the image width to show just an area of interest. (This feature is not available on linear array transducers.)
TRNS ZONE	Press to increment the number of transmit zones.
POSITION	Turn to position the caret(s) to a focal area within the image.
L/R	Flips the image from left to right.
U/D	Flips the image up and down.
SIZE	Changes the image size.

# Image Optimization Controls

CONTROL	USE
DYN RANGE	Turn clockwise to increase the dynamic range, or counterclockwise to decrease the dynamic range.
PERSIST	Controls how rapidly an image appears to change over time. Use lower levels for rapidly changing anatomy. Use higher levels to provide a smoother image for slow moving structures.
DGC SLIDERS	Each slider adjusts gain at the corresponding depth.
TISSUE EQUALIZATION TECHNOLOGY	Automatically optimizes gain and depth gain compensation (DGC) across the two-dimensional image.
	Tissue equalization technology (TEQ) optimizes the image when you press <b>TEQ</b> during imaging.
	Native tissue equalization technology (Native TEQ) continuously monitors the image and automatically optimizes gain and depth gain compensation (DGC) when change in the image meets the sensitivity threshold you select in the Setup menu.
	Native TEQ is available with software version 8.5 or higher.
	For more information, see "Tissue Equalization Technology Options" on page 89 and System Setup in the <i>Administrator Manual</i> .
POST	Adjusts the assignment of gray levels to echo amplitude. Use soft keys to select a postprocessing map. Options range from low to high contrast.
	<b>NOTE:</b> You can alternatively use a numeric key on the alphanumeric keyboard to select a map.
SPACETIME	Adjusts SpaceTime resolution control. Press up to emphasize temporal resolution (T1 or T2) or down to emphasize spatial resolution (S1 or S2).
	Use <b>SPACETIME</b> to apply Spatial Compounding Plus settings available in 2-D mode.
2D GAIN	Turn clockwise to increase overall gain, or counterclockwise to decrease overall gain.
EDGE	Press up for sharper borders or down for smoother borders.
DELTA	Adjusts Delta Differential Echo Amplification. Use Delta amplification to control the degree of contrast resolution within an image. Press up to use a higher level of contrast resolution, or down to use a lower level of contrast resolution.
B COLOR	Selects a mapping between different colors or hues of a color and echo amplitude.

CONTROL	USE
MULTIHZ	MultiHertz multiple frequency imaging. Toggle up to
	increase the imaging frequency (enters NTHI and
	compounding) or down to decrease the
	imaging frequency.

RES Enhanced Resolution Imaging RES Enhanced Resolution Imaging lets you enhance the resolution of a portion of the image and view it in real-time. You can perform all functions on the enhanced image, including using other operating modes.



1. Press **RES** to display the RES box.



2. Position the RES box; then press **RES** (or double-click) to enhance the image.

CONTROL [SOFT KEY]	FUNCTION
[EXIT]	Removes the RES box and exits the RES function.
[()RES]	Activates and applies Enhanced Resolution Imaging (RES).
	Selects the RES box type.
TRACKBALL	Adjusts position or size of RES box.
[()RES POS/SIZE]	Controls whether the trackball adjusts the RES box position ( <b>POS</b> ) or size ( <b>SIZE</b> ).
	You can customize the system to increase the size of the RES box with either the center point anchored or the upper-left corner anchored. For instructions, see the <i>Administrator Manual</i> .

Dual Imaging	You can display images side-by-side different scan planes, view structure wider field of view.	e on the screen to compare anatomy in es or pathologies, and to display a
	During real-time imaging when Du image is displayed in real-time and select the left or right image for acti orientation indicator at the top of th indicator at the top of the inactive in depends on image orientation.	al imaging is enabled, the active the other image is frozen. You can vation. The system displays a gold he active image and a gray orientation mage. The position of the indicator
	Use the RES, Image Width, U/D or real-time images.	L/R Invert controls to recenter
	When "Live Dual" is enabled, both changes made to the active image a	images are displayed in real-time and re applied to both images.
	For example:	
	• Use color to view both an anato image in the side-by-side displa	mic image and pathologic blood flow ay.
	• Use CPS to view both the anato contrast agent in the side-by-sic	my with contrast agent and without le display.
	• Use Spatial Compounding Plus an enhanced image in the side-l	to view both the original image and by-side display.
	The system displays the images in a acquired using a transducer other the trackball to reposition real-time ima simultaneously repositions both images.	a "pan box" when the images were han a linear array transducer. Use the age(s) in the "pan box." The system ages.
Transducers	Dual imaging is compatible with an	ny imaging transducer.
Presets	Dual imaging is available with any available with the following exam p	exam preset. "Live Dual" imaging is presets.
	"LIVE DUAL" IMAG	ING EXAM PRESETS
	CARDIAC	ABDOMINAL
	CPS LVO	CPS Abdomen

- CPS Exercise SE
- CPS Pharm SE
- CPS MCE
- PCI MCE

You can save the following Dual imaging settings to an Exam Preset:

- Image size (adjusted using the **Setup** screen or the **SIZE** key)
- "Live Dual" setting

#### • To activate "Dual" imaging:

**NOTE:** You cannot display Dual images when strip modes are active or during live quad imaging.

### 1 Press DUAL.

The system resizes the live, real-time (active) image and then places the image on the left of the screen. The system displays a gold orientation indicator at the top of the active image and a gray orientation indicator at the top of the inactive image. The position of the indicator depends on image orientation.

- 2 To select the other image for activation, press [()**DUAL L/R**] or use the trackball to position the cursor on the other image and then press a **SELECT** key. You can also program the footswitch to select an image for activation.
- To activate "Live Dual" imaging:
- 1 Press DUAL.
- 2 Press [LIVE DUAL].
- To exit Dual imaging, select from one of the following methods:
- Press 2-D ONLY.
- Press **DUAL** again.
- Activate a strip mode (PW, CW, or Aux CW).
- Press **[EXIT]** (if the system is not in Cine or frozen).

CONTROL	FUNCTION
DUAL	Displays two images, side-by-side on the screen. The active image is real-time (live) while the other image is frozen.
TRACKBALL	For images acquired using a transducer other than a linear array transducer, repositions the images in a "pan box."
[()DUAL L/R]	Selects the other image for activation during live imaging.
[LIVE DUAL]	Displays two real-time images, side-by-side on the screen with one image active.
[DATA FIELDS	<b>SHOW</b> displays the data fields.
SHOW/HIDE]	<b>HIDE</b> removes the data fields from the screen (time and date continue to display).
	<b>NOTE:</b> Stopwatch information, Power, and MI are still displayed when <b>HIDE</b> is selected.
[EXIT]	Exits Dual imaging.

# Controls

#### Interaction of Dual Imaging with Other Functions

FUNCTION	INTERACTION WITH DUAL IMAGING
2-D MODE	Use any of the 2-D imaging parameters with the active side of the Dual imaging screen.
	Use Tissue Equalization (TEQ) or Native Tissue Equalization technology (Native TEQ) with the real-time image.
ANNOTATIONS	Use with either image.
BALANCE	When using ADI or CPS techniques during Live Dual, use to toggle between all three balance states on one side of the dual display, and the tissue only image on the other side of the display.
CADENCE CONTRAST IMAGING	Use CPS or postprocessing maps with the active side of the Dual imaging screen.
CINE	Activates Cine on the active image.
CLIP STORE AND IMAGE STORE	Captures both sides.
COLOR DOPPLER	Use any of the color Doppler parameters with the active side of the Dual imaging screen.
	Press <b>LIVE DUAL</b> to display the CD "pan box" on the real-time image and clear the frozen image.
GAIN/FRZ/RUN	Press to freeze, or rotate to change the gain of the real-time image.
IMAGE WIDTH	Use with real-time images that are acquired with non-linear transducers (for example, curved, vector, or sector format transducers).
L/R INVERT	Use with the real-time image.
MEASUREMENTS	You may take measurements on both images.
	CD (Color Doppler) calipers are only available on Live Dual images.
PAGE	Selects the other image for activation during live imaging.
PHYSIO	Displays a physio trace on the active image. When you change the active window from one side to another, the system redraws the physio trace.
POST PROCESSING	Applies the selected map to the active image.
PRINTING	Prints both sides.
PRIORITY	Switches between active functions.
SIZE	Applies change to both sides simultaneously.
SPACETIME	During Live Dual imaging, applies changes to both images.

	F	UNCTION	INTERACTION WITH DUAL IMAGING
	S	SPATIAL COMPOUNDING PLUS	Optimizes clips and images during Live Dual imaging. Images may not have the same Spatial Compounding setting.
	V	/CR RECORD	Records both images. Dual imaging suspends during VCR Playback or if an External Video is active.
Tissue Contrast Enhancement Technology (TCE)	TC cli res de	CE tissue contrast enha nical information for 2 solution while preserv finition, border defini	Incement technology enhances image quality and 2D imaging. This technology increases contrast ing detail information, improving anatomic tion, and tissue conspicuity.
	NC Er me im me	<b>DTE:</b> After you have enhancement Technolog easurement tools are nage. The aspect ratio of easured results.	enhanced an image with Tissue Contrast y (TCE) and then stored the enhanced image, tot available for use on the stored, enhanced of these images does not support reliable
Controls			
	c	CONTROL	
	[	SOFT KEY]	FUNCTION
		POST	Activates Tissue Contrast Enhancement technology (TCE) on a selected image in Review.
	[	SMOOTH]	Specifies the level of speckle reduction applied to the selected image. Settings range from <b>1</b> (lowest level) to <b>3</b> (highest level).
	[	CONTRAST]	Specifies the level of contrast enhancement applied to the selected image. Settings range from <b>1</b> (lowest level) to <b>3</b> (highest level).
	[	EXIT]	Exits Tissue Contrast Enhancement (TCE).
Activating and	•	To activate Tissue	Contrast Enhancement (TCE):
Exiting TCE	1	Press <b>REVIEW</b> to disp	play the review screen.
	2	Use the trackball to press <b>POST</b> .	position the cursor over a 2-D image and then
		The system activates TCE settings.	s TCE and then displays soft keys for
	3	<b>3</b> To adjust speckle reduction, select <b>[SMOOTH]</b> .	
	4	To adjust contrast resolution, select [CONTRAST].	
	5	To exit TCE, press <b>[E</b>	EXIT].

Tissue Equalization Technology Options	Tissue equalization options enable you to automatically optimize gain and depth gain compensation during B-mode imaging.	
	• TEQ optimizes gain and depth gain compensation (DGC) across the two-dimensional image each time you press <b>TEQ</b> .	
	• Native TEQ (available with software version 8.5 or higher) continuously monitors the image and automatically optimizes gain and DGC when change in the image meets the sensitivity threshold you select in the Setup menu.	
lcons	When TEQ or Native TEQ is active, an icon is visible above the image. The Native TEQ icon is gold when the option is active and gray when the option is inactive.	
	OPTION ICON	
	TEQ 🛁	
Accessing Tissue Equalization Setup	To access the Tissue Equalization setup screen, do one of the following:	
	• Press CODE + TEQ.	
	<ul> <li>Press SETUP, then select 2-D on the Options menu, and click</li> <li>Tissue Equalization on the 2-D Options screen.</li> </ul>	
	For information on selecting tissue equalization settings, see System Setup in the <i>Administrator Manual</i> .	
Exam Presets	You can save any tissue equalization setup settings to an exam preset. See "Customizing Presets" in the <i>Administrator Manual</i> .	
	Most Siemens exam presets are set to activate Native TEQ automatically. The exceptions, which use TEQ, are:	
	All contrast exam presets	
	General Imaging: CPS Abdomen	
	<ul> <li>Cardiology: CPS LVO, CPS MCE, CPS Exercise SE, CPS Pharm SE, PCI MCE</li> </ul>	
	<b>NOTE:</b> Due to gain fluctuations in the B-mode image, Native TEQ is not recommended for quantification of the contrast agent wash-in signal during contrast agent imaging.	
Transducers	TEQ is available with all transducers. Native TEQ is available with all transducers except the Aux CW.	
Activating and Exiting	To activate TEQ:	
TEQ Options	<b>1</b> During imaging in B-mode, press <b>TEQ</b> .	
	The system activates TEQ and optimizes the image. The TEQ icon is displayed above the image.	
	<b>2</b> Press <b>TEQ</b> again to re-apply TEQ updates to the image.	
	<b>3</b> Press <b>TEQ</b> twice in rapid succession to exit TEQ.	

- To activate Native TEQ, do one of the following:
  - During imaging in B-mode, select any exam preset that includes Native TEQ.
  - During imaging in B-mode with **NTEQ feature** selected in Setup, press **TEQ**.

The system activates Native TEQ, optimizes the image, and monitors the image, continuously optimizing the image as appropriate.

- To pause Native TEQ, press **TEQ** once.
- To stop Native TEQ, press **TEQ** twice in rapid succession.
- To reactivate Native TEQ, press **TEQ** once.
- To adjust the sensitivity threshold, press the **BALANCE** key. Each time you change the sensitivity threshold, it is displayed on the lower left of the screen for several seconds.
- To change the target tissue intensity during imaging with Native TEQ active, adjust the **GAIN** knob, then press the **GAIN** knob to retain the change during the current patient exam.

**NOTE:** When you adjust the DGC sliders or the **GAIN** knob, the system pauses Native TEQ. To reactivate Native TEQ, press **TEQ**.

• When you enter a triggered mode, the system pauses Native TEQ. To reactivate Native TEQ, exit the triggered mode, and press **TEQ**.

Spatial Compounding Plus	Spatial Compounding Plus is a 2-D image optimization technique that produces improved contrast resolution and improved visualization and continuity of linear structures. Spatial Compounding Plus combines image data acquired with distinct apertures and/or lines of sight to the ultrasound target and can yield images superior to that of conventional ultrasound.	
	<b>NOTE:</b> Spatial Compounding Plus is not available when using mixed modes, Contrast Pulse Sequencing (CPS), Live-Quad imaging, or triggered imaging.	
	See the <i>Transducer Specifications Manual</i> for a list of transducers that support this technique.	
Activating Spatial Compounding Plus	To use Spatial Compounding Plus, push SPACETIME down to cycle through the settings until the system displays the SC indicator in the data field. For example: SC1.	
	The available settings are transducer-dependent.	

Transmit Compounding	Transmit Compounding is a 2-D image optimization technique that produces improved contrast resolution and penetration. Transmit Compounding combines image data acquired with distinct frequencies and can yield images superior to that of either component frequency.
	See the <i>Transducer Specifications Manual</i> for a list of transducers that support this technique.
Activating Transmit Compounding	<ul> <li>To use Transmit Compounding, push MULTIHZ to cycle through the settings until the system displays the C indicator in the data field.</li> <li>For example: C10.0MHZ.</li> </ul>
	For transducers capable of using NTHI with Transmit Compounding, the system displays both the ${f H}$ and ${f C}$ indicator in the data field.
B Color Maps	Use B color maps to enhance images and clips.
B Color Maps for General Imaging	
2D-Mode	• A - Cameo
	• B - Moonlight
	• C - Sage
	• D - Cocoa
	• E - Solar
	• F - Arctic
Pulsed Wave Doppler	• 1 - CoolBlue
	• 2 - Magenta
	• 3 - Rainbow
	• 4 - Sepia
	• 5 - Temp
	• 6 - Aqua
	• 7 - Invrbow
	• 8 - Opal

### **B** Color Maps for Cardiac

#### 2D-Mode

- 1 CoolBlue
- 2 Magenta
- 3 Rainbow
- 4 Sepia
- 5 Temp
- 6 Aqua
- 9 Black
- 10 Amber

#### Pulsed Wave Doppler

- 1 CoolBlue2 Magenta
- 2 Magenta 3 Rainbow
- 4 Sepia
- 5 Temp
- 6 Aqua
- 7 Invrbow
- 8 Opal
- 10 Amber

## Selecting a B Color Map

- To select and display a B color map:
- 1 Press B COLOR.
- **2** Press the B color map soft key to cycle through the series of color maps until the desired map is displayed.

# Native Tissue Harmonic Imaging

The Native Tissue Harmonic Imaging (NTHI) option is a 2-D image optimization technique that produces improved images in the scanning of technically difficult patients. NTHI may help to reduce clutter noise, resulting in image clarity with better tissue contrast and information content. See the *Transducer Specifications Manual* for a list of transducers that support the NTHI option.

When you use NTHI, the outer edges of the image may appear darker; this darker appearance is normal. It is recommended that you use the appropriate NTHI Image Preset to optimize the image. If you do not, you may need to adjust the following image optimization controls when using NTHI:

- Overall gain
- Dynamic range
- DGC sliders
- Edge
- DELTA amplification

Activating Native Tissue Harmonic Imaging

 To use Native Tissue Harmonic Imaging, push MULTIHZ up to cycle through the settings until the system displays the H indicator in the data field.
 For example: H3.5MHZ.

Triggered Images	<ul> <li>You can use triggers to update the 2-D or Color Doppler image at regular intervals. There are two types of triggers: timed triggers and ECG-based triggers. These triggers have settings that are Exam Presets including:</li> <li>R-wave (Single, Dual, or Multiple) and Timed</li> </ul>
	wave count
	• delay 1
	• delay 2
	When using ECG with triggers enabled, the system applies the current trigger setting values. Enabling triggers without using ECG applies the current trigger setting values unless an R-wave is the current mode. In the case of R-wave, the mode changes to timed. For more information on Exam Presets, see "ACUSON Exam Presets" on page 44.
ECG Triggers	If you are displaying an ECG, you can select up to two trigger points in the cardiac cycle. These points determine when the 2-D or Color Doppler image is updated. For more information about displaying an ECG, see Chapter 4.
	You use the trackball to place one or two ECG-based trigger points in the cardiac cycle.
	If you select two trigger points, the system displays two images from each heart cycle. The trackball controls the offset from the R-wave. There is one offset for T1 and one offset for T2.
	If you select multiple triggers, the system generates a primary trigger at the specified location ( $\Delta$ T1) and generates multiple secondary triggers at the specified interval ( $\Delta$ T) for each R-wave.
	To set ECG triggers, you must first display an ECG trace. If there is no ECG trace, entering the trigger function activates a timed trigger. Removing the trace exits the ECG trigger function.
	<ul> <li>Primary (Single) R-wave triggers are represented by solid, full-height bars</li> </ul>
	<ul> <li>Second (Dual) R-wave triggers are represented by dotted, full-height bars</li> </ul>
	• Secondary (Multiple) triggers are represented by solid, third-height bars

When the ECG trigger function is active, trigger markers display across the ECG to indicate where frames were acquired relative to the ECG. **R-TRIG** replaces the frame rate in the data field. The data field also reports the current values for the trigger points and the beat interval (for example, N=1) for triggering. Trigger points that are placed too close together produce error messages.

DISPLAY	DESCRIPTION
∆ <b>T1=</b>	Time (msec) after Nth R-wave at which to acquire 2-D image for first trigger.
∆ <b>T2=</b>	Time (msec) after Nth R-wave at which to acquire 2- D image for second trigger. Appears only when two triggers are active.
Δ <b>T=</b>	Time (msec) between intervals to acquire 2-D image.
N=	Number of R-waves to count between triggered images.

Use the trackball to control trigger points and set these trigger parameters. See "Trigger Controls" on page 97.

You can set a timed trigger to display an image at regular intervals without respect to an ECG waveform.

You can set a timed trigger with or without an ECG present. A timed trigger updates the 2-D or Color Doppler image at regular time intervals. You can set a timed trigger for every 25 milliseconds up to every 15,000 milliseconds in 25 millisecond intervals. When the timed trigger function is active, **T-TRIG** replaces the frame rate display in the data field, and the trigger interval (in milliseconds) appears after the T= label. Use the trackball to change the delay. See "Trigger Controls" on page 97.

#### **Timed Triggers**

#### Trigger Controls

Use the following controls with the trigger function.

CONTROL	FUNCTION
TRIG	Turns on or off the trigger function.
	You can also program the footswitch to start the
	trigger function. See Chapter 41 for
	more information.
[RWAVE/TIME]	Switches between R-wave and timed triggers.
[SINGLE/DUAL/	<b>SINGLE</b> activates a primary R-wave trigger.
MULTI]	<b>DUAL</b> activates a primary R-wave trigger and a secondary R-wave trigger.
	<b>MULTI</b> activates a primary R-wave trigger and multiple secondary triggers for each R-wave. T secondary triggers each occur at the specified interval.
[ΔT1/N]	Appears when <b>ECG</b> triggers are active.
(one trigger) OR $[\Delta T1/\Delta T2/N]$	Select <b>T1</b> to adjust the offset of the <b>T1</b> trigger relative to the R-wave using the trackball.
(two inggets)	Select <b>T2</b> to adjust the offset of the <b>T2</b> trigger relative to the R-wave using the trackball.
	Select <b>N</b> to adjust number of R-waves to count before acquiring trigger images using the track
	Use the trackball to adjust the selected item.
[Δ <b>T1/</b> Δ <b>T/N <sup>()</sup>]</b>	$\Delta$ <b>T1</b> sets the time interval between the R-wave a the start of the primary image frame when usin R-wave triggered imaging (single, dual, or multiple triggering frames). $\Delta$ <b>T1</b> is indicated b full-height yellow bar in the physio window.
	$\Delta T$ sets the time interval between frames when using time-triggered imaging or multiple-triggered imaging. $\Delta T$ is indicated by one-third height yellow bar in the physio wind
	<b>N</b> sets destruction and imaging intervals to user-defined values.
[Δ <b>T]</b>	Appears when timed triggers are active. Indicate that the trackball controls the timed trigger interval. This key is always active; pressing it l no effect.
	Use the trackball to adjust the time interval.

**Storing Triggered Clips** 

You can use the system's AEGIS function to automatically store image clips at trigger points. For instructions on setting up triggered captures, see "AEGIS Software Setup" on page 446. For more information about storing clips, see "AEGIS Software" on page 58. Chapter 9 - 2-D Imaging Mode

# **COLOR DOPPLER BASICS**

**Overview** Color Doppler (CD) information appears within the 2-D image, displaying blood flow velocity (Color Doppler Velocity) or red blood cell energy (Color Doppler Energy) information in real-time. It uses color representation to display either the velocity, energy, or acceleration at the sample area. Color Bar -Color Doppler Box

> You can select different Color Doppler options as listed in the following table. Refer to the appropriate chapter for more information.

OPTIONS	CHAPTER
CDE	Color Doppler Energy. See Chapter 11.
CDV	Color Doppler Velocity. See Chapter 11.
CLARIFY VE	Clarify vascular enhancement technology. See Chapter 12.
DTI	Doppler Tissue Imaging. See Chapter 14.
HTD	High Frame Rate Tissue Doppler Imaging. See Chapter 14.
ADI	Agent Detection Imaging. See Chapter 15.
CCI	Coherent Contrast Imaging. See Chapter 15.
CPS	Contrast Pulse Sequencing. See Chapter 14 and Chapter 15.
PCI	Power Contrast Imaging. See Chapter 14 and Chapter 15.

# Entering and Exiting Color Doppler

# • To enter Color Doppler mode:

## 1 Press D COLOR.

**2** Use the following controls to select alternate Color Doppler options and to adjust the position of the Color Doppler box.

CONTROL [SOFT KEY]	FUNCTION
[ANGLE L/C/R]	Press to adjust the incident angle to flow for linear transducers that provide electronic steering.
[(())CD POS/SIZE]	Select <b>POS</b> to adjust the position of the Color Doppler box.
	Select <b>SIZE</b> to adjust the size of the Color Doppler box.
	For non-linear transducers, selects the full- height or truncated Color Doppler box.
OPTIONS	Displays a menu of Color Doppler modes.
D COLOR	Exits Color Doppler mode.

**3** Use **IMAGE** to select the appropriate Image Preset. See "Recalling Image Presets" of the *Administrator Manual*.
## Using Color Doppler with RES

You can use Color Doppler mode with the 2-D RES enhanced resolution imaging function to expand the 2-D image and CD information.



### Basic Formatting Controls

CONTROL	FUNCTION		
BASELINE	Press up or down to display a larger range of signals below or above the baseline, respectively. The scale values change proportionally, but the total range does not.		
GATE	Press up or down to increase or decrease the size of the Doppler gate. Increasing the gate size increases color sensitivity. Reducing the gate size increases color resolution.		
INVERT	Press to toggle between a normal and inverted Color Doppler bar display.		
PRIORITY	In combined Doppler mode, you view Color Doppler information on the 2-D image and spectral Doppler information in a strip at the same time. Press until the function you want is active.		





### Using CDE

The CDE option on select transducers assigns a color to the energy measurement generated by moving reflectors (blood flow). Color Doppler Energy displays the energy from the returning Doppler signal. Color Doppler Energy is more sensitive than Color Doppler Velocity, relatively angle independent, and free of aliasing. Color Doppler Energy is especially useful in the detection of small-volume, low amplitude, low velocities and deep flows.



### **CDE Data Field**

Edge		Persistence
Space Time	T1/-1/ 3/E·1+3	Postprocessing
Gate	1/2 CD-4 0MHz	Frequency
Filter	CD Gain = 50	Gain
Color Option	CDE 40dB	Dynamic Range

### Entering and Exiting Color Doppler Options

### • To enter Color Doppler options:

- **1** Press **D COLOR** to enter Color Doppler mode.
- **2** Press **OPTIONS** to display the CD option menu and select the color option you want.
- **3** Use these soft keys to adjust the characteristics of the Color Doppler box.

CONTROL	USE	
	Press to highlight <b>POS</b> and to adjust the position of the Color Doppler box.	
[CD POS/SIZE]	Press to highlight <b>SIZE</b> and to adjust the size of the Color Doppler box.	
[ANGLE L/C/R]	Press to adjust the incident angle to flow for linear transducers that provide electronic steering.	
	For non-linear transducers, press to use the full-	
[CD PAN △/_]	height ( $\triangle$ ) or the truncated ( $\Box$ ) Color Doppler box.	

- **4** Use **IMAGE** to select the appropriate Image Preset. See "Recalling Image Presets" of the Administrator manual.
- **5** Press **D COLOR** or **2-D ONLY** to exit Color Doppler mode.

### Image Format Controls

CONTROL	USE
GATE	Press up or down to increase or decrease the size of the Color Doppler gate. Increasing the gate size increases color sensitivity. Reducing the gate size increases color resolution.
INVERT	Press to toggle between normal and inverted Color Doppler bar display.
DGAIN	CD gain is independent of 2-D and spectral Doppler gain. Turn <b>DGAIN</b> clockwise to increase the amount of color displayed, or counterclockwise to decrease it.
MULTI HZ	MultiHertz multiple frequency imaging. Press to increase or decrease the color imaging frequency.

## Image Optimization Controls

CONTROL	USE
FILTER	Press up to use a higher filter or down to use a lower filter. Higher filter settings produce greater degrees of motion discrimination.
SPACETIME	Press up to emphasize temporal resolution or down to emphasize spatial resolution.
EDGE	Smooths color. Press up for sharper color distinction or down for smoother color distinction.
DYN RANGE (CDE only)	Turn to adjust the dynamic range until the level you want appears. Higher levels provide greater sensitivity to the low energy component of the signal.
PERSIST	Controls how rapidly an image appears to change over time. Use lower levels for rapidly changing anatomy. Use higher levels to provide a smoother image for slow moving structures.
POST	See "Postprocessing" on page 107.
	Press up or down to change the velocity range and display higher or lower velocity signals.
SCALE	You can customize the direction of the <b>SCALE</b> key (select which direction increases or decreases the velocity range). See Chapter 41 for instructions.

Postprocessing	The postprocessing maps control which colors represent different levels of CD mean velocity, variance, or energy information. The different color options provide multiple postprocessing maps that you can modify to accent some of the velocities, mix color information with the gray scale information, or tag a range of velocities. The following sections describe the postprocessing maps for each CD option, and what features you can use to modify them.
CDE	The CDE option provides energy color maps.



CDV

The CDV option provides the following types of postprocessing maps.



Selecting a Postprocessing Map		•	o select and modify a postprocessing map in any of the CD ptions:	
		1	Press <b>POST</b> .	
		2	Press [CD MAP] to select the map you want.	
			CDV, press <b>[V/VV]</b> to choose between velocity and locity-variance maps.	
		3	Press [MODIFY] to display the modification soft keys.	
		4	To leave the map function, press <b>POST</b> .	
FEATURE	CD OPTI	ON	MODIFY	
	CDV		Turns on or off the Accent feature. Accent highlights differences between high velocity/disturbed flow and low velocity/background flow by changing the relative brightness of the colors. You can use Accent with Mix in velocity or	
ACCENT	CDV		Sologie the Mix level. The Mix feature combines 2.D gray scale	
МІХ	<b>CDV AND CDE</b> and CD information to create a more translucent ap		and CD information to create a more translucent appearance.	
VELOCITY TAG CDV			Lets you emphasize, or tag, a range of velocities within the CD display. Tagged velocities appear in a contrasting color in the color bar and on the CD display. There are four options:	
			<ul> <li>OFF No velocity tag</li> <li>+ Velocities above a selected value are tagged</li> <li>- Velocities below a selected value are tagged</li> <li>± A selectable range of velocities are tagged</li> <li>Use the trackball SELECT KEY to adjust the size of the velocity tag range.</li> </ul>	

Overview	(Requires software version 8.5 or higher.) Clarify <sup>™</sup> vascular enhancement technology (Clarify VE) is an optional feature that uses color Doppler flow information to decrease artifacts in the 2-D mode image, resulting in an improved view of anatomical structures with flow. Use Clarify VE during 2-D mode imaging to enhance definition of tissue, vessel walls, and structures within vessels.	
<b>Δατά Field</b>	Fil CD	terBalance GainCD Gain = 50 Clarify 10dB
Transducers	Wł Cla	nen Clarify VE is active, you see <b>Clarify</b> at the bottom of the data field arify VE is compatible with the 4C1 transducer.
Presets	Clarify VE is available with any exam preset. You can save Clarify VE settings to exam presets. See your <i>Administrator Guide</i> .	
	Exi apj	sting ACUSON-protected imaging presets are updated with propriate Clarify VE settings.
	Cla opt	rrify VE is available during imaging with the Perspective display tion when 3D is active.
Activating and	٠	To enter Clarify VE:
Exiting Clarify VE	1	Press <b>D COLOR</b> to enter Color Doppler mode.
	2	Press <b>OPTIONS</b> to display the CD option menu.
	3	Select CLARIFY.
	4	To exit Clarify VE, press <b>D COLOR</b> or <b>2-D ONLY</b> .
Changing the Clarify VE ROI	When Clarify VE is active, you can reposition and resize the Clarify VE region of interest (ROI).	
	•	To reposition or resize the Clarify VE ROI:
	1	Enter Clarify VE.
	2	Use these soft keys or the Select keys to adjust the characteristics of the Clarify VE ROI.
		Press <b>PROTOCOL</b> to cycle through soft key options.

	SOFT KEY	FUNCTION			
	3000/MSEC/ 6000/MSEC	Select the clip capture time.			
		Select $\triangle$ to use the full-height or $\square$ to use the truncated Clarify VE ROI box.			
	[CD POS/SIZE]	Select <b>POS</b> to adjust the position of the Clarify VE ROI box.			
		Select <b>SIZE</b> to adjust the size of the Clarify VE ROI box.			
Changing Clarify VE Levels	When Clarify VE added to the imag blood flow inforn artifact due to hea low of 1 to a high	is active, you can select the level of flow information ge. With a higher level for Clarify VE, you see greater nation in the image. However, you might also see flash art beat or respiration. Clarify VE levels range from a of 7.			
	To change the	ne Clarify VE level:			
	1 Activate Clar	ify VE.			
	2 Press the <b>BALANCE</b> key up or down until the required Clarify VE level is displayed.				
	The Clarify VE balance level is displayed above the CD frequency line in the data field, next to <b>BE</b> .				
Image Optimization Controls	The following controls are disabled when Clarify VE is active: Post, MultiHertz, SpaceTime, Persistence, Edge, CD Gain, Gate, Dynamic Range.				
	The following tab	le describes specific Clarify VE controls.			
	CONTROL [SOFT KEY]	FUNCTION			
	BALANCE	Changes the level of Clarify VE information, from a low of 1 to a high of 7.			
	FILTER	Filters flow information according to parameters you select in Setup.			
		Filter 1: general use			
		Filter 2: more flow information in the image			
	SCALE	Changes the velocity range and displays higher- or lower-velocity signals.			
		Use <b>SCALE</b> to visualize vessels that exhibit varying levels of Color Doppler energy.			
		<ul><li>Higher scale setting show larger vessels.</li><li>Lower scale settings show smaller vessels.</li></ul>			

## HIGH RESOLUTION COLOR FLOW

Overview	(Requires software version 9.5 or higher.)				
	High Resolution detailed flow in small vessels. H resolution of the vessel sensitivit	High Resolution Color Flow (HRCF) is a color mode that provides detailed flow information in large vessels and improved visualization in small vessels. High Resolution Color Flow offers enhanced spatial resolution of the color flow content with improved slow-flow and deep vessel sensitivity, thus providing better color presentation.			
Data Field					
	Edge	Persistence			
	Space Time	Postprocessing			
	Gate/Filter	Frequency			
		CD Coin = 50			
	HRCF Option	HRCF			
Transducers	HRCF requires following transc	the Advanced Imaging option and is compatible with the ducers.			
	TRANSDUCER	FREQUENCIES (MHz)			
	4C1	4.0			
	6C2	3.5, 6.5			
	15L8W	9.0, 10.0, 14.0			

Activating and Exiting HRCF

### • To activate HRCF:

1 Press **D COLOR** to enter Color Doppler mode.

The system activates the Color Doppler mode last used.

- 2 If **HRCF** is displayed, use the corresponding soft key to select the color option or press **OPTIONS** to display the CD option menu and select **HRCF**.
- **3** Use these soft keys to adjust the characteristics of the Color Doppler box.

SOFT KEY	FUNCTION	
[CD POS/SIZE]	Press to highlight <b>POS</b> and to adjust the position of the Color Doppler box.	
	Press to highlight <b>SIZE</b> and to adjust the size of the Color Doppler box.	
[ANGLE L/C/R]	Press to adjust the incident angle to flow for linea transducers that provide electronic steering.	
[CD PAN 🍐 🖂]	Select $\triangle$ to use the full-height or $\square$ to use the truncated Clarify VE ROI box.	

**NOTE:** Color Box steering is available for all frequencies on the 15L8w linear transducer with HRCF.

- **4** Use **IMAGE** to select the appropriate Image Preset. See "Recalling Image Presets" of the *Administrator's Manual*.
- **5** Optimize the color display.
- 6 To exit HRCF, press D COLOR or 2-D ONLY.

### Image Format Controls

	CONTROL	USE
	BASELINE	Press up or down to display a larger range of signals below or above the baseline, respectively. The scale values change, but the total range does not.
	INVERT	Press to toggle the display of a normal Color Doppler bar with an inverted Color Doppler bar display.
Image Optimization		
	CONTROL	USE
	DGAIN	CD gain is independent of 2-D and spectral Doppler gain. Turn <b>DGAIN</b> clockwise to increase the amount of color displayed, or counterclockwise to decrease it.
	MULTI HZ	MultiHertz multiple frequency imaging. Press to increase or decrease the color imaging frequency.
	FILTER	Press up to use a higher filter or down to use a lower filter. Higher filter settings produce greater degrees of motion discrimination.
	GATE	Press up or down to increase or decrease the size of the Color Doppler gate. Increasing the gate size increases color sensitivity. Reducing the gate size increases color resolution.
	OUTPUT TRANSMIT POWER	Controls transmit power/MI. Changes the total transmit power for color signal strength. Increasing the power enhances the color display, decreasing the power reduces the color display.
	SPACETIME	Press up to emphasize temporal resolution or down to emphasize spatial resolution.
	EDGE	Smooths color. Press up for sharper color distinction or down for smoother color distinction.
	PERSIST	Controls how rapidly an image appears to change over time. Use lower levels for rapidly changing anatomy. Use higher levels to provide a smoother image for slow moving structures.
	POST	See "Postprocessing" on page 114.
	SCALE	Press up or down to change the velocity range and display higher or lower velocity signals.
		You can customize the direction of the <b>SCALE</b> key (select which direction increases or decreases the velocity range). See Chapter 41 for instructions.

### Postprocessing

The postprocessing maps control which colors represent different levels of CD mean velocity, variance, or energy information. The different color options provide multiple postprocessing maps that you can modify to accent some of the velocities, or mix color information with the gray scale information.

MAPS	ILLUSTRATION	DESCRIPTION
ENERGY COLOR	Energy	Displays colors that correspond to the different levels of energy found in an image. Lower energy levels appear on the left of the color bar, and higher energy levels appear on the right.
VELOCITY COLOR MAP	Velocity	The velocity function assigns color shades to the direction and velocity of blood flow. The upper portion of the color bar represents flow toward the transducer and the lower portion represents flow away from the transducer. The saturation or hue of the color indicates the velocity of the blood flow. Darker shades indicate low velocities, and lighter shades indicate high velocities.
VELOCITY- VARIANCE COLOR MAP	Velocity	The velocity-variance function assigns colors to mean velocity and variance of blood flow at a specific velocity level. Many sample volumes can have the same mean, yet be distinctly different. The amount of variance represents the range, or spread, of different velocities contributing to the mean velocity within a given sample volume. For example, blood moving at a constant velocity has very little variance.

Selecting a Postprocessing Map

### • To select and modify a postprocessing map in HCRF:

- 1 Press [POST].
- **2** Press **[CD MAP]** to select the map you want.
- **3** Use the soft keys shown in the following table to modify the postprocessing map. You may need to press **[MODIFY]** to see some of these controls.

SELECTION	DESCRIPTION	
ACCENT	Turns on or off the Accent feature. Accent highlights differences between high velocity/ disturbed flow and low velocity/background flow by changing the relative brightness of the colors.	
	OFF No Accent	
	1 Accent 1	
	2 Accent 2	
MIX	Selects the Mix level. The Mix feature combines 2-D gray scale and CD information to create a more translucent appearance.	

4 To leave the map function, press **[POST]**.

Chapter 13 - High Resolution Color Flow

## **DOPPLER TISSUE IMAGING**

Overview	Doppler Tissue Imaging color-encodes the Doppler shift information from the moving tissue of the myocardium (or any moving tissue). It presents tissue movement in the way Color Doppler Velocity (CDV) presents blood flow.				
DTI Presentation Methods	Doppler Tissue Imaging enables the visualization of tissue motion by using a presentation method available during Color Doppler imaging.				
	<ul> <li>High Frame Rate Tissue Doppler Imaging (HTD) – Color presentation with the ability to extract velocities from a 2-D color map for improved visualization and quantification of lower velocities.</li> </ul>				
	High Frame Rate Tissue Doppler Imaging (HTD) optimizes imaging resolution at high frame rates (greater than 100 Hz).				
	HTD is available on the 3V2c-S, 4V1c-S, and 8V3c-S transducers.				
	<ul> <li>Doppler Tissue Velocity (DTV) – Color presentation of mean velocities of tissue in the sample area.</li> </ul>				
	• Doppler Tissue Energy (DTE) – Color presentation of Doppler sigenergies returning from the tissue.				
	• Doppler Tissue Acceleration (DTA) – Color presentation of the rate of change of velocities in the sample area.				
Color Bar_ Color Doppler Box_	Pt: 138.51 pm 3/2c #34 3/2ht 140mm Cardia General 11/-1/ 0/V:1.1+1 1/2 ED20htt DTV HE22 				
	Set Left Set Right Run/Stop				

### **Data Field**

	Edge	Persistence	
SpaceTime Gate Filter Balance	T1/-3/ 1/1/ 0 CD Gain	0/VE:1 CD:H3.5MHz = 77	—Postprocessing — Frequency —Gain
DTI Option—	HTD	60dB	

Entering and Exiting Doppler Tissue Imaging

### • To enter Doppler Tissue Imaging:

- 1 Press **D COLOR** to enter Color Doppler mode. The system enters the Color Doppler mode last used.
- 2 Press **OPTIONS** to display the Color Doppler (CD) options menu.
- **3** Select a presentation method for Doppler Tissue Imaging, such as **HTD**.
- **4** Use these soft keys to adjust the characteristics of the Color Doppler box.

[SOFT KEY]	FUNCTION
	Press to highlight <b>POS</b> and to adjust the position of the Color Doppler box.
[CD POS/SIZE]	Press to highlight <b>SIZE</b> and to adjust the size of the Color Doppler box.
	For non-linear transducers, selects the full-
[CD PAN △/_]	height ( $\triangle$ ) or the truncated ( $\square$ ) Color Doppler box.

- **5** Use **IMAGE** to select the appropriate Image Preset. See "Recalling Image Presets" in the *Administrator Manual*.
- 6 Press **D COLOR** or **2-D ONLY** to exit Color Doppler mode.

## Image Optimization Controls

Doppler Tissue Imaging uses most of the Color Doppler controls described in Chapter 9 and Chapter 11. The following table describes specific Doppler Tissue Imaging functions.

CONTROL	FUNCTION		
BALANCE	When using HTD, press <b>BALANCE</b> to cycle		
(HTD only)	through the image displays: grayscale only, a mixed mode of grayscale and velocity, and velocity only. Selections are indicated in the Data Display box. Settings in the Data Display box:		
	+1 grayscale only.		
	0	mixed mode (grayscale and velocity information).	
	-1	velocity only.	
DGC CONTROLS	Adjusts the color gain.		

CONTROL	FUNCTION		
FILTER	The two Doppler Tissue Imaging filter settings have the effect of rejecting more signals as you increase the filter setting. There are two filter settings:		
	<ul> <li>Filter 1 – Allows the display of all velocities, including stationary echoes.</li> </ul>		
	• Filter 2 – Rejects the lowest velocity signals. Press <b>FILTER</b> up to use a higher filter setting or down to use a lower filter setting.		
	<b>NOTE:</b> HTD has only one filter setting: Filter 1.		
SPACETIME	Press up to emphasize temporal resolution or down to emphasize spatial resolution. To increase the frame rate, use a SpaceTime resolution control setting that emphasizes temporal resolution.		
DYN RANGE	Adjust the dynamic range until the level you want appears. Adjusting the dynamic range changes the way the energy colors are displayed.		
(DTE, HTD only)			
SCALE	Press up or down to change the velocity range and display higher or lower velocity signals.		
	You can customize the direction of the <b>SCALE</b> key (select which direction increases or decreases the velocity range). See Chapter 41 for instructions.		
POST	Select or modify a postprocessing map. See "Selecting a Postprocessing Map" on page 93.		

### Postprocessing

Doppler Tissue Imaging postprocessing allows you to change the appearance of the color information by assigning a different postprocessing map. The following section describes the Doppler Tissue Imaging postprocessing maps and the features you can use to modify them.

MAPS	ILLUSTRATION	DESCRIPTION
DIRECTIONAL COLOR DTV and HTD	58 Flow toward transducer Flow away from transducer	Displays data regarding direction of flow or rate of change using two velocity bars.
NONDIRECTIONAL COLOR DTA	.08 .08	Assigns color shades to the velocity of moving tissue without regard to direction. Outer portions of the color bar represent the highest velocities and inner portions represent the lowest velocities.
ENERGY COLOR DTE	26 Energy	Displays colors that correspond to the different levels of energy found in an image. Lower energy levels appear on the left of the color bar, and higher energy levels appear on the right.

### Selecting a Postprocessing Map

## • To select and modify a postprocessing map in any of the Doppler Tissue Imaging options:

- 1 Press [POST].
- **2** Press **[CD MAP]** to select the map you want.
- **3** Use the soft keys shown in the following table to modify the postprocessing map. You may need to press **[MODIFY]** to see some of these controls.

FEATURE	MOD	FY	
ACCENT (DTV, DTA only)	Turns on or off the Accent feature. Accent highlights differences between high velocity/ disturbed flow and low velocity/background flow by changing the relative brightness of the colors.		
МІХ	Selects the Mix level. The Mix feature combines 2-D gray scale and CD information to create a more translucent appearance.		
VELOCITY TAG (DTV, DTA, HTD)	Lets you emphasize, or tag, a range of velocities within the CD display. Tagged velocities appear in a contrasting color in the color bar and on the CD display. There are four options:		
	<b>OFF</b> No velocity tag		
	+	Velocities above a selected value are tagged	
	-	Velocities below a selected value are tagged	
	<ul> <li>A selectable range of velocities are tagged</li> </ul>		
	Use the trackball to adjust the size of the velocity tag range.		
	<b>NOTE:</b> When storing clips for use with Axius Quantitative Strain Rate Imaging (QSI), select <b>OFF</b> for <b>VELOCITY TAG</b> .		

**4** To leave the map function, press **[POST]**.

### Using Doppler Tissue Imaging Strip Mode

You can also combine Doppler Tissue Imaging and M-mode information. Doppler Tissue Imaging strip mode uses color to show tissue motion at a specific point in the Doppler Tissue Imaging image.

- To use Doppler Tissue Image strip mode:
- **1** Press **D COLOR** to display CD information on the 2-D image.
- **2** Press **OPTIONS** to select DTV or DTE mode from the options menu.
- **3** Press **M MODE** to display a color strip and frozen 2-D image.
- **4** Press **UPDATE** or click a trackball **SELECT KEY** to freeze the Doppler Tissue Imaging strip and activate the 2-D image.

### CHAPTER 15

## CARDIOLOGY CADENCE CONTRAST AGENT IMAGING

**NOTE:** At the time of this publication, the sole cleared application of ultrasound contrast agents by the U.S. Food and Drug Administration is Left Ventricular Opacification (LVO).

# **Overview** The Cadence Contrast Imaging option offers contrast agent detection techniques and features that can be used for a variety of approved as well as investigational applications.

Cadence Contrast Agent Imaging Techniques			
COHERENT CONTRAST IMAGING (CCI)	Uses single-pulse cancellation technology to detect the presence of contrast agent within the myocardium. CCI can be used as:		
	<ul> <li>low-Mechanical Index (MI), nondestructive, continuous 2D technique</li> <li>high-MI, R-wave triggered, intermittent technique</li> </ul>		
CONTRAST PULSE SEQUENCING (CPS)	CPS is a low-MI technique used for the detection and characterization of Myocardial Contrast Enhancement (MCE). The CPS detection technique provides a method to separate and display the following:		
	<ul> <li>contrast agent signal only</li> <li>tissue signal only</li> <li>combination of contrast agent and tissue signal</li> </ul>		
	Using CPS provides improved spatial resolution, temporal resolution, display uniformity and agent-to-tissue specificity compared to other detection techniques.		
POWER CONTRAST IMAGING (PCI)	PCI is a high-MI technique based on a loss of correlation in signals between multiple received pulses producing:		
	<ul><li>sensitivity to contrast agents</li><li>rejection of tissue signals</li></ul>		
	PCI is used in conjunction with R-wave triggered imaging. PCI color-encodes change in the status of certain ultrasound contrast agents during the process of insonation (bubble activation or destruction). PCI can be used during the Left Ventricle Opacification (LVO) or MCE phases of contrast agent injection.		

Contrast Agent Quantification Technique	
AXIUS ACQ	Axius Auto-Tracking Contrast Quantification (Axius ACQ) is an optional feature that measures the progression of contrast agent enhancement in conditions such as coronary artery disease, tumor neovasculature, and liver metastases.
	Axius ACQ illustrates contrast agent enhancement by displaying graphs indicating changes of intensity over time within defined regions of interest (ROIs). Axius ACQ also measures the average value and the curve-fitted value for each ROI on each image frame.
	For more information on Axius ACQ, see Chapter 17.
Contrast Agent Destruction Modes	
PRECISIONBURST	The Contrast Agent Imaging PrecisionBurst feature is designed for use with refill acquisitions during imaging with contrast agent. PrecisionBurst destroys contrast agent at specified intervals during perfusion assessment in Cardiac and General Imaging applications.
	Use PrecisionBurst with the Contrast Pulse Sequence (CPS) imaging technique to combine low-power imaging with a high-power burst that destroys contrast agent. You can customize the high-power burst using a selected sequence technique.
	PrecisionBurst can be used with high-power contrast imaging. You can repeat sequences of high-power imaging combined with high-power bursts by using either the Power Contrast Imaging (PCI) technique (for Cardiac applications) or the Agent Detection Imaging (ADI) technique (for General Imaging applications). Contrast agent "washes back" into the scan plan between high-power bursts; by varying the time between these bursts, you acquire a set of images that describes the "wash-in" curve.
	Clips of images obtained using PrecisionBurst are used in conjunction with the Axius Auto-Tracking Contrast Quantification (Axius ACQ) option.
	For more information on PrecisionBurst, see Chapter 18.
MICRO-BUBBLE DESTRUCTION (MBD)	MBD is a high-MI non-imaging mode, using a color Doppler method for rapid destruction of contrast agent. Use MBD in conjunction with low-MI CCI or CPS imaging to provide two outcomes:
	<ul> <li>to create a rapid high-power burst that destroys the contrast agent in the myocardium</li> <li>to watch the replenishment of agent to the myocardium (after enabling and disabling MBD)</li> </ul>

Contrast Imaging Controls		FUNCTION		
	BALANCE	Whe	en using CPS techniques, pressing <b>BALANCE</b> toggles	
		between 8.0 Contrast specific, 2-D specific, and a combination of Contrast and 2-D. Selections are displayed using a display map and in the Data Dis box. The Data Display box shows:		
		+1	Contrast agent image only	
		0	Mixed display of detected contrast agent image with 2-D signal	
		-1	2-D signal only	
		Bala	nce is selectable in live, Cine, or frozen images.	
PROTOCOL   Displays     Press aga		plays a soft key menu for choosing the protocol type. s again to exit.		
	<b>TRIGGERS</b> You can set a time regular intervals. A Color Doppler ima set a timed trigger 15,000 millisecond active, <b>T-TRIG</b> repla field, and the trigge after the $\Delta T$ = label the delay.		can set a timed trigger to display an image at lar intervals. A timed trigger updates the 2-D or or Doppler image at regular time intervals. You can timed trigger in 25 millisecond intervals up to 00 milliseconds. When the timed trigger function is re, <b>T-TRIG</b> replaces the frame rate display in the data , and the trigger interval (in milliseconds) appears the $\Delta$ T= label. Use the trackball to change delay.	
		For 1 see C	more information about displaying an ECG, Chapter 4.	
		For 1 Prec	more information about triggers using the isionBurst option, see Chapter 18.	
	MI @ FOCUS (MIF)	Mec.	hanical Index at the transducer's deepest cronic focus.	
	MI @ SURFACE (MIS)	Mec	hanical Index at the transducer surface.	
	PRESETS	You each frequ See ' deta	can use Exam Presets to set a default frequency for a contrast technique. Select a transducer and uency for each contrast technique (CPS and PCI). "Setting Default Exam Presets" on page 38 for iled information.	
	STOP WATCH	Usec injec	d in contrast imaging to time the duration of tions and "wash-in" phases.	
		Use Whe repla See '	the system Stop Watch in Cine or Freeze mode. en frozen, scroll through the captured frames to ay the time stamp as it was captured with the image. "Using the System Stop Watch" on page 20 for e details.	

CONTROL	FUNCTION
TISSUE EQUALIZATION (TEQ)	TEQ control provides the ability, at the press of a button, to adjust for relatively uniform tissue and/or noise level throughout the image. In the Setup page under 2-D Options, TEQ provides the ability to change the target brightness levels. Turning and pressing the <b>GAIN</b> knob changes the target brightness. This adjustment is retained as the new target until performing an Exam Preset recall. See "Image Optimization Controls", next.
	<b>NOTE:</b> Due to gain fluctuations in the B-mode image, Native TEQ is not recommended for quantification of the contrast agent wash-in signal during contrast agent imaging.

Image Optimization Controls

Some Contrast imaging techniques use the color Doppler controls described in "Color Doppler Basics" in Chapter 10 and "CDE and CDV" in Chapter 11. The following table describes specific contrast imaging functions.

CONTROL	FUNCTION
DOPPLER GAIN	Controls the overall color Doppler signal level throughout the imaging field.
DYN RANGE	Turn to adjust the display of energy colors in the dynamic range.
FILTER	Filters the display of signal from tissue motion. Press the toggle key up to use a higher filter setting or down to use a lower filter setting. Increasing the filter setting rejects more signals.
	• <b>FILTER 1</b> allows the display of most signals.
	• <b>FILTER 2</b> rejects more tissue motion signal and some agent signal.
GATE	Provides greater sensitivity to contrast at higher settings. (Achieve best spatial resolution at lowest settings.)
OUTPUT TRANSMIT POWER	Controls transmit power/MI. Set at full power (0db) for high MI, R-wave triggered imaging. Reduce for low MI settings.
POST	See "Postprocessing" on page 94.
SCALE	Press the toggle key up or down to change the velocity range and display higher or lower velocity signals.
	You can customize the direction of the <b>SCALE</b> key (select which direction increases or decreases the velocity range). See Chapter 31 for instructions.
SPACETIME	Press the toggle key up to emphasize temporal resolution or down to emphasize spatial resolution. To increase the frame rate, use a setting that emphasizes temporal resolution.
TRANSMIT FOCUS	Controls beam focusing in image.

### Using CCI Contrast Imaging

### • To enter CCI Contrast Imaging:

- **1** Select the 3V2c-S transducer.
- **2** Toggle **MULTIHZ** until CA3.5MHz is displayed in the data field.

TRANSDUCE	
R	FREQUENCIES
3V2c-S	CA3.5MHz

The following table lists CCI controls and their functions:

CONTROL	FUNCTION
DGC	Controls brightness levels at different depths.
DYNAMIC RANGE	Controls range of brightness levels.
GAIN	Controls overall brightness of 2D image.
OUTPUT	Controls transmit power / MI.
TRANSMIT POWER	• Set at low power (-15 to –21dB) for continuous nondestructive imaging.
	• Set at full power (0 db) for high-MI imaging.
SPACETIME	Provides higher frame rate and better nearfield sensitivity at higher T settings, and better penetration and resolution at higher S settings.
TISSUE EQUALIZATION (TEQ)	Optimizes overall 2-D brightness and uniformity. Use the Low Power Contrast setting in the Setup Page under 2-D Options, in conjunction with continuous nondestructive imaging.
	Turning and pressing the <b>GAIN</b> knob changes target brightness. This adjustment is retained as the new target until performing an Exam Preset recall.
	<b>NOTE:</b> Due to gain fluctuations in the B-mode image, Native TEQ is not recommended for quantification of the contrast agent wash-in signal during contrast agent imaging.
TRANSMIT FOCUS	Controls transmit beam focusing in image.

### • To exit CCI, choose one of the following methods:

- Toggle **MULTIHZ** to a setting other than CA3.5MHz.
- Change the transducer.
- Change the Exam Preset.
- Begin a new exam.

### Using CPS Contrast Imaging

## To enter CPS Contrast Imaging, use the following steps or recall CPS Exam Presets:

- **1** Select the appropriate transducer for imaging.
- 2 Press CADENCE.

### TRANSDUCER FREQUENCIES

3V2c-S	P1.5 and P2.0 MHz
4V1c-S	P1.5 and P2.0 MHz
15L8w-S	P7.0, P8.0, P10.0, and P14.0 MHz
15L8-S*	P7.0, P8.0, P10.0, and P14.0 MHz

\* Typically used with CPS in a Cardiac research application with small animals.

Pressing the **CADENCE** key activates CPS, lights the key, and displays CPS in the Data Field Display. If the CPS feature is not supported or has not been activated, the key will not light.

The following table lists CPS controls and their functions:

CONTROL	FUNC	CTION
BALANCE	+1	Contrast agent signal only
	0	Mixed display of detected contrast agent signal with 2-D signal
	-1	2-D signal only
	Allov freez durir	ws you to toggle between live imaging, e, or Cine review states. (Not available ng AEGIS review.)
2D GAIN	Cont Balar	rols the brightness and is relative to the nee he position.
MULTIHERTZ	Disp imag	lays the available frequencies for CPS ing (upon pressing <b>CADENCE</b> ).
POST	Acce on pa	sses <b>[POST]</b> and <b>[MAP]</b> . See "Postprocessing" age 94.
TISSUE EQUALIZATION (TEQ)	See T	ïssue Equalization on page 128.

### • To use CPS through Exam Presets:

- **1** Save step 1 through step 2 of "Using CPS Contrast Imaging" as an Exam Preset. See "Exam Presets" in the *Administrator Manual* for details.
- **2** Press **EXAM PRESETS** and select the appropriate contrast exam preset.
- **3** Press CADENCE.
- To exit CPS, choose one of the following methods:
- Press **CADENCE** (returns to 2-D mode).
- Press **2D ONLY** (returns to 2-D mode).
- Change the transducer.
- Change the Exam Preset.
- Begin a new exam.

### Using Power Contrast Imaging (PCI)

- To enter PCI, use the following steps or recall PCI Exam Presets:
- **1** Select the appropriate transducer.
- **2** Press **D COLOR**. The Sequoia system will enter the last used Color Doppler mode.
- **3** Press **OPTIONS** to display the CD option menu and select **PCI**.

TRANSDUCER	FREQUENCIES
3V2c	H3.5 MHz
3V2c-S	H3.5 MHz
4V1c-S	H3.5 MHz
5V2c	H5.0 MHz

**4** Adjust as needed, the color Doppler box size, position, and pan height, using the following soft keys to adjust size, position, and height:

CONTROL	FUNCTION
[CD PAN/ △/ △]	Adjusts between a full-height pan display and a truncated pan display.
	<ul> <li>Select until △ is highlighted for a full display.</li> </ul>
	<ul> <li>Select until (□) is highlighted for a truncated display.</li> </ul>
[CD POS/SIZE]	Adjusts the color Doppler pan box size and position.
	<ul> <li>Select until <b>POS</b> is highlighted to adjust position.</li> <li>Select until <b>SIZE</b> is highlighted to adjust size.</li> </ul>
DGC	Controls color Doppler signal level at varying depths.
DOPPLER GAIN	Controls the overall color Doppler signal level throughout the imaging field.
DYN RANGE	Turn to adjust the display of energy colors in the dynamic range.
FILTER	Filters the display of signal from tissue motion. Press the toggle key up to use a higher filter setting or down to use a lower filter setting. Increasing the filter setting rejects more signals.
	• <b>FILTER 1</b> allows the display of most signals.
	• <b>FILTER 2</b> rejects more tissue motion signal and some agent signal.
GATE	Provides greater sensitivity to contrast at higher settings. (Achieve best spatial resolution at lowest settings.)
POST	See "Postprocessing" on page 94.

- To use PCI through Exam Presets:
- 1 Save step 1 through step 4 of "Using PCI Contrast Imaging" as an Exam Preset.
- 2 Press EXAM PRESETS.
- 3 Press D COLOR.
- To exit PCI, choose one of the following methods:
- Press **D COLOR** (exits Color Doppler mode).
- Press **2D ONLY** (returns to 2-D mode).
- Change the transducer.
- Change the Exam Preset.
- Begin a new exam.

## **Using PCI Strip Mode** You can also combine PCI and M-mode information. PCI strip mode uses color to show information along a specific line in the PCI image.

The strip mode is especially helpful in identifying periods in the cardiac cycle where motion is minimal.

- To use PCI strip mode:
- 1 Press **D COLOR** to display CD information on the 2-D image.
- 2 Press OPTIONS.
- **3** Select **PCI mode** from the Options menu.
- 4 Press **M MODE** to display a color strip and frozen 2-D/color image.
- **5** Press **UPDATE** or click a trackball **SELECT KEY** to freeze the PCI strip and activate the 2-D image.

### To enter MBD, use the following steps or recall MBD Exam Presets:

- **1** Select the appropriate transducer.
- 2 Press D COLOR.

The Sequoia system enters the last-used Color Doppler mode.

3 Press OPTIONS to display the CD option menu, and then select MBD.

TRANSDUCER	FREQUENCIES
3V2c-S	D2.0 MHz
4V1c-S	D2.0 MHz

Using MBD

**4** Adjust as needed, the color Doppler box size, position, and pan height, using the following soft keys:

SOFT KEY	FUNCTION	
	Adjusts between a full height pan display and a truncated pan display.	
	• Select until $\triangle$ is highlighted for a full display.	
	<ul> <li>Select until (□) is highlighted for a truncated display.</li> </ul>	
[CD POS/SIZE]	Adjusts the color Doppler pan box size and position.	
	<ul> <li>Select until <b>POS</b> is highlighted to adjust position.</li> <li>Select until <b>SIZE</b> is highlighted to adjust size.</li> </ul>	
	8 8 9	

### • To exit MBD, choose one of the following methods:

- Press **D COLOR** (exits Color Doppler mode).
- Press **2D ONLY** (returns to 2-D mode).
- Change the transducer.
- Change the Exam Preset.
- Begin a new exam.

### Postprocessing

CPS and PCI postprocessing allows you to change the appearance of the display. The following section describes the CPS and PCI postprocessing maps and the features used to modify them.

### To activate display maps, invoke the corresponding contrast agent imaging technique (for CPS press CADENCE).

CPS display maps are displayed on the left side of the screen. The CPS maps are shown here with their corresponding Data Display Box.



### **CPS Display Maps**

### **PCI Display Maps**

There are six display maps, named **E1** through **E6**. Each one uses different colors to represent different levels of energy in the image. Lower energy levels appear on the bottom of the color bar, and higher energy levels appear on the top, as shown in the following illustration:



#### Selecting a Postprocessing Map

- To select and modify a postprocessing map:
- 1 Press [POST].

Pressing [POST] displays the first postprocessing map, [CD MAP E1].

- **2** Press **[CD MAP E1]** to access and display the next postprocessing map. Continue pressing this soft key until the desired map is displayed.
- **3** Select the map to use.
  - Maps **E3** and **E6** have no shades of gray or white in the map.
  - Map **E6** (cyan) has a linear gradation of blue and green colors from 0 to 255 (with no red at all). These maps may be useful for quantification purposes.
- **4** Select **[MODIFY]** and use the following soft keys to modify the map:

FEATURE	MODIFY
МІХ	Selects the Mix level. The Mix feature combines 2-D gray scale and CD information to create a more translucent appearance.

**5** To exit the map function, select **[POST]**.

Chapter 15 - Cardiology Cadence Contrast Agent Imaging
# GENERAL IMAGING CADENCE CONTRAST AGENT IMAGING

**NOTE:** At the time of this publication, the sole cleared application of ultrasound contrast agents by the U.S. Food and Drug Administration (FDA) is Left Ventricular Opacification (LVO). Within the United States, no General Imaging Cadence Contrast Agent Imaging applications are cleared for use by the FDA, this feature is only being provided for research and/or investigational purposes within the United States. Please reference the current regulations within your country for the cleared applications of ultrasound contrast agents.

**Overview** The Cadence Contrast Imaging option offers contrast agent detection techniques and features for a variety of applications.

Contrast Agent Imaging Techniques	
CONTRAST PULSE SEQUENCING (CPS)	CPS is a low MI technique used for the detection and characterization of lesions. The CPS detection technique provides a means to separate and display the following:
	<ul> <li>Contrast agent signal only</li> <li>Tissue signal only</li> <li>Combination of contrast agent and tissue signal</li> </ul>
	Using CPS provides improved spatial resolution, temporal resolution, display uniformity and agent-to-tissue specificity compared to other detection techniques.
CONVERGENT CONTRAST PULSE SEQUENCING (CNV)	Convergent Contrast Pulse Sequencing (CPS) is a low Mechanical Index (MI) detection technique that is a convergence of Contrast Pulse Sequencing (CPS) and Color Doppler Energy (CDE). Use this technique primarily in general imaging applications to differentiate macro vasculature from micro vasculature. Macro vasculature with higher flowing velocities are identified using the CDE option of Convergent CPS; the micro vasculature with stationary or slower flowing velocities are identified using the CPS option of Convergent CPS.
	For more information on CNV, see Chapter 19.
AGENT DETECTION IMAGING (ADI)	ADI is a high resolution technique that is designed for high Mechanical Index (MI) contrast agent imaging suitable for parenchymal and late phase Radiology Imaging applications. ADI is based on a loss of correlation in signals between multiple pulses received producing:
	<ul><li>Sensitivity to contrast agents</li><li>Rejection of tissue signals</li></ul>
	This sensitivity to the contrast agent signature allows for unique analysis and display options. Using ADI on the ACUSON Sequoia platform, the clinician can select to solely display:
	<ul> <li>Contrast agent signal only</li> <li>Tissue signal only</li> <li>Combination of contrast agent and tissue signal</li> </ul>
	Since the agent and tissue displays are acquired separately and combined with a post processing function, the selection of the one of these three options can be achieved after images are acquired in Cine memory and during real-time imaging. This capability allows the clinician to compare the anatomical reference obtained via conventional 2-D mode with the functional contrast image obtained at the same time.

Contrast Agent Quantification Technique	
AXIUS ACQ	Axius Auto-Tracking Contrast Quantification (Axius ACQ) is an optional feature that measures the progression of contrast agent enhancement in conditions such as coronary artery disease, tumor neovasculature, and liver metastases.
	Axius ACQ illustrates contrast agent enhancement by displaying graphs indicating changes of intensity over time within defined regions of interest (ROIs). Axius ACQ also measures the average value and the curve-fitted value for each ROI on each image frame.
	For more information on Axius ACQ, see Chapter 17.
Contrast Agent Destruction Modes	
PRECISIONBURST	The Contrast Agent Imaging PrecisionBurst feature is designed for use with refill acquisitions during imaging with contrast agent. PrecisionBurst destroys contrast agent at specified intervals during perfusion assessment in Cardiac and General Imaging applications.
	Use PrecisionBurst with the Contrast Pulse Sequence (CPS) imaging technique to combine low-power imaging with a high-power burst that destroys contrast agent. You can customize the high-power burst using a selected sequence technique.
	PrecisionBurst can be also used with high-power contrast imaging. You can create repeat and progressive sequences of high-power imaging combined with high-power bursts by using either the Power Contrast Imaging (PCI) technique (for Cardiac applications) or the Agent Detection Imaging (ADI) technique (for General Imaging applications).
	Clips of images obtained using PrecisionBurst are used in conjunction with the Axius Auto-Tracking Contrast Quantification (Axius ACQ) option.
	For more information on PrecisionBurst, see Chapter 18.
MICRO-BUBBLE DESTRUCTION (MBD)	MBD is a high-MI non-imaging mode, using a color Doppler method for rapid destruction of contrast agent. Use MBD in conjunction with low-MI CPS imaging to provide two outcomes:
	<ul> <li>To create a rapid high-power burst that destroys the contrast agent in the anatomy</li> <li>To watch the replenishment of agent to the target tissue (after enabling and disabling MBD)</li> </ul>

# Contrast Imaging Controls

CONTROL	FUNCTION		
BALANCE	When using CPS, CNV, or ADI techniques, pressing <b>BALANCE</b> toggles between a Contrast specific, 2-D specific, and a combination of Contrast and 2-D. Selections are displayed using a display map and in the Data Display box. The Data Display box uses:		
	+1 Contrast agent image only		
	<b>0</b> Mixed display of detected contrast agent signal with 2-D image		
	-1 2-D image only		
	Allows you to toggle between live imaging, freeze, or Cine review states. (Not available during AEGIS review.)		
DUAL	Displays two images, side-by-side on the screen. The active image is real-time (live) while the other image is frozen.		
	In Live Dual, use to toggle between all three balance states on one side of the dual display, and the tissue only image on the other side of the display.		
MULTIHZ	Increases or decreases the imaging frequency.		
PROTOCOL	Displays a soft key menu for choosing the protocol type. Press again to exit.		
TRIGGERS	You can set a timed trigger to display an image at regular intervals. A timed trigger updates the 2-D or Color Doppler image at regular time intervals. You can set a timed trigger in 25-millisecond intervals up to 15,000 milliseconds. When the timed trigger function is active, <b>T-TRIG</b> replaces the frame rate display in the data field, and the trigger interval (in milliseconds) appears after the $\Delta$ T= label. Use the trackball to change the delay.		
	For more information about displaying an <b>ECG</b> , see Chapter 4.		
	For more information about triggers using the PrecisionBurst option, see Chapter 18.		
MI @ FOCUS (MIF)	Mechanical Index at the transducer's deepest electronic focus.		
MI @ SURFACE (MIS)	Mechanical Index at the transducer surface.		
PRESETS	You can use Exam Presets to set a default frequency for each contrast technique. Select a transducer and frequency for each contrast technique (CNV, ADI, and CPS). See "Setting Default Exam Presets" on page 47 for detailed information.		

CONTROL	FUNCTION
STOP WATCH	Used in contrast imaging to time the duration of injections and "wash-in" phases.
	Use the system Stop Watch in Cine or strip Freeze mode. When frozen, scroll through the captured frames to replay the time stamp as it was captured with the image. See "Image Optimization Controls" on page 83.
TISSUE EQUALIZATION (TEQ)	<b>TEQ</b> control provides the ability, at the press of a button, to adjust for relatively uniform tissue and/or noise level throughout the image. In the Setup page under 2-D Options, <b>TEQ</b> provides the ability to change the target brightness levels. Turning and pressing the <b>GAIN</b> knob changes the target brightness. This adjustment is retained as the new target until performing an Exam Preset recall. See "Image Optimization Controls" on page 83.
	<b>NOTE:</b> Due to gain fluctuations in the B-mode image, Native <b>TEQ</b> is not recommended for quantification of the contrast agent wash-in signal during contrast agent imaging.

# Image Optimization Controls

Contrast imaging uses most of the color Doppler controls described in "Color Doppler Basics" in Chapter 10 and "CDE and CDV" in Chapter 11. The following table describes specific contrast imaging functions:

CONTROL	FUNCTION
2D GAIN	Controls the brightness and is relative to the <b>BALANCE</b> key position.
D GAIN	Turn clockwise to increase the amount of Doppler gain or counterclockwise to decrease it.
DYN RANGE	Turn to adjust the display of energy colors in the dynamic range.
FILTER	Filters the display of signal from tissue motion. Press the toggle key up to use a higher filter setting or down to use a lower filter setting. Increasing the filter setting rejects more signals.
	• <b>FILTER 1</b> allows the display of most signals.
	• <b>FILTER 2</b> rejects more tissue motion signal and some agent signal.
GATE	Provides greater sensitivity to contrast at higher settings. (Achieve best spatial resolution at lowest settings.)
OUTPUT TRANSMIT POWER	Controls transmit power/MI. Set at full power (0db) for high-MI, R-wave triggered imaging. Reduce for low-MI imaging.
POST	See "Postprocessing" on page 146.
SCALE	Press the toggle key up or down to change the velocity range and display higher or lower velocity signals.
	You can customize the direction of the <b>SCALE</b> key (select which direction increases or decreases the velocity range). See Chapter 41 for instructions.
SPACETIME	Press the toggle key up to emphasize temporal resolution or to emphasize spatial resolution. To increase the frame rate, use a setting that emphasizes temporal resolution.
TRANSMIT FOCUS	Controls beam focusing in image.

# Using CPS Contrast Imaging

# • To enter CPS Contrast Imaging, use the following steps or recall CPS Exam Presets:

- **1** Select the appropriate transducer.
- 2 Select CPS Abdomen, Breast, Thyroid, Testicle, or another appropriate exam preset.

# 3 Press CADENCE.

TRANSDUCER	FREQUENCIES
4C1-S	P2.5, P2.0, and P1.5 MHz
4V1-S	P2.5, P2.0, and P1.5 MHz
6C2-S	P3.0 and P2.0 MHz
EV-8C4-S <sup>1</sup>	P8.0, P5.0, and P4.0 MHz
15L8w-S	P7.0, P8.0, P10.0, and P14.0 MHz
15L8-S	P7.0, P8.0, P10.0, and P14.0 MHz

1. Requires software version 10.0 or higher.

Pressing the **CADENCE** key activates CPS, lights the key, and displays CPS in the Data Field Display. If the CPS feature is not supported or has not been activated, the key will not light.

You can use the Contrast Imaging Controls and the Image Optimization controls with this feature. See "Contrast Imaging Controls" on page 140. See "Image Optimization Controls" on page 142.

The following table lists CPS controls and their functions:

CONTROL	FUNC	CTION
BALANCE	+1	Contrast agent image only
	0	Mixed display of detected contrast agent with 2-D image
	-1	2-D image only
	Allov or Ci revie	ws you to toggle between live imaging, freeze, ne review states. (Not available during AEGIS w.)
2D GAIN	Cont BAL	rols the brightness and is relative to the <b>ANCE</b> key position.
MULTIHERTZ	Disp (upo	lays the available frequencies for CPS imaging n pressing <b>CADENCE</b> ).
POST	Acce page	sses <b>[POST]</b> and <b>[MAP]</b> . See "Postprocessing" on 146 for more information.
TISSUE EQUALIZATION (TEQ)	See "	Tissue Equalization (TEQ)" on page 141.

- To exit CPS, choose one of the following methods:
- Press **CADENCE** (returns to 2-D mode)
- Press **2D ONLY** (returns to 2-D mode)
- Change the transducer
- Change the Exam Preset
- Begin a new exam

# Using ADI Contrast Imaging

- To enter ADI Contrast Imaging:
- **1** Select the appropriate transducer.
- **2** Select the Abdomen exam preset or another appropriate exam preset.
- **3** For the 4C1 and 4V1 transducers, use the fundamental B-mode frequency of 3 MHz. For the 6C2 transducer, use the fundamental B-mode frequency of 4 MHz.
- 4 Press D COLOR.
- 5 Press the **OPTIONS** key and select **ADI**.

TRANSDUCER	FREQUENCIES
4C1	CD 2.0 MHz
4C1-S	CD 2.0 MHz
4V1	CD 2.0 MHz
4V1-S	CD 2.0 MHz
6C2	CD 2.5 MHz
6C2-S	CD 2.5 MHz

You can use the Contrast Imaging Controls and the Image Optimization controls with this feature. See "Contrast Imaging Controls" on page 140. See "Image Optimization Controls" on page 142.

CONTROL	FUNCTION	
BALANCE	+1	Contrast agent image only
	0	Mixed display of detected contrast agent with 2-D image
	-1	2-D image only
	Allo Cine	ws you to toggle between live imaging, freeze, or review states. (Not available during AEGIS review.)
D GAIN	Cont the i	rols the overall color Doppler signal level throughout maging field, which controls ADI signal brightness.
FILTER	Filte	rs the display of signal from tissue motion.
GATE	Prov Best	ides greater sensitivity to contrast at higher settings. spatial resolution at lowest settings.
OUTPUT TRANSMIT POWER	Cont full p	rols the transmit power/Mechanical Index. Set at power (0db) for high MI imaging.
TRANSMIT FOCUS	Cont	rols transmit beam focusing in image.

# To exit ADI Contrast Imaging, choose one of the following methods:

- Press **D COLOR** (exits Color Doppler mode)
- Press **2D ONLY** (returns to 2-D mode)
- Change the transducer
- Change the Exam Preset
- Begin a new exam

### Postprocessing

ADI and CPS postprocessing allows you to change the appearance of the display. The following section describes the ADI and CPS postprocessing maps and the features used to modify them.

## To activate display maps, invoke the corresponding contrast agent imaging technique (for CPS, press CADENCE.)

ADI display maps are displayed on the left side of the screen. The ADI maps are shown here with their corresponding Data Display Box.



# CPS Display Maps

CPS display maps are displayed on the left side of the screen. The CPS maps are shown here with their corresponding Data Display Box.



#### **ADI Display Maps**

Selecting a CPS Postprocessing Map

- To select and modify a CPS postprocessing map:
- 1 Press [POST].

Pressing [POST] accesses [POST] and [MAP-2].

- **2** Press **[MAP-2]** to access and display the next postprocessing map. Continue pressing this soft key until the desired map is displayed.
- To select and modify an ADI postprocessing map:
- 1 Press [POST].

Pressing **[POST]** displays the first postprocessing map, **[CD MAP BE1]**.

**2** Press **[CD MAP BE1]** to access and display the next postprocessing map. Continue pressing this soft key until the desired map is displayed.

Selecting an ADI Postprocessing Map

# Using MBD

### To enter MBD, use the following steps or recall MBD Exam Presets:

- **1** Select the appropriate transducer.
- 2 Press **D COLOR**. The Sequoia system will enter the last used Color Doppler mode.
- **3** Press **OPTIONS** to display the CD option menu and select **MBD**.

TRANSDUCER	FREQUENCIES
4C1-S	D2.0 MHz
4V1-S	D2.0 MHz
6C2-S	D2.0 MHz
EV-8C4-S <sup>1</sup>	D4.0 MHz

<sup>1.</sup> Requires software version 10.0 or higher. Requires the CPS for General Imaging option.

**4** Adjust the color Doppler box size, position, and pan height, as needed, using the following soft keys:

[SOFT KEY]	FUNCTION	
	Adjusts between a full-height pan display and a truncated pan display.	
	• Select until $\triangle$ is highlighted for a full display.	
	<ul> <li>Select until (□) is highlighted for a truncated display.</li> </ul>	
[CD POS/SIZE]	Adjusts the color Doppler pan box size and position.	
	<ul><li>Select until <b>POS</b> is highlighted to adjust position.</li><li>Select until <b>SIZE</b> is highlighted to adjust size.</li></ul>	

- To exit MBD, choose one of the following methods:
- Press **D COLOR** (exits Color Doppler mode)
- Press **2D ONLY** (returns to 2-D mode)
- Change the transducer
- Change the Exam Preset
- Begin a new exam

# CHAPTER 17

# AXIUS AUTO-TRACKING CONTRAST QUANTIFICATION

Overview	Axius Auto-Tracking Contrast Quantification (Axius ACQ) is an optional feature that measures the progression of contrast agent enhancement in conditions such as coronary artery disease, tumor neovasculature, and liver metastases.		
	Axius ACQ illustrates contrast agent enhancement by displaying graphs indicating changes of intensity over time within defined regions of interest (ROIs). Axius ACQ also measures the average value and the curve-fitted value for each ROI on each image frame.		
	You can export the Axius ACQ data to a connected storage device.		
Compatible Clips	To be compatible with Axius ACQ, clips must be stored using one of the following Cadence Contrast Agent Imaging techniques:		
	• Agent Detection Imaging (ADI); set <b>BALANCE</b> to <b>+1</b> to ensure that contrast information only is used for automatic alignment.		
	<ul> <li>Coherent Contrast Imaging (CCI). Compatible only for cardiology clips using the CA3.5MHz setting on the 3V2c-S transducer.</li> </ul>		
	<ul> <li>Contrast Pulse Sequence imaging (CPS); set BALANCE to +1 or 0. If you set BALANCE to 0, then you must select the correct color map (using the POST key) to specify use of tissue information only for automatic alignment: for general imaging transducers (4C1-S, 4V1-S, 6C2-S, 15L8-S, 15L8w-S), select 6; for cardiology transducers (3V2c-S, 4V1c-S), select 5.</li> </ul>		
	Power Contrast Imaging (PCI)		
	You can use Time Decimated Capture or R-wave Decimated Capture to reduce the number of image frames stored in the clip. (See "Storing Clips" on page 59 for detailed decimated capture steps.)		
	For more information on Cadence Contrast Agent Imaging techniques, see Chapter 15 and Chapter 16.		

RecommendedBefore storing clips, activate an exam preset that is compatible with AxiusPrerequisites forACQ. PrecisionBurst should be used to acquire a clip used for AxiusStoring ClipsACQ. Recommended exam presets are listed below.

# CPS Abdomen

**NOTE:** The **ACQ Analysis** image preset within **CPS Abdomen** is optimized for use with Axius ACQ.

- Breast
- Testicular
- Thyroid

Recommended exam presets for cardiology are listed below.

- CPS MCE
- CPS Exercise SE
- CPS Pharm SE
- PCI MCE

For information on storing clips, see "Storing Clips" on page 59.

The controls used for Axius ACQ consist of soft keys, controls on the keyboard, menu items on the Axius ACQ navigation menu, and selections (other than soft keys) on some screens, such as the Axius ACQ **Setup** screen.

Controls

## Soft Keys

[SOFT KEY]	FUNCTION		
[SET PHASE]	Specifies use of the cardiac phase of the currently selected image frame for analysis.		
	<b>NOTE:</b> This soft key is available for clips containing ECG traces only.		
[USE ALL IMAGES]	Specifies use of all image frames for analysis.		
[(()) MENU]	Displays the Axius ACQ navigation menu.		
[ADD ROI]	Displays the following soft keys for defining an ROI:		
	[PRIOR]		
	[MARK]		
	[DRAW]		
[PRIOR]	Displays the previous set of soft keys.		
[MARK]	Places the first point of the ROI, activates the <b>[MARK]</b> method of ROI placement, and displays the following soft keys:		
	[BACK UP]		
	[()MARK]		
	[DRAW]		
	[(())END TRACE]		
[DRAW]	Places the first point of the ROI, activates the [DRAW] method of ROI placement, and displays the following soft keys:		
	[BACK UP]		
	[MARK]		
	[()DRAW]		
	[(())END TRACE]		
[BACK UP]	Removes the last point added to the ROI being defined or edited.		
[(())END TRACE]	Completes the ROI definition or applies ROI edits, connecting the last point to the first point.		
[EDIT ROI]	Activates the selected ROI for editing and displays the following soft keys:		
	[BACK UP]		
	[DELETE ROI]		
	[CANCEL]		
[DELETE ROI]	Removes the selected ROI.		
[CANCEL]	Discards any changes and exits the screen.		
[NEXT ROI]	Selects the next defined ROI.		
[SET TIME ZERO]	Specifies the currently selected image frame as time zero.		

[SOFT KEY]	FUNCTION		
[ZOOM/PAN]	<b>[ZOOM]</b> adjusts magnification of the image frames in the clip.		
	<b>[PAN]</b> repositions the image frames in the clip.		
[(()) APPLY]	Saves new settings and exits the screen.		
[RESET]	In the <b>Zoom/Pan</b> screen, applies default settings for clip magnification and position.		
	In the <b>Manual Alignment</b> screen, cancels repositioning or rotation completed since displaying the <b>Manual Alignment</b> screen.		
[RESTORE DEFAULT]	Restores the factory default settings for the displayed screen.		
[GRAPH/LEGENDS ]	<b>GRAPH</b> displays the TIC (time intensity curve) graph in full-screen format.		
	<b>LEGENDS</b> displays the TIC graph and legends (representative image of currently selected image frame and list of ROIs).		
[DATA SUMMARY]	Displays the <b>Data Summary</b> screen.		
[ANALYSIS]	Displays the <b>Analysis</b> screen.		
[EXCLUDE IMAGE]	Omits the selected image frame from analysis.		
[INCLUDE IMAGE]	Adds the selected image frame back to the analysis.		
[TRANS/ROTATE]P	TRANS repositions the selected image frame in relation to the ROI(s).		
	ROTATE rotates the selected image frame in relation to the ROI(s).		
[EXPORT]	Sends the Axius ACQ data to a storage device that is connected to a USB port on the Perspective advanced display option.		
	This function is available from the <b>Analysis</b> and <b>Data Summary</b> screens.		
	<b>NOTE:</b> This function is available only when a USB storage device (such as a memory card reader) is connected to the Perspective advanced display option.		

#### Controls on the Keyboard

Axius ACQ uses the following controls on the keyboard.

CONTROL	FUNCTION
AUTO MEASURE	Activates Axius ACQ from the <b>Review</b> screen when the cursor is positioned on a compatible clip.
	During Axius ACQ, exits Axius ACQ.
GAIN/FRZ/RUN	During Axius ACQ:
	Plays or freezes the clip when pressed.
	Cycles through the image frames in the clip or the data points in the Time Intensity Curve (TIC) graph when turned.
RES	During Axius ACQ, displays the <b>Zoom/Pan</b> screen.
SETUP	During Axius ACQ, displays the <b>Setup</b> screen.
	<b>NOTE:</b> This function is not available from the <b>Zoom/Pan</b> screen.
DELETE	Exits Axius ACQ and deletes the clip.
REVIEW	Exits Axius ACQ and exits the <b>Review</b> screen.

**Navigation Menu** 

The navigation menu contains the following items:

- ROI Placement
- Analysis
- Data Summary
- Manual Alignment
- Specify Phase
- Specify Time Zero
- Zoom/Pan
- Setup
- Exit

The **Exit** navigation menu item exits Axius ACQ. All other navigation menu items display the named screen. For example, the **Analysis** navigation menu item displays the **Analysis** screen.

#### **ROI Placement Screen**

The **ROI Placement** screen displays the currently selected image frame, the ECG trace (or timeline if the clip does not contain an ECG trace), and a TIC preview displaying the data points of the selected ROI. The system indicates the position of time zero with a purple triangle below the ECG trace or timeline and with a vertical purple line on the TIC preview. The system indicates the currently selected image frame with a vertical white line on the ECG trace or timeline and on the TIC preview. Each ROI and related set of data points is indicated in a unique color. The boundary of the selected (active) ROI is solid; the boundary of each unselected ROI is dashed.



Example of the **ROI Placement** screen

In addition to soft keys, this screen has a pop-up menu that is displayed when you roll the trackball to position the cursor on a data point of the TIC preview and press a trackball **SELECT** key.

SELECTION	FUNCTION
Exclude	Omits the selected image frame from analysis.
Cancel	Exits the pop-up menu.

When you position the cursor within the boundaries of an ROI, the system changes the cursor shape to one of the following graphics.

DESCRIPTION OF GRAPHIC	INDICATION
Hand with pointer finger	ROI is not selected
Open hand	ROI is selected but reposition function is not enabled
Closed hand	ROI is selected and reposition function is enabled

#### **Analysis Screen**

The **Analysis** screen displays the TIC graph for all defined ROIs that are selected for display. When **[LEGENDS]** is selected, the screen also displays the list of ROIs, indicating the ROIs selected for display, and a representative image of the currently selected image frame. Each ROI and related set of data points is indicated in a unique color. The boundary of the selected (active) ROI is solid; the boundary of each unselected ROI is dashed.

The TIC graph displays the data points of the ROIs and the curve fit to the data. The system indicates the position of time zero with a vertical purple line on the TIC graph. The system indicates the currently selected image frame with a vertical white line on the TIC graph.



Example of the **Analysis** screen

In addition to soft keys, this screen has a pop-up menu that is displayed when you roll the trackball to position the cursor on a data point of the TIC graph and press a trackball **SELECT** key.

SELECTION	FUNCTION
Exclude	Omits the selected image frame from analysis.
Cancel	Exits the pop-up menu.

#### Data Summary Screen

The Data Summary screen displays the measurements and parameters for all defined ROIs that are selected for display. This screen also displays the list of ROIs, indicating the ROIs selected for display, and a representative image of the currently selected image frame. Each ROI is indicated in a unique color. The boundary of the selected (active) ROI is solid; the boundary of each unselected ROI is dashed.



Example of the Data Summary screen

```
The Manual Alignment screen displays the currently selected image
Manual Alignment Screen
                             frame and the ECG trace (or timeline if the clip does not contain an ECG
                             trace). The system indicates the position of time zero with a purple
                             triangle below the ECG trace or timeline. The system indicates the
                             currently selected image frame with a vertical white line on the ECG trace
                             or timeline. Each ROI is indicated in a unique color. The boundary of the
                             selected (active) ROI is solid; the boundary of each unselected ROI is
                             dashed. Excluded image frames are indicated with a large red X.
                             The Specify Phase screen displays the currently selected image frame
Specify Phase Screen
                             and the ECG trace (or timeline if the clip does not contain an ECG trace).
                             The system indicates the position of time zero with a purple triangle
                             below the ECG trace or timeline. The system indicates the currently
                             selected image frame with a vertical white line on the ECG trace or
                             timeline. Each ROI and related set of data points is indicated in a unique
                             color. The boundary of the selected (active) ROI is solid; the boundary of
                             each unselected ROI is dashed.
```

If the clip contains a destruction frame (image frame at the position of time zero), then the system indicates the destruction frame using a purple vertical line on the ECG trace or timeline.



Example of the **Specify Phase** screen

Specify Time Zero Screen	The <b>Specify Tin</b> frame, the ECG trace), and a TIG selected ROI. Th triangle below t on the TIC prev frame with a ve TIC preview. Ea unique color. Th boundary of eac	<b>me Zero</b> screen displays the currently selected image trace (or timeline if the clip does not contain an ECG C preview displaying the data points of the most recently ne system indicates the position of time zero with a purple the ECG trace or timeline and with a vertical purple line tiew. The system indicates the currently selected image artical white line on the ECG trace or timeline and on the tech ROI and related set of data points is indicated in a ne boundary of the selected (active) ROI is solid; the ch unselected ROI is dashed.	
	If the clip contains a destruction frame (image frame at the position of time zero), then the system indicates the destruction frame using a purple vertical line on the ECG trace or timeline.		
	In addition to so when you roll th TIC preview an	oft keys, this screen has a pop-up menu that is displayed he trackball to position the cursor on a data point of the d press a trackball <b>SELECT</b> key twice.	
	SELECTION	FUNCTION	
	Exclude	Omits the selected image frame from analysis.	
	Cancel	Exits the pop-up menu.	
Zoom/Pan Screen	The <b>Zoom/Pan</b> screen displays the currently selected image frame, the ECG trace (or timeline if the clip does not contain an ECG trace), and a TIC preview displaying the data points of the most recently selected ROI. The system indicates the position of time zero with a purple triangle below the ECG trace or timeline and with a vertical purple line on the TIC preview. The system indicates the currently selected image frame with a vertical white line on the ECG trace or timeline and on the TIC preview. Each ROI is indicated in a unique color. The boundary of the selected (active) ROI is solid; the boundary of each unselected ROI is dashed.		

#### Axius ACQ Setup Screen

**NOTE:** The Perspective advanced display option retains the settings for the Axius ACQ **Setup** screen through power cycles of the system.

The Axius ACQ **Setup** screen has the following selections in addition to soft keys.

SELECTION	FUNCTION			
Alignment Type	<b>Auto</b> applies <b>Rigid Body</b> if the clip contains an ECG trace and <b>Warping</b> if the clip does not contain an ECG trace.			
	<b>Warping</b> tracks and aligns local distortions (or many small structures) that occur in the image due to respiratory interference. This is the default setting for clips not containing ECG traces.			
	<b>Rigid Body</b> aligns large structures from image frame to image frame in a clip. This is the default setting for clips containing ECG traces.			
	Manual disables automatic alignment.			
Data Type	<b>Log</b> removes the effect of the postprocessing curve yet retains log compression. Using log compression reduces the differences between high-amplitude signals. With the log compressed data values averaged within the ROI, the effect of the stronger data values is reduced.			
	<b>Antilog</b> applies an antilog operation after removing pp. With the uncompressed data values averaged within the ROI, the result may be dominated by the brightest pixels due to the wide dynamic range of ultrasound images.			
	<b>Color Pixels</b> shows the fraction of colored pixels in the ROI. Colored pixels are pixels where the color Doppler signal is displayed in the pixel instead of the underlying B-mode signal.			
Enable Main Data Fields	When checked (selected), displays text and graphics that were captured outside the ultrasound image.			
Arrival Time Constant	Indicates the quantity of contrast that results in a significant change in the clip. For example, a constant of 1.1 indicates that an increase of ten percent results in a significant change in the clip.			
	This constant is used in conjunction with time zero to locate the image frame containing the significant increase of contrast agent. This image frame is the first of at least two consecutive image frames in which the measured intensity exceeds the product of the measured intensity at time zero and the Arrival Time (AT) constant. The system considers only the image frames after time zero.			

# Activating and Exiting Axius ACQ

You can activate Axius ACQ for a selected, compatible clip in a live, restarted, or reviewed study or teaching file.

When you activate Axius ACQ, the system loads and aligns the clip and displays the first image frame. If an ECG was acquired with the clip, then the ECG trace is displayed below the image frame. If the clip does not contain an ECG trace, then a timeline is displayed below the image frame. The system indicates the position of the currently displayed image frame using a vertical white line on the ECG trace/timeline.

If the clip contains an ECG trace, then the system initially displays the **Specify Phase** screen. The system exits the screen when you select a cardiac phase (or select **[USE ALL IMAGES]**) and then displays the currently selected image frame on the **ROI Placement** screen.

If the clip does not contain an ECG trace, then the system initially displays the **ROI Placement** screen.

While Axius ACQ is active, you can display the Axius ACQ navigation menu to select a menu item. You can also complete the following standard functions: annotate, print, record to VCR, and store clips and images. For more information on these functions, see Chapter 6 of the Administrator manual and Chapter 8 of the Administrator manual.

When you exit Axius ACQ, the system displays the **Review** screen.

### • To activate Axius ACQ:

**NOTE:** To display a clip from a previous study, review the study, restart the study (if stored less than 24 hours ago), or create and restart a teaching file (if stored more than 24 hours ago). You must restart the study (or create and restart a teaching file) to store additional images or clips. See "Restarting a Study" on page 35 and "Creating a Teaching File" on page 64.

1 Press **REVIEW** to display the clip in the **Review** screen.

The system displays the stored images and clips.

- **2** Roll the trackball to position the cursor on the required clip. Alternatively, press **QUAD** to display the required clip in full-screen format.
- **3** Press **AUTO MEASURE** to activate Axius ACQ.

If the clip contains a large amount of data, then the system displays a progress indicator on the screen.

- 4 If the clip contains an ECG trace, then select the required cardiac phase (or select **[USE ALL IMAGES]**) from the **Specify Phase** screen.
- **5** To display another image frame in the clip, rotate the **GAIN/FRZ/RUN** control.
- 6 To play or freeze the clip, press the **GAIN/FRZ/RUN** control.
- 7 To display the Axius ACQ navigation menu and select a menu item, select [ (( )) MENU], roll the trackball to position the cursor on the menu item, and then press a trackball SELECT key.
- To exit Axius ACQ, choose one of the following methods:
- Press **AUTO MEASURE** or select **Exit** from the Axius ACQ navigation menu.
- Press **DELETE**.

The system also deletes the clip.

• Press **REVIEW**.

The system also exits the **Review** screen.

Generating the TICs, Measurements, and Parameters	You can view the clip, set up for quantification, and define and edit ROIs. The system generates the TICs, measurements, and parameters based on the defined ROIs and quantification setup.		
Viewing the Clip	You can review, magnify, and reposition the clip.		
Reviewing the Clip	You can stop or start playback of the clip or review the clip image frame by image frame. You can also select an image frame for display.		
	To stop or start playback of the clip:		
	• Press GAIN/FRZ/RUN.		
	To review the clip image frame by image frame:		
	• Turn <b>GAIN/FRZ/RUN</b> .		
	To select an image frame for display, choose one of the following methods:		
	• Turn <b>GAIN/FRZ/RUN</b> .		
	<ul> <li>Roll the trackball to position the cursor on the TIC graph/TIC preview or ECG trace/timeline and press a trackball SELECT key.</li> </ul>		
	<b>NOTE:</b> The TIC graph is displayed on the <b>Analysis</b> screen. The TIC preview is displayed on the <b>ROI Placement</b> screen and the <b>Specify Time Zero</b> screen. The ECG trace or timeline is displayed on all screens that display the clip in full-screen format (except the <b>Zoom/Pan</b> screen).		
Magnifying the Clip	You can increase or decrease the magnification level for the clip.		
	To adjust magnification of the clip:		
	1 While Axius ACQ is active, select [(())MENU] to display the navigation menu and then select <b>Zoom/Pan</b> to display the <b>Zoom/Pan</b> screen. Alternatively, press the <b>RES</b> key to display the <b>Zoom/Pan</b> screen.		
	2 Select <i>[ZOOM/PAN]</i> until <b>ZOOM</b> is highlighted.		
	<b>3</b> To increase magnification, roll the trackball up.		
	<b>4</b> To decrease magnification, roll the trackball down.		
	5 Select [(())APPLY] to save changes and exit the <b>Zoom/Pan</b> screen.		
Repositioning the Clip	You can reposition the clip.		
	To reposition the clip:		
	1 While Axius ACQ is active, select [(())MENU] to display the navigation menu and then select <b>Zoom/Pan</b> to display the <b>Zoom/Pan</b> screen.		
	2 Select [ZOOM/PAN] until PAN is highlighted.		
	<b>3</b> Roll the trackball to reposition the clip.		
	4 Select [(())APPLY] to save changes and exit the <b>Zoom/Pan</b> screen.		

Setting Up for You can change the cardiac phase, time zero, or quantification settings Quantification before or after ROIs are defined. If you make the changes after defining ROI(s), then Axius ACQ functions are temporarily unavailable until the system recalculates TICs, measurements, and parameters using the changed settings. If the clip contains an ECG trace, then you can specify a cardiac phase for Specifying the Cardiac Phase for Quantification analysis. You can also choose to use all image frames in the clip for (Clips with ECG analysis. Traces Only) **NOTE:** The **Specify Phase** screen is available for clips containing ECG traces only. For optimal performance of the automatic motion tracking function in cardiac clips, specify a cardiac phase (do not use all image frames for analysis). When you specify a cardiac phase for analysis, you designate an interval from each R-wave in the clip at which to select an image frame. The system shifts the time zero indicator (if the indicator was marking an image frame not in the specified cardiac phase), collects the sequence of image frames in the specified cardiac phase, and automatically aligns the image frames if an automatic alignment method is enabled. If ROIs are defined when you specify or change the phase (or select all image frames for analysis), then the system recalculates TICs, measurements, and parameters. When automatic alignment is complete, the system displays the ROI Placement screen. Only the image frames in the specified cardiac phase are used for analysis. By omitting image frames, you can reduce the image brightness changes caused by cardiac motion that may obscure contrast agent variation. Omitted image frames are not available for ROI definition or other Axius ACQ functions. By default, clips containing an ECG trace use the R-wave cardiac phase for analysis; clips not containing an ECG trace use all image frames for analysis. TO: DO THIS: While Axius ACQ is active, select [(())MENU] to **DISPLAY THE** display the navigation menu and then select SPECIFY PHASE SCREEN Specify Phase. Display the **Specify Phase** screen, display the SPECIFY THE image frame corresponding to the required **CARDIAC PHASE FOR** cardiac phase, and then select [SET PHASE]. ANALYSIS USE ALL IMAGE Display the Specify Phase screen and then FRAMES FOR select [USE ALL IMAGES]. ANALYSIS

# **Changing the Position of** You can change the position of time zero on the clip. **Time Zero**

Time zero is the image frame at which contrast agent was destroyed using PrecisionBurst. The system uses time zero to fit the curve to the data and to calculate Arrival Time (AT). Image frames before time zero are omitted from the curve fit to the data on the TIC graph, although their data points are displayed.

If ROIs are defined when you change the position of time zero, then the system recalculates TICs, measurements, and parameters. The system displays the **ROI Placement** screen after you change the position of time zero.

The default position of time zero is the last burst image frame of the clip, if destruction occurred in the clip (contrast agent was destroyed using PrecisionBurst). If destruction did not occur in the clip, then the default position of time zero is the first image frame of the clip.

### • To change the position of time zero:

**NOTE:** Before ROIs are defined, you can also change the position of time zero from the **ROI Placement** screen. Rotate the **GAIN/FRZ/RUN** control to display an image frame corresponding to the required placement for time zero and then select [SET TIME ZERO].

- 1 While Axius ACQ is active, select [(())MENU] to display the navigation menu and then select **Specify Time Zero** to display the **Specify Time Zero** screen.
- **2** Display the image frame corresponding to the required cardiac phase.
- **3** Select **[SET TIME ZERO]**.

Selecting the TIC Calculation and Alignment Methods You can select the TIC calculation method and image frame alignment method and you can specify the Arrival Time (AT) constant. You can also enable or disable the display of text and graphics that were captured outside the ultrasound image.

If ROIs are defined when you change a method or the AT constant, then the system recalculates TICs, measurements, and parameters.

### To display the Axius ACQ Setup screen:

• While Axius ACQ is active, press **SETUP**. Alternatively, select **[(())MENU]** to display the navigation menu and then select **Setup**.

то:	DISPLAY THE AXIUS ACQ SETUP SCREEN AND THEN DO THIS:
SELECT A TIC CALCULATION METHOD	Select a <b>Data Type</b> option and then select [(())APPLY] to save changes and exit the <b>Setup</b> screen.
SELECT AN AUTOMATIC ALIGNMENT METHOD (OR DISABLE	Select an <b>Alignment Type</b> option and then select <b>[(())APPLY]</b> to save changes and exit the <b>Setup</b> screen.
AUTOMATIC ALIGNMENT)	<b>NOTE:</b> Siemens recommends selecting <b>Manual</b> only when structure movements within the clip do not exist.
SPECIFY THE ARRIVAL TIME (AT) CONSTANT	To adjust the existing value in increments of .01, select the up or down arrow to the right of the <b>Arrival Time Constant</b> text field for each increment and then select <b>[(())APPLY]</b> to save changes and exit the <b>Setup</b> screen.
	To enter the required value, roll the trackball to position the cursor in the <b>Arrival Time</b> <b>Constant</b> text field, use the alphanumeric keyboard to enter the value, and then select [(())APPLY] to save changes and exit the <b>Setup</b> screen.
ENABLE OR DISABLE DISPLAY OF TEXT AND GRAPHICS CAPTURED OUTSIDE THE ULTRASOUND IMAGE	Select or clear the <b>Enable Main Data Fields</b> check box and then select <b>[(())APPLY]</b> to save changes and exit the <b>Setup</b> screen.
RESTORE DEFAULT SETTINGS	Press [RESTORE DEFAULT].

Defining and Editing ROIs	You can define, change, and delete ROIs. You can manually align image frames to ROIs and exclude image frames from analysis.		
Defining ROIs	You can define up to eight ROIs.		
	Wł low sele	en ROI(s) are de ver right of the sc ected ROI.	fined, the system displays a small TIC preview on the reen. The TIC preview displays the data points for the
	٠	To define an R	01:
	1	While Axius AC menu and then screen.	CQ is active, select [(())MENU] to display the navigation select <b>ROI Placement</b> to display the <b>ROI Placement</b>
	2	Select [ADD ROI]	] to display soft keys for adding ROIs.
	3	Roll the trackba [MARK] or [DRA	ll to the starting point of the ROI and then select <b>W]</b> to indicate the required ROI placement method.
		The system place	res the first point of the ROI.
	4	If <b>[DRAW]</b> is sele	ected, then roll the trackball to trace the ROI.
		The system cont movement of th	tinuously places the points of the ROI according to e trackball.
	5	If <b>[MARK]</b> is selected, then for each point of the ROI, roll the trackball to position the cursor at the required location and select <b>[MARK]</b> again.	
		The system plac select <b>[MARK]</b> .	res discrete points of the ROI each time you
	6	To undo the last	t ROI point, select [BACK UP].
	7	To complete the	ROI, select [END TRACE].
Editing ROIs	You can undo points of and add points to a completed ROI. You can reposition an ROI on a specific image frame. You can also delete an ROI.		
	Wł sys	en you position tem changes the	the cursor within the boundaries of an ROI, the cursor shape to one of the following graphics.
	D	ESCRIPTION F GRAPHIC	INDICATION
	Р	ointing hand	ROI is not selected
	0	pen hand	ROI is selected but reposition function is not enabled

ROI is selected and reposition function is enabled

Closed hand

# • To display the ROI Placement screen:

• While Axius ACQ is active, select [(())MENU] to display the navigation menu and then select **ROI Placement** to display the **ROI Placement** screen.

то:	DISPLAY THE ROI PLACEMENT SCREEN AND THEN DO THIS:				
SELECT AN ROI	Choose one of the following methods:				
	• If more than one ROI is defined, select <b>[NEXT ROI]</b> until the required ROI is displayed.				
	<ul> <li>Roll the trackball to position the cursor inside the boundary of the required ROI and then press a trackball SELECT key.</li> </ul>				
	The boundary of the selected (active) ROI is solid; the boundary of each unselected ROI is dashed.				
DISPLAY SOFT KEYS FOR EDITING FOR THE SELECTED ROI	Select [EDIT ROI].				
UNDO POINTS OF AN ROI DURING EDITING	For each point, select <b>[BACK UP]</b> .				
ADD POINTS TO AN ROI DURING EDITING	For the <b>[DRAW]</b> ROI placement method, undo at least one point of the ROI by selecting <b>[BACK UP]</b> , select <b>[DRAW]</b> , and then roll the trackball to trace the ROI.				
	For the <b>[MARK]</b> ROI placement method, undo at least one point of the ROI by selecting <b>[BACK UP]</b> , select <b>[MARK]</b> , and then for each point of the ROI, roll the trackball to position the cursor at the required location and select <b>[MARK]</b> again.				
REPOSITION AN ROI	<b>1</b> Select (activate) the required ROI.				
ON AN IMAGE FRAME	<b>2</b> Press a trackball <b>SELECT</b> key to enable the reposition function.				
	<b>3</b> Roll the trackball to reposition the ROI.				
	<b>4</b> Press a trackball <b>SELECT</b> key to de-select the ROI.				
DELETE THE SELECTED ROI	Select [EDIT ROI] and then select [DELETE ROI].				

#### Manually Aligning Image Frames to the ROI(s)

You can reposition or rotate the selected image frame in relation to the defined ROI(s). You can also cancel the repositioning and rotating (manual alignments) until you exit the **Manual Alignment** screen.

# • To display the Manual Alignment screen:

**NOTE:** The **Manual Alignment** screen is available when one or more ROIs are defined.

• While Axius ACQ is active, select [(())MENU] to display the navigation menu and then select Manual Alignment to display the Manual Alignment screen.

то:	DISPLAY THE MANUAL ALIGNMENT SCREEN AND THEN DO THIS:				
SELECT AN IMAGE FRAME	Choose one of the following methods:				
	• Rotate <b>GAIN/FRZ/RUN</b> to display the required image frame.				
	• Roll the trackball to position the cursor on the related portion of the ECG trace/timeline and then press a trackball <b>SELECT</b> key.				
REPOSITION (TRANSLATE) THE SELECTED IMAGE FRAME IN RELATION TO THE ROI(S)	Select <b>[TRANS/ROTATE]</b> until <b>TRANS</b> is highlighted and then roll the trackball.				
ROTATE THE SELECTED IMAGE FRAME IN RELATION TO THE ROI(S)	Select <b>[TRANS/ROTATE]</b> until <b>ROTATE</b> is highlighted and then roll the trackball.				
CANCEL MANUAL ALIGNMENTS	Select [RESET].				
	<b>NOTE:</b> You can cancel manual alignments until you exit the <b>Manual Alignment</b> screen.				

Excluding Image Frames from Analysis

You can exclude an image frame from analysis by selecting the image frame or by selecting the related data point on the TIC graph or TIC preview.

When you exclude an image frame from analysis, the system removes the related data point for each ROI from the TIC graph and TIC preview. Excluded image frames are indicated on the **Manual Alignment** screen with a superimposed large red X.

- To exclude an image frame from analysis by selecting the image frame:
- 1 While Axius ACQ is active, select [(())MENU] to display the navigation menu and then select **Manual Alignment** to display the **Manual Alignment** screen.
- **2** To select the required image frame, choose one of the following methods:
  - Rotate GAIN/FRZ/RUN.
  - Roll the trackball to position the cursor on the related portion of the ECG trace/timeline and then press a trackball **SELECT** key.
- **3** Select [EXCLUDE IMAGE].
- To exclude an image frame from analysis by selecting the related data point:
- 1 Display either the **ROI Placement** screen or the **Analysis** screen: While Axius ACQ is active, select **[(())MENU]** to display the navigation menu and then select the related option.
- 2 Roll the trackball to position the cursor on the related data point displayed in the TIC graph (displayed on the Analysis screen) or the TIC preview (displayed on the ROI Placement screen and the Specify Time Zero screen) and then press a trackball SELECT key twice.

The system displays a pop-up menu.

**3** Select **Exclude** from the pop-up menu.

Viewing the TICs, Measurements, and Parameters	You can view the TICs (analysis data) and measurements and parameters (data summary) after ROI(s) are defined.				
	To display the Analysis screen (view the TICs):				
	• While Axius ACQ is active, select [(())MENU] to display the navigation menu and then select <b>Analysis</b> to display the <b>Analysis</b> screen. Alternatively, from the <b>Data Summary</b> screen, select [ANALYSIS].				
	<ul> <li>To display the Data Summary screen (view the measurements and parameters):</li> </ul>				
	• While Axius ACQ is active, select [(())MENU] to display the navigation menu and then select <b>Data Summary</b> to display the <b>Data Summary</b> screen. Alternatively, from the <b>Analysis</b> screen, select [DATA SUMMARY].				
Customizing the Display	You can toggle display of the full-screen TIC graph with display of the TIC graph and legend. The legend includes the list of ROIs, indicating the ROIs included in and excluded from analysis, and a small representative image of the currently selected image frame.				
	To toggle display of the full-screen TIC graph with display of the TIC graph and legend:				
	• Select [GRAPHS/LEGENDS].				
Excluding ROIs	You can exclude an ROI to omit its data points from the TIC graph.				
from Analysis	The system retains excluded ROIs.				
	<b>NOTE:</b> Exported Axius ACQ data contains excluded ROIs. To omit an ROI from the Axius ACQ data, delete the ROI before exporting the data.				
	To exclude an ROI from analysis:				
	<b>1</b> Display either the <b>Analysis</b> screen or the <b>Data Summary</b> screen.				
	2 If the <b>Analysis</b> screen is displayed, select <b>[GRAPHS/LEGENDS]</b> until <b>LEGENDS</b> is highlighted.				
	<b>3</b> Clear the check box for the required ROI listed on the upper left of the screen.				

**4** To include the ROI in analysis again, select the check box for the ROI.

# Exporting the Axius ACQ Data

You can export the Axius ACQ data to a storage device that is connected to a USB port on the Perspective advanced display option. The exported data can be viewed using spreadsheet applications or any other software that can display data formatted as comma-separated variable (CSV). See "Sequoia System Components" on page 3.

Exported Axius ACQ data contains the following items:

- Measurements and parameters from the data summary
- Analysis data, which includes (for each ROI on each image frame [identified by timestamp]) the average value and the value of the functions fit to image frames after time zero
- The information used to create the Axius ACQ data, which includes image frame timestamps (adjusted for time zero) and the fit type used (exponential)

The system stores the Axius ACQ data to a comma-separated variable (CSV) formatted file named with the date and time. The system places the file on the root directory of the connected storage device, using the following path (where <date\_time> is the subdirectory named with the date and time of export): \ACQ\<date\_time>\

### • To export the Axius ACQ data to a connected storage device:

**NOTE:** Siemens recommends connecting the storage device to the ultrasound system before beginning the examination to prevent a delay in availability of export functionality.

- Select [(())MENU] to display the Axius ACQ navigation menu and then select either Analysis (to display the Analysis screen) or Data Summary (to display the Data Summary screen).
- 2 Select [EXPORT].

For information on compatible devices, see "Exporting Data" on page 74.

# CONTRAST AGENT IMAGING PRECISIONBURST

Overview	The Contrast Agent Imaging PrecisionBurst feature is designed for use with refill acquisitions during imaging with contrast agent. PrecisionBurst destroys contrast agent at specified intervals in Cardiac and General Imaging applications.		
	Use PrecisionBurst with the Contrast Pulse Sequence (CPS) imaging technique to combine low-power imaging with a high-power burst that destroys contrast agent. You can customize the high-power burst using a selected sequence technique.		
	PrecisionBurst can be used with high-power contrast imaging. You can create repeat and progressive sequences of high-power imaging combined with high-power bursts by using either the Power Contrast Imaging (PCI) technique (for Cardiac applications) or the Agent Detection Imaging (ADI) technique (for General Imaging applications).		
	Clips of images obtained using PrecisionBurst are used in conjunction with the Axius Auto-Tracking Contrast Quantification (Axius ACQ) option.		
Transducers	The PrecisionBurst feature is available on the following transducers:		
	• Cardiology: 3V2c-S, 4V1c-S, 15L8-S		
	• <b>GI:</b> 4V1-S, 4C1-S, 6C2-S, 15L8-S, 15L8w-S		

Triggers	For cardiac applications, the system synchronizes burst sequences with the cardiac cycle, using triggers to generate burst frames and images at specific points relative to the R-wave. You can use multiple triggers for a single burst sequence, at repeated regular intervals, or at increasingly longer intervals. For general imaging, triggers are timed using frames or seconds.
	The system displays a solid, full-height vertical, magenta bar on the ECG trace to indicate the contrast image frame that follows the destruction burst. The system also places a unique vertical, yellow bar on the ECG trace to indicate the position (relative to the heart cycle) for each R-wave trigger:
	<ul> <li>Primary (Single) R-wave triggers are represented by solid, full-height bars</li> </ul>
	<ul> <li>Second (Dual) R-wave triggers are represented by dotted, full-height bar</li> </ul>
	<ul> <li>Secondary (Multiple) triggers are represented by solid, third-height bar</li> </ul>
	When a trigger is delayed, the color of the corresponding bar changes to cyan and the system displays a message indicating the delay.
Data Field	
	Store in progress

	Store in	progr	ess	
	. 🖚	0:	02:30	
	HR= 71	bpm		
R-Wave Delay	—∆T1=50	ms	N=1	Beat Interval
Trigger Interval	- AT=40m	1s (25H	lz)	
Burst Power (dB)	Burst=+	6dB		
Burst MI	BMI=1.1	IMI=	.19	Image MI
Burst Duration	-Dur=1HB	3		
#### Controls

Use the **TRIG** key to enable PrecisionBurst. The **TRIG** key is located on the top row of the alphanumeric keyboard. The system displays context-sensitive content for the soft keys that changes from screen to screen. Some selections display only as a result of earlier selections; for example, burst interval does not display if you are using only a single burst.

[SOFT KEY]	FUNCTION	
[TRIG/BURST]	<b>TRIG</b> displays the Trigger soft key menu.	
	<b>BURST</b> enables the PrecisionBurst feature and displays the Burst soft key menu. If an ECG is used, then the system also displays an ECG window. (Trigger settings remain in effect.)	
[SINGLE/ REPEAT/PROG]	<b>SINGLE</b> generates one burst sequence of a specified duration.	
	<b>REPEAT</b> generates a burst sequence that repeats at a specified interval, from 1 to 20 heartbeats or seconds, until you select [(())STOP BURST]. Use this selection in high MI applications.	
	<b>PROG</b> generates a burst sequence that repeats and produces contrast images at progressively longer intervals following the burst event. The system resumes normal imaging after the longest interval concludes or when you select <b>[(())STOP BURST]</b> . Use this selection in high MI applications.	
	• All [1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20]	
	• Even [2,4,6,8,10,12,14,16,18,20]	
	• <b>Doubling</b> [1,2,4,8,16]	
[()B:PWR/DUR/	<b>B:PWR</b> adjusts the burst power.	
INT]	<b>DUR</b> adjusts the duration of the burst, in frames (milliseconds) or seconds for timed triggers and frames (milliseconds) or heartbeats for R-wave triggers.	
	<b>INT</b> defines the burst interval, the time between the last burst frame and the next contrast image, for repeated and progressive burst sequences. You can adjust the interval during repeated burst sequences.	

	[SOFT KEY]	FUNCTION	
	[(())START	Activates the burst sequence.	
	BUHSI]	You can program the foot switch to toggle <b>[(())START BURST]</b> with <b>[(())STOP BURST]</b> . See the <i>Administrator Manual</i> for details on customizing the footswitch.	
	[(())STOP	Ends a repeating or progressive burst sequence.	
	BURST]	You can program the foot switch to toggle <b>[(())START BURST]</b> with <b>[(())STOP BURST]</b> . See the <i>Administrator Manual</i> for details on customizing the footswitch.	
Optional Clip Capture Methods	You can use Time Decimated Capture or R-wave Decimated Capture to reduce the number of frames stored for a series of images. See the <i>Administrator Manual</i> for more information on customizing. For more information on these methods, see your Administrator Manual.		
Recommended Exam	The following exam presets are recommended for Cardiac applications.		
Presets	CPS MCE		
	CPS Exercise SE		
	CPS Pharm SE		
	PCI MCE		
	The following exam presets are recommended for General Imaging applications.		
	CPS Abdomen		
	Breast		
	Testicular		
	Thyroid		

#### PrecisionBurst Parameters

PARAMETER	FUNCTION	SETTINGS
BURST ON/OFF	Displays the Burst menu when the <b>TRIG</b> key is pressed.	On
		Off
BURST SEQUENCE	Selects the type of	Single
ITPE	burst sequence.	Repeated
		Progressive
BURST DURATION	Selects a burst duration.	1 to 5 frames
		1 to 5 heartbeats (ECG only)
		1 to 5 seconds
BURST POWER	Adjusts the power of a	Maximum: 0 dB
	burst event.	Minimum: -9 dB
BURST INTERVAL	Selects the interval for	Repeat: 1 to 20
	Repeat or Progressive bursts, in seconds for	Progressive: [1,2,3,4,20]
	heartbeats for	[2,4,6,820]
	R-wave triggers.	[1,2,4,8,16]
R-WAVE TRIGGER	Selects the number of R-wave triggers.	Single
ТҮРЕ		Dual
		Multiple
$\Delta$ T MAX FRAME RATE	Sets the trigger to the maximum rate.	On
		Off

Single, Repeated, and Progressive Sequences	You can choose a single, repeated, or progressive burst sequence. Use an R-wave method for Cardiac applications or a time-based method for General Imaging applications. The R-wave method uses ECG.	
	<b>NO</b> pre	<b>TE:</b> You can store trigger settings and burst settings to an exam set.
Cardiac Single-Burst Sequence (R-wave	•	To perform a Cardiac single-burst sequence (R-wave method) with multiple imaging triggers:
Method)	1	Press TRIG.
	2	Confirm or change the trigger settings as follows:
		(a) Select <b>[TRIG/BURST]</b> until <b>TRIG</b> is highlighted.
		(b) Select [R-WAVE/TIME] until R-WAVE is highlighted.
		(c) Select [SINGLE/DUAL/MULTI] until MULTI is highlighted.
		(d) Select [ΔT1/ΔT/N] until ΔT is highlighted and then use the trackball to set the interval between frames to the minimum setting (highest frame rate) or desired frame rate setting.
		(e) Select [ΔT1/ΔT/N] until ΔT1 is highlighted and then use the trackball to specify the interval between the R-wave and the primary image, the first image following the end of the burst event.
	3	Confirm or change the burst settings:
		(a) Select <b>[TRIG/BURST]</b> until <b>BURST</b> is highlighted.
		(b) Select [SINGLE/REPEAT/PROG] until SINGLE is highlighted.
		(c) Select <b>[()B:PWR/DUR]</b> until <b>B:PWR</b> is highlighted and then use the trackball to select the required power level.
		(d) Select <b>[()B:PWR/DUR]</b> until <b>DUR</b> is highlighted and then use the trackball to select the duration of the burst.
	4	Press <b>CLIP STORE</b> to begin clip acquisition.
	5	Select [(())START BURST] or double-click a trackball SELECT key.
		The system performs a single burst sequence with the specified settings and then resumes normal imaging. The image immediately following the burst and the triggers are indicated on the ECG trace (if the ECG trace is displayed).
	6	Observe the destruction of contrast agent and the replenishment of the area as contrast "washes back" into the anatomy.
	7	To repeat the burst sequence, select [(())START BURST] again.
	8	To end clip acquisition, press CLIP STORE.
	9	To exit PrecisionBurst, press <b>TRIG</b> .

General Imaging Single-Burst Sequence (Timed Method)

# To perform a General Imaging single-burst sequence (timed method):

### 1 Press TRIG.

- **2** Confirm or change the trigger settings as follows:
  - (a) Select **[TRIG/BURST]** until **TRIG** is highlighted.
  - (b) Use the trackball to set the [△T] interval between frames to the minimum setting (highest frame rate) or desired frame rate setting.
- **3** Confirm or change the burst settings:
  - (a) Select **[TRIG/BURST]** until **BURST** is highlighted.
  - (b) Select **[SINGLE/REPEAT/PROG]** until **SINGLE** is highlighted.
  - (c) Select **[()B:PWR/DUR]** until **B:PWR** is highlighted and then use the trackball to select the required power level.
  - (d) Select **[()B:PWR/DUR]** until **DUR** is highlighted and then use the trackball to select the duration of the burst.
- **4** Press **CLIP STORE** to begin clip acquisition.
- 5 Select [(())START BURST] or double-click a trackball SELECT key.

The system performs a single burst sequence with the specified settings and then resumes normal imaging. The image immediately following the burst and the triggers are indicated.

- **6** Observe the destruction of contrast agent and the replenishment of the area as contrast "washes back" into the anatomy.
- 7 To repeat the burst sequence, select [(())START BURST] again.
- **8** To end clip acquisition, press **CLIP STORE**.
- **9** To exit PrecisionBurst, press **TRIG**.

	• To perform a repeated burst sequence using a single trigger
Sequence (Cardiac)	until you select [(())STOP BURST].
Popostod Purot	Once started the hurste will continue at the energified interval settings

(Cardiac applications):

- 1 Press TRIG.
- **2** Confirm or change the trigger settings:
  - (a) Select [TRIG/BURST] until TRIG is highlighted.
  - (b) Select [R-WAVE].
  - (c) Select [SINGLE/DUAL/MULTI] until MULTI is highlighted.
  - (d) Select [ΔT1/N] until ΔT1 is highlighted and then use the trackball to set the interval (ΔT1) between the R-wave and the primary image frame.
- **3** Confirm or change the burst settings:
  - (a) Select **[TRIG/BURST]** until **BURST** is highlighted.
  - (b) Select [SINGLE/REPEAT/PROG] until REPEAT is highlighted.
  - (c) Select **[()B:PWR/DUR/INT]** until **B:PWR** is highlighted and then use the trackball to select the required power level.
  - (d) Select **[()B:PWR/DUR/INT]** until **DUR** is highlighted and then use the trackball to select the duration of the burst.
  - (e) Select [()B:PWR/DUR/INT] until INT is highlighted and then use the trackball to select the interval at which to repeat the burst sequence.
- 4 Press **CLIP STORE** to begin clip acquisition.
- 5 Select [(())START BURST] or double-click a trackball SELECT key.

The system performs the burst sequence repeatedly. The image immediately following the burst and the trigger are indicated on the ECG trace.

- **6** To change the interval, roll the trackball to adjust **INT**.
- 7 Select [(())STOP BURST] or double-click a trackball SELECT key.
- **8** To end clip acquisition, press **CLIP STORE**.
- **9** To exit PrecisionBurst, press **TRIG**.

#### Repeated Burst Sequence (General Imaging)

Once started, the bursts will continue at the specified interval settings until you select **[(())STOP BURST]**.

- To perform a repeated burst sequence using a single trigger (General Imaging applications):
- 1 Press TRIG.
- **2** Confirm or change the trigger settings:
  - (a) Select **[TRIG/BURST]** until **TRIG** is highlighted.
  - (b) Use the trackball to set the [△T] interval between frames to the minimum setting (highest frame rate) or desired frame rate setting.
- **3** Confirm or change the burst settings:
  - (a) Select **[TRIG/BURST]** until **BURST** is highlighted.
  - (b) Select [SINGLE/REPEAT/PROG] until REPEAT is highlighted.
  - (c) Select **[()B:PWR/DUR/INT]** until **B:PWR** is highlighted and then use the trackball to select the required power level.
  - (d) Select **[()B:PWR/DUR/INT]** until **DUR** is highlighted and then use the trackball to select the duration of the burst.
  - (e) Select **[()B:PWR/DUR/INT]** until **INT** is highlighted and then use the trackball to select the interval at which to repeat the burst sequence.
- 4 Press **CLIP STORE** to begin clip acquisition.
- 5 Select [(())START BURST] or double-click a trackball SELECT key.
  - The system performs the burst sequence repeatedly. The image immediately following the burst and the trigger are indicated on the ECG trace.
- **6** To change the interval, roll the trackball to adjust **INT**.
- 7 Select [(())STOP BURST] or double-click a trackball SELECT key.
- 8 To end clip acquisition, press CLIP STORE.
- **9** To exit PrecisionBurst, press **TRIG**.

Progressive Burst Sequence (Cardiac) Burst pulses are generated after the R-wave for the specified duration. After acquiring the contrast image, the system begins another burst/delay/image sequence automatically. Bursts continue at the specified interval settings until the sequence is complete or you select [(())STOP BURST].

- To perform a progressive burst sequence using a single trigger (Cardiac applications):
- **1** Press **TRIG**.
- **2** Confirm or change the trigger settings:
  - (a) Select [TRIG/BURST] until TRIG is highlighted.
  - (b) Select [R-WAVE].
  - (c) Select [SINGLE/DUAL/MULTI] until SINGLE is highlighted.
  - (d) Select [ΔT1/N] until ΔT1 is highlighted and then use the trackball to set the interval (ΔT1) between the R-wave and the primary image frame.
- **3** Confirm or change the burst settings:
  - (a) Select [TRIG/BURST] until BURST is highlighted.
  - (b) Select [SINGLE/REPEAT/PROG] until PROG is highlighted.
  - (c) Select **[()B:PWR/DUR/INT]** until **B:PWR** is highlighted and then use the trackball to select the required power level.
  - (d) Select **[()B:PWR/DUR/INT]** until **DUR** is highlighted and then use the trackball to select the duration of the burst.
  - (e) Select **[()B:PWR/DUR/INT]** until **INT** is highlighted and then use the trackball to select the required progression of intervals.
- 4 Press **CLIP STORE** to begin clip acquisition.
- 5 Select [(())START BURST] or double-click a trackball SELECT key.

The system repeats the burst sequence at progressively longer intervals.

- **6** Wait for the sequence to complete or select **[(())STOP BURST]** (or double-click a trackball **SELECT** key).
- 7 To end clip acquisition, press **CLIP STORE**.
- 8 To exit PrecisionBurst, press TRIG.

#### Progressive Burst Sequence (General Imaging)

Burst pulses are generated for the specified duration. After acquiring the contrast image, the system begins another burst/delay/image sequence automatically. Bursts continue at the specified interval settings until the sequence is complete or you select **[(())STOP BURST]**.

- To perform a progressive burst sequence using a single trigger (General Imaging applications):
- 1 Press TRIG.
- **2** Confirm or change the trigger settings:
  - (a) Select **[TRIG/BURST]** until **TRIG** is highlighted.
  - (b) Use the trackball to set the [△T] interval between frames to the minimum setting (highest frame rate) or desired frame rate setting.
- **3** Confirm or change the burst settings:
  - (a) Select **[TRIG/BURST]** until **BURST** is highlighted.
  - (b) Select **[SINGLE/REPEAT/PROG]** until **PROG** is highlighted.
  - (c) Select **[()B:PWR/DUR/INT]** until **B:PWR** is highlighted and then use the trackball to select the required power level.
  - (d) Select **[()B:PWR/DUR/INT]** until **DUR** is highlighted and then use the trackball to select the duration of the burst.
  - (e) Select **[()B:PWR/DUR/INT]** until **INT** is highlighted and then use the trackball to select the required progression of intervals.
- 4 Press **CLIP STORE** to begin clip acquisition.
- 5 Select [(())START BURST] or double-click a trackball SELECT key.

The system repeats the burst sequence at progressively longer intervals.

- **6** Wait for the sequence to complete or select **[(())STOP BURST]** (or double-click a trackball **SELECT** key).
- 7 To end clip acquisition, press CLIP STORE.
- 8 To exit PrecisionBurst, press TRIG.

Chapter 18 - Contrast Agent Imaging PrecisionBurst

# **CONVERGENT CPS**



+1

Balance

#### Controls

You can choose to optimize the image through the color parameter controls.

CONTROL [SOFT KEY]	FUNCTION	
[ANGLE L/C/R]	Adjusts the incident angle to flow for linear transducers that provide electronic steering.	
[()CD POS/SIZE]	Adjusts the position of the Color Doppler box when <b>POS</b> is highlighted.	
	Adjusts the size of the Color Doppler box when <b>SIZE</b> is highlighted.	
BALANCE	Changes the Balance setting to display only the contrast agent information, only the 2-D mode information, or a combination of both contrast agent information and 2-D mode information. Cycle through live imaging, freeze, and Cine review (not available during AEGIS review).	
	+1 Contrast agent image only	
	<b>0</b> Mixed display of detected contrast agent with 2-D image	
	-1 2-D image only	
DOPPLER GAIN	Controls the overall Color Doppler signal level throughout the imaging field.	
DGC	Controls brightness levels at different depths.	
DUAL	Displays two images, side-by-side on the screen. The active image is real-time (live) while the other image is frozen.	
	In Live Dual, use to toggle between all three balance states on one side of the dual display, and the tissue only image on the other side of the display.	
EDGE	Sharpens borders when increased; smooths borders when decreased.	
FILTER	Adjusts to higher filter settings when increased; adjusts lower filter settings when decreased. Higher filter settings produce higher sensitivity to flow, but with a reduction in frame rate.	
GATE	Increases the size of the Doppler sample gate when pressed up; decreases the size of the gate when pressed down. Higher gate settings produce an image with less resolution.	
MULTIHZ	Increases or decreases the imaging frequency.	
OUTPUT TRANSMIT POWER	Controls transmit power / mechanical index (MI).	
POST	Accesses the Convergent CPS postprocessing map soft keys.	
PROTOCOL	Displays a soft key menu for choosing the protocol type. Press again to exit.	

CONTROL [SOFT KEY]	FUNCTION
SCALE	Changes the velocity range and displays higher or lower velocity signals.
	During Convergent CPS, use <b>SCALE</b> to visualize vessels that exhibit varying levels of Color Doppler energy.
	<ul><li>Higher scale setting show larger vessels.</li><li>Lower scale settings show smaller vessels.</li></ul>
SPACETIME	Emphasizes temporal resolution when pressed up; emphasizes spatial resolution when pressed down.
	To increase the frame rate, use a setting that emphasizes temporal resolution.
STOP WATCH	Times the duration of injections and "wash-in" phases used in contrast imaging. Use the system Stop Watch in Cine or Freeze mode. When frozen, scroll through the captured frames to replay the time stamp as it was captured with the image. See "Using the System Stop Watch" on page 28" for more details.
TISSUE EQUALIZATION (TEQ)	Adjusts for relatively uniform tissue and/or noise level throughout the image.
TRANSMIT FOCUS	Controls transmit beam focusing in image.

# Activating and Exiting Convergent CPS

When the combined power and color settings are too high, contrast agent is destroyed. You need to reduce the output power in 2-D mode and Color mode.

- To activate Convergent CPS:
- **1** Select a 15L8-S or 15L8w-S transducer.
- **2** Start a new or restart an existing study.
- **3** Select the appropriate Exam Presets (Breast, Thyroid, or Testicle) or adjust the Exam settings manually.
- 4 Press MULTIHZ to adjust the 2-D mode frequency.

**NOTE:** Siemens recommends a setting of **8 MHz** for the fundamental frequency.

**5** Rotate **OUTPUT** to adjust the 2-D mode transmit power.

**NOTE:** Siemens recommends a transmit power setting of -30dB (**MI=.05**).

- 6 Press D COLOR.
- 7 Press OPTIONS.
- 8 Select **CNV** from the Options pop-up menu.
- 9 Rotate **OUTPUT** to adjust the color mode transmit power.

**NOTE:** Siemens recommends a transmit power color setting of -15dB and a mechanical index color setting of **MIcd=.35**.

- **10** Continue to optimize the image by using the color parameter controls.
- 11 To exit Convergent CPS, press D COLOR.

This action exits Convergent CPS and Doppler color and accesses the mode that was active prior to activating Convergent CPS.

# Convergent CPS Color Maps

Convergent CPS color maps are non-directional. The upper bar of the color map represents CDE information within the image and the lower bar represents CPS information.



- To select a Convergent CPS map:
- 1 Press POST.
- 2 Press [CD MAP CE1] until the required map is displayed.

# **SPECTRAL DOPPLER MODE**

Overview

Spectral Doppler Mode graphs both direction and velocity of blood flow within chambers and vessels on a spectral display. There are several Spectral Doppler modes:

MODE	FUNCTION
PULSED WAVE DOPPLER	Displays velocities within the range axially bounded by the Doppler gate on the cursor placed within the 2-D image.
CONTINUOUS WAVE DOPPLER	Displays velocities all along the Doppler cursor placed within the 2-D image.
HPRF	Allows increased velocity detection at depth and localization of flow. Use when you want a higher Doppler velocity scale than Pulsed Wave Doppler can provide.
	On Sequoia C256 and C512 systems, press <b>SCALE</b> up to enter HPRF mode.
	On Sequoia 512 systems, enter HPRF when the PW gate reaches a depth that requires it.
AUXILIARY CONTINUOUS WAVE DOPPLER	Uses a special small-size non-imaging auxiliary transducer that allows improved access to areas requiring documentation of blood flow.

### Data Field



# Entering and Exiting Spectral Doppler

#### • To enter and exit spectral Doppler:

- 1 Use the trackball to position the Doppler cursor on the area of interest in the 2-D image.
- **2** Press the key for the Doppler mode you want:

**PW** – Enters Pulsed Wave Doppler mode.

**CW** – Enters Continuous Wave Doppler mode.

**AUX –** Enters Auxiliary Continuous Wave Doppler mode. (AUX CW does not use cursor position.)

- **3** Use **IMAGE** to select the appropriate Image Preset. See "Recalling Image Presets" in the *Administrator Manual*.
- 4 Press the Doppler mode key or **2D ONLY** to exit.

### Image Format Controls

CONTROL [SOFT KEY]	FUNCTION
CURSOR	Activates the cursor line (or removes an active cursor). Use the trackball to position the cursor.
[ANGLE L/C/R]	Press to adjust the incident angle to flow for linear transducers that provide electronic steering.
BASELINE	Press up to display a larger range of signals below the baseline, or down to display a larger range of signals above it.
SWEEP	Press up to increase the sweep speed of the strip or down to decrease it.
INVERT	Press to toggle between normal and inverted spectral display.
SIZE	Switches between a full-screen Doppler display and combined 2-D and Doppler display.
UPDATE	Press to switch between simultaneous and interval update imaging.
VOLUME	You can control the volume of the speakers or headphones.
	To use the headphones, insert the headphone jack into the right side of the system.
	Turn the volume knob (located on the monitor below the soft keys) clockwise to increase the audio volume, or counterclockwise to decrease it.
CONTROL	FUNCTION
ANGLE	Press to display the angle indicator, and then turn to adjust incident angle to flow.
B COLOR	Selects a mapping between different colors or hues of a color and echo amplitude. Use soft keys to select a color map.

# Strip Optimization Controls

CONTROL	FUNCTION
DGAIN	Turn clockwise to increase the amount of gain or counterclockwise to decrease it.
FILTER	Press up to use a higher filter or down to use a lower filter. Higher filter settings eliminate lower Doppler frequency shifts.
GATE	Press up to increase the size of the Doppler sample gate or down to decrease the size of the gate.
DYN RANGE	Turn to adjust the dynamic range until the level you want appears. Adjusting the dynamic range determines the range of echo amplitudes that are displayed.
EDGE	Press up for sharper borders or down for smoother borders.
PERSIST	Smooths spectral Doppler information over time. High persistence levels result in longer time averaging, therefore smoother signals.
POST	Adjusts the assignment of gray levels to echo amplitude. Use soft keys to select a postprocessing map. Options range from low to high contrast.
SCALE	Adjust to change the velocity range and display higher or lower velocity signals. When you increase the scale higher than that which Pulsed Wave supports, the system enters HPRF (on transducers that support it).
	You can customize the direction of the <b>SCALE</b> key (select which direction increases or decreases the velocity range). See Chapter 37 for instructions.
TISSUE EQUALIZATION TECHNOLOGY (TEQ) FOR SPECTRAL DOPPLER	Automatically applies the optimization (scale, baseline, gain, and dynamic range) to the spectral Doppler strip.
Jse TEQ technolo Doppler to autom Doppler strip. Op lynamic range.'	gy for spectral Doppler with PW, CW, or Auxiliary C atically apply the specified optimization to the spectr timization includes scale, baseline, gain, and
Vhen you activat lisplays a messag	e TEQ technology for spectral Doppler, the system e indicating that the optimization process is occurrin

When the process is complete, the system displays a TEQ icon on the upper left corner of the spectral Doppler strip to indicate that the specified optimization has been applied to the spectral Doppler strip. (When spectral Doppler is active, optimization is applied to the spectral Doppler strip only.)

TEQ Technology for Spectral Doppler

The optimization remains in effect for the current patient examination unless you activate TEQ again, manually adjust the optimized parameters (scale, baseline, gain, or dynamic range), activate or deactivate Update mode, reposition the range gate, or change common optimization parameters (such as **B COLOR** or **POST**).

TEQ for Doppler remains active for the current patient examination until you complete one of the following tasks:

- End the patient examination
- Select another Doppler mode (PW or CW/Aux CW) or exit Doppler
- Recall an exam preset
- Select another transducer
- Select another image specification

### • To activate TEQ technology for spectral Doppler:

**NOTE:** If the parameter setup options for TEQ for Doppler are disabled and simultaneous 2-D mode and Doppler is active, then activating TEQ affects the 2-D image only.

- 1 Activate PW, CW, or Aux CW and then press the **TEQ** key.
- **2** To re-apply optimization when viewing another anatomy of interest or flow (acquiring another flow signal), press the **TEQ** key again.

**NOTE:** Siemens recommends re-applying optimization after acquiring another flow signal. For example, if you first apply optimization when viewing the mitral valve, then re-apply optimization when viewing another valve.

Native TEQ is available with software version 8.5 or higher.

If Native TEQ is active when you enter CW or PW Doppler, Native TEQ remains active in Doppler and the **TEQ** key controls TEQ for Doppler, not Native TEQ. The following conditions apply:

DOPPLER SETTING	NATIVE TEQ STATUS
INTERVAL UPDATE	Paused
SIMULTANEOUS MODE	Active

Press the trackball **SELECT** key to toggle the active view between the Doppler strip and the B-mode image.

When TEQ technology for spectral Doppler is active, you can adjust the overall gain and then save this offset for subsequent optimizations during the current patient examination (for the current exam type and transducer). This offset, which represents the increments of gain adjustment to be added to or subtracted from the optimized gain, is also called the target spectral intensity. Use the **D GAIN** control on the keyboard to adjust the overall gain. Use the **2D GAIN** control on the keyboard to save the target spectral intensity (TEQ gain offset).

You can save a target spectral intensity (TEQ gain offset) for PW and for CW/Aux CW Doppler. (CW and Aux CW share a TEQ gain offset.)

Using Native TEQ with Spectral Doppler

Target Spectral Intensity (Saving TEQ Gain Offsets for the Current Patient Examination) Use Presets to specify the target spectral intensity used for all examinations (see "Customizing Strip Modes" on page 45 in the *Administrator Manual*) or to store a target spectral intensity value specific to an exam type.

# • To save a target spectral intensity (TEQ gain offset) for the current patient examination:

- 1 Activate PW, CW, or Aux CW and then press the **TEQ** key.
- 2 Rotate the **D GAIN** control to adjust the overall gain and then press the **2D GAIN** control on the keyboard.

The system saves and applies the target spectral intensity (TEQ gain offset) for all subsequent optimizations during the current patient examination (for the current exam type and transducer).

- To apply a saved target spectral intensity (TEQ gain offset):
- Activate PW, CW, or Aux CW and then press the **TEQ** key.

The system applies the specified optimization for the parameters (scale and baseline; gain and dynamic range) and then applies the saved target spectral intensity (TEQ gain offset) to the spectral Doppler strip.

# Overview

You use M-mode to display a graphic representation of a line of interest within the 2-D display. M-mode displays a graph that shows how the line you selected changes over time.



# Data Field



#### **Entering and Exiting** To enter and exit M-mode: • M-mode 1 Use the trackball to position the cursor on the area of interest in the 2-D image. 2 Press M MODE. 3 Use IMAGE to select the appropriate Image Preset. See "Recalling Image Presets" of the Administrator manual. Press M MODE or 2-D ONLY to exit M-mode. 4 **M-mode Expand Option** M-mode Expand allows for a more detailed look at an M-mode image. While in M-mode Expand, the M-mode image size is doubled, showing only half the original image. The M-mode cursor displays a diamond indicator that specifies the location of the Spectral Doppler gate depth. Use the trackball to move both the cursor and the diamond indicator to area of interest on the 2-D image. To enter M-mode Expand through 2-D mode: ٠ Press the **2-D ONLY** key. 1 Press the **CURSOR** key. 2 3 Select the M option on the fourth soft key. This reveals [EXPAND]. 4 To enter M-mode Expand, press [EXPAND]. This soft key is highlighted when M-mode Expand is activated and then returns to a non-highlighted state when deactivated. To enter M-mode Expand through M-mode: ٠ Press the **M MODE** key, displaying **[EXPAND]**. 1

- 2 To enter M-mode Expand, press [EXPAND].
- **3** Use **[EXPAND]** to toggle in and out of M-mode Expand.

# Image Format Controls

Strip Optimization Controls

Use the following keys with M-mode.

CONTROL	USE
CURSOR	Activates the cursor line. Use the trackball to position the cursor.
SIZE	Switches between a full-screen M-mode display and combined 2-D and M-mode display.
SWEEP	Press up to increase the sweep speed of the strip or down to decrease it.
CONTROL	USE
M GAIN	Turn clockwise to increase the amount of M-mode gain or counterclockwise to decrease it.
FRZ/RUN/GAIN	Turn clockwise to increase the amount of overall M-mode gain or counterclockwise to decrease it.
DGC	Increases or decreases M-mode gain at specific depths along the strip.
EDGE	Press up to use a higher level or down to use a lower level. Higher levels produce sharper borders. Lower levels produce smoother borders.
POST	Adjusts the assignment of gray levels to echo amplitude. Use soft keys to select a postprocessing map. Options range from low to high contrast.
B COLOR	Selects a mapping between different colors or hues of a color and echo amplitude. Use soft keys to select a color map.

Chapter 21 - M-Mode

# **COLOR M-MODE**

You use Color M-mode to display a graphic representation of an area of interest within the Color Doppler display. Color M-mode displays timing information from the CD display, and supports the display characteristics and features of standard M-mode.

**NOTE:** Color M-mode is not available with the NTHI option. (See "Tissue Contrast Enhancement Technology (TCE)" on page 88.) You must exit the NTHI option before you can enter Color M-mode.



### **Data Field**



Entering and Exiting Color M-mode	You can enter Color M-mode from Color Doppler or from M-mode.		
From Color Doppler	To enter Color M-mode from Color Doppler:		
	1 Enter color Doppler mode and optimize the color Doppler display. For instructions, see Chapter 2 of the Administrator manual.		
	<ul> <li>To display the cursor menu: If the cursor is not displayed, press CURSOR.</li> <li>If the cursor is displayed but not active, toggle PRIORITY.</li> </ul>		
	2 Select [M/PW] until M is highlighted.		
	As an option, select <b>[EXPAND]</b> for a more detailed look at the M-mode image. See "M-mode Expand Option" on page 194 for more details.		
	<b>3</b> Use the trackball to position the cursor on the area of interest in the 2-D image.		
	4 Press <b>M-MODE</b> to enter Color M-mode.		
From M-mode	To enter Color M-mode from M-mode:		
	<b>1</b> Optimize the M-mode display. For instructions see Chapter 19.		
	<b>2</b> Press <b>D COLOR</b> to enter Color Doppler mode and switch to Color M-mode.		
Switching the	To switch the active Mode from CD to Color M-mode:		
Active Mode	• Press UPDATE.		
	• Click the trackball <b>SELECT KEY</b> .		
	• Select [() UPDATE].		
	When the CD image is active, all CD features and controls are available. When the Color M-mode strip is active, all M-mode controls and some CD controls are available.		
Exiting Color M-mode	To exit Color M-mode, press CD, M-MODE or 2-D ONLY.		

# Strip Format Controls

Controls	CONTROL	USE
	CURSOR	Activates or deactivates the cursor line. Use the trackball to reposition the cursor.
	SWEEP	Press down to decrease the speed at which information is displayed. Press up to increase the speed.
Strip Optimization Controls		
	CONTROL	USE
	DGAIN	Turn clockwise to increase the amount of Color M-mode gain or counterclockwise to decrease it. Color M-mode gain is independent of 2-D gain and M-mode gain.
	DYN RANGE	Turn to adjust the dynamic range. In DTE mode, you can adjust the Color M-mode dynamic range. Changes that you make to Color M-mode dynamic range affect only the Color M-mode strip.
	EDGE	Press up to use a higher level or down to use a lower level. Higher levels produce sharper borders. Lower levels produce smoother borders.
		Your changes apply to the Color M-mode strip and the next CD frame.
	FILTER	Press up or down to change the filter setting. Changing the Color Doppler filter setting changes both the CD and Color M-mode filter.
	GATE	Press up to increase the gate size and the system's sensitivity to Color Doppler information. Press down to decrease the gate size. Changing the gate sizes changes both the Color Doppler and Color M-mode displays.
	POST	See Chapter 11 for more information on postprocessing.
	SCALE	Press up or down to change the velocity range and display higher or lower velocity signals.
		You can customize the direction of the <b>SCALE</b> key (select which direction increases or decreases the velocity range). See Chapter 37 for instructions.

Chapter 22 - Color M-Mode

# FREESTYLE EXTENDED IMAGING

Overview	The FreeStyle extended imaging feature extends your field of view by piecing together multiple 2-D frames into a single, extended 2-D image. Use this feature, for example, to view a complete thyroid or liver.		
	FreeStyle extended imaging works best for imaging areas that are mainly static. Avoid including objects that cast shadows, and avoid scanning regions with significant pulsatility effects, such as major arteries near the heart.		
WARNING!	To avoid technique-related artifacts and measurement inaccuracies, read this entire chapter before using the FreeStyle extended imaging feature.		
	To ensure accuracy, measurements should only be made on FreeStyle images that are acquired in a single scan plane.		
	If the structure to be measured is contained within the boundary of a single, standard 2D-mode frame, measurements should be made on the corresponding frame retrieved from CINE and not on the FreeStyle image. This avoids the possibility of including motion artifacts in a measurement.		
IMPORTANT:	The FreeStyle Extended Imaging option is cleared by the United States Food and Drug Administration (FDA) for use with general imaging transducers (linear and curved array transducers work best). It is not cleared for use with transcranial or cardiology transducers. For complete transducer specifications, including applications, see your <i>Transducer Specifications Manual</i> .		
Capturing an Extended	To capture a FreeStyle extended image:		
Field of View (EFOV) Image	<b>1</b> Apply a generous amount of coupling gel across the area you want to image.		
	2 Press PERSPECTIVE.		
	<b>3</b> Select [FREESTYLE].		

**4** Position the transducer at one end of the area you want to image. The face of the transducer should be parallel to the region you want to view, as illustrated in the following diagram:



**5** Set image format and optimization controls before beginning the capture. Do not change these controls during a capture.

Set the image depth so that it includes the area you are interested in and does not extend far beyond it. (This is especially important when scanning around a curved object.) Shallow depths and high frequencies produce the best images.

Optimize gain throughout the image.

- **6** Instruct the patient to remain still. If it is safe to do so, instruct the patient to hold his or her breath.
- 7 Start scanning, then press **CLIP STORE** to begin the clip capture. (The system uses the first frames to determine the direction of motion.)
- **8** Move the transducer across the region you want to view as shown in the diagram.

Make sure that you move the transducer in one smooth, continuous motion. To help maintain the position of the transducer perpendicular to the skin, keep your little finger in contact with the skin adjacent to the transducer.

As you move the transducer, watch the image ahead of the center region of the image frame. If this area seems to be moving out of the plane of interest, adjust the transducer position carefully.

- **9** When you reach the opposite end of the region you want to view, press **CLIP STORE** to exit the capture function.
- **10** While the system constructs the EFOV image, you will see a status message.

If you want to view the extended field-of-view image later, select **[POSTPONE]**. If you want to discard the captured clip, select **[DELETE]**. Otherwise, wait until the extended field-of-view image appears.

#### Reviewing the EFOV Image

When you perform an EFOV clip capture, the system automatically constructs and displays the EFOV image. When you use the on-board AEGIS Digital image and data management system software to review

images, FreeStyle acquisitions appear with an sicon on them. Click the icon to initiate the reconstruction. Use the following controls to review a FreeStyle image:

CONTROL [SOFT KEY]	FUNCTION
[COMP:0/1/2/3]	Appears only when Compounding is enabled. The <b>0/1/2/3</b> corresponds to the level of image compounding, <b>"0"</b> meaning no compounding.
[DELETE]	Appears immediately after capturing a FreeStyle extended imaging clip. Deletes the clip and returns to live imaging.
	You should delete any images that do not cover the region of interest or that appear discontinuous in any way (tissue appears to suddenly move or disappear). Rescan to acquire the image again.
[EXIT]	Exits review.
[RESTORE]	Restores the image to its original position and orientation.
[ROTATE/ ZOOM/PAN]	Selects one of the three functions for manipulating the image.
	When <b>ROTATE</b> is selected, move the trackball up or to the right to rotate the image clockwise. Move the trackball down or to the left to rotate counterclockwise.
	When <b>ZOOM</b> is selected, move the trackball up or to the right to increase the magnification (scale) of the image size. Move the trackball down or to the left to decrease the image magnification.
	When <b>PAN</b> is selected, move the trackball to move the image in the same direction.

Assessing Image Quality	Because there are many variables that affect the acquisition of an image, it
	is important that you assess the quality of the resulting image before you
	use it for diagnostic purposes or take measurements from it.

**CAUTION!** Your judgment as a trained sonographer or physician is required to determine if the following artifactual characteristics exist. The presence of these artifacts make the quality of an image suspect and may require re-acquisition.

If the image quality does not meet the following criteria, you should delete it and acquire it again:

- The image is continuous (no areas where tissue appears to suddenly move or disappear).
- There are no shadows within the image.
- The anatomy is well-defined (no evidence of distortions).
- The skin line is continuous.
- The image acquisition is from a single, flat plane.
- There are no large black regions within the image.
- The image contains the appropriate 2-D slice of the organ of interest. Using the incorrect slice to take measurements can result in misleading measurements. See "Taking Measurements During Review" next.

The following illustrations show examples of images unsuitable for diagnostic use:





•	To take measurements, use the following	controls:
---	-----------------------------------------	-----------

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)

Linear Distance Measurement Range and Accuracy of FreeStyle Extended Images The following table provides accuracy information for FreeStyle extended imaging measurements. This table assumes a tissue velocity of 1540 m/s and that the acquisition is made using a single flat scan plane.

TRANSDUCER FORMAT	RANGE	TOLERANCE OR VALUE
LINEAR	0-70 cm	4% or 1.5 mm, which ever is greater
CURVED LINEAR	0-70 cm	5% or 1.5 mm, whichever is greater
VECTOR WIDE VIEW ARRAY	0-70cm	7% or 1.5 mm, whichever is greater

WARNING!

**G!** An unreliable caliper measurement can be caused by the following sources of error:

- **Wrong B-mode slice:** When attempting to measure the maximum length within a three-dimensional organ, remember that the measurement is being taken from a two-dimensional slice within that organ. Repeat the scan until you are certain that you have the slice that is most relevant to a possible diagnosis.
- Non planar acquisition: FreeStyle imaging (like similar ultrasound image composition products) assumes that the acquisition lies in a single flat plane. If the acquisition follows a curve, then an unwrapped image is formed.

In the case of a poorly reconstructed FreeStyle image, as determined by the above criteria or by the clinical experience and training of the user, dimensional measurements should not be made. If for any reason measurements are made using a poorly reconstructed image, these measurements should not be used for diagnostic decisions.

Color FreeStyle	Color FreeStyle behaves exactly like 2-D FreeStyle and is only available in Color Doppler Velocity (CDV). Color Doppler acquisitions display a continuous loop of a full dynamic cardiac cycle. When a sufficient number of cardiac cycles are not detected, the following message displays: "Insufficient cardiac cycles for dynamic capture, converting to static". The system then converts to a static maximum flow mode. In the Static mode, color Doppler collects information for maximum flow through a location. Use of color maps and their availability depends on the transducer, reconstruction algorithm, and CDV verses CDE selections.
Capture a Color	To capture a Color FreeStyle CDI clip:
FreeStyle Clip	<b>1</b> Apply a generous amount of coupling gel across the imaging area.
	<b>2</b> Press <b>DCOLOR.</b> To exit CDV, press <b>DCOLOR</b> again.
	<b>3</b> Follow the stops in "Capturing an Extended Field of View (FEOV)

**3** Follow the steps in "Capturing an Extended Field of View (EFOV) Image" on page 201 to complete the color FreeStyle clip capture.

The following table shows Color FreeStyle imaging controls and functions:

CONTROL [SOFT KEY]	FUNCTION
CALIPERS ON/OFF	Press to position a caliper within the image. When calipers are on, the image freezes and the display remains frozen until calipers are turned off.
ADD CALIPER	Press to position a second caliper within the image and display the distance (to the nearest millimeter) between the two calipers.
	The FreeStyle extended imaging feature supports only one pair of calipers. For information about measurements accuracy, see "Linear Distance Measurement Range and Accuracy of FreeStyle Extended Images" on page 206.
GAIN/FRZ/RUN	Press the wheel to freeze the clip, then turn to scroll through the clip frame-by-frame. When the frame is dynamic (not frozen), rotate the wheel left to reduce the playback rate, and rotate the wheel to the right to increase the playback rate.
D-COLOR	Pressing this key turns the color on and off.
[ROTATE/ ZOOM/PAN]	Selects one of the three functions for manipulating the image.
	When <b>ROTATE</b> is selected, move the trackball up or to the right to rotate the image clockwise. Move the trackball down or to the left to rotate counterclockwise.
	When <b>ZOOM</b> is selected, move the trackball up or to the right to increase the magnification (scale) of the image size. Move the trackball down or to the left to decrease the image magnification.
	When <b>PAN</b> is selected, move the trackball to move the image in the same direction.

To ensure a good-quality image, see "Assessing Image Quality" on page 204.

# **Using Annotations**

## • To add annotations to a Perspective review:

- **1** If not already active, press **PERSPECTIVE** to enter the Perspective display option.
- **2** Acquire the Perspective images and/or reconstructions for review.
- **3** Press **REVIEW** to enter the review mode and select the image or reconstruction to review. (See "Reviewing the EFOV Image" for more details.)
- **4** Press **TEXT** to enter annotations. See Chapter 6, "Annotating Images" for details for entering text and arrows on images.
- **5** Press **TEXT** again to exit annotations.
## CHAPTER 24

# **3-D SURFACE RENDERING AND MULTI-PLANAR RENDERING**

3-D and Color 3-D Surface Rendering	The 3-D Surface Rendering feature constructs a 3-D reconstruction from a clip that contains a series of 2-D "slices." You can use the option to create a 3-D view of any anatomy surrounded by or filled with fluid (for example, a fetal face).		
	Follow these general steps to create a 3-D reconstruction:		
	1	Capture a 2-D clip of the anatomy that you want to reconstruct as a 3-D clip.	
	2	Enter the Review function. Then assess the quality of the image within the clip before you continue the reconstruction process. See "Selecting an Image for Reconstruction" on page 210.	
	3	Within the clip, mark a region of interest (ROI). The ROI separates the anatomy you want to reconstruct from surrounding tissues. See "Setting the ROI" on page 211.	
	4	Review the 3-D reconstruction created from the 3-D clip. You have several options for optimizing the 3-D reconstruction. See "Reviewing the 3-D Reconstruction" on page 212.	
	5	Finally, you can animate the 3-D reconstruction to view it from different angles and in motion. See "Animating the 3-D View" on page 217.	
Capturing the 3-D or	٠	To capture the image:	
Color 3-D Image	1	Press PERSPECTIVE.	
	2	Select [FREESTYLE/3D] until 3D is highlighted.	
	3	Position the transducer at one end of the area you want to image. The face of the transducer should be perpendicular to the region you want to view as illustrated in the following diagram.	
IMPORTANT:	M ca w re ha	love the transducer at a constant rate from left to right during the apture. Change in sweep rate may result in distortion of structures ithin the 3-D reconstruction. Position the transducer notch on the left lative to direction of the scan. The illustration has the notch facing the and or on the lefthand side in relation to the transducer motion.	



- 4 Press **CLIP STORE** to begin the 3-D clip capture.
- **5** When you reach the opposite end of the region you want to view, press **CLIP STORE** to exit the capture function.
- To select a 3-D image for reconstruction:
- 1 Press **REVIEW** to enter the on-board AEGIS software review function.
- 2 Press **PAGE** up or down to page through captured images and clips until you see the 3-D clip, marked with a **3D** icon.
- **3** Assess the quality of the clip before you continue. See "Assessing Image Quality" next.
- **4** Use the trackball and **SELECT KEYS** to click the 3D icon to initiate the reconstruction.



#### Assessing Image Quality

Because there are many variables that affect the acquisition of an image, it is a good idea to assess the quality of the acquired clip before you use it to create a 3-D reconstruction. If the image quality does not meet the following criteria, you should delete it and acquire it again:

- The patient (including a fetus) was still during the acquisition.
- The transducer was held perpendicular to the skin line throughout the acquisition.
- Movement of the transducer was at a constant speed with no twisting or rotation throughout the acquisition.

Selecting an Image for Reconstruction

#### Setting the ROI

You specify the region of interest for the 3-D view by drawing an outline using the trace tool. The ROI separates the anatomy you want to review in three dimensions from surrounding tissues. You must draw the ROI in the plane parallel to the scan plane.

- To draw the ROI while in AEGIS review:
- **1** Press **FREEZE/CINE** to freeze the clip.
- **2** Press **TRACE** to display the Sequoia system's trace tool.

**NOTE:** As an option, click the **3-D** icon to enter the 3-D reconstruction package and draw the ROI using the ROI editing tools. For instructions, see "Changing the ROI" on page 215. When you use the Sequoia system's trace tool, the system begins processing the 3-D information in the background while you work, so the overall reconstruction process can be faster. Another option is to press **[SHOW 3D SURFACE]** or double click a trackball **SELECT KEY** to enter 3-D view.



**3** Use the trace tool, trackball, and the **SELECT KEYS** to draw an outline of the ROI.

то:	DO THIS:
Mark the bounding points of the outline	Use the trackball to move the pointer to each desired bounding point, position, then click either <b>SELECT KEY</b> .
Complete the outline	Press <b>[END ROI]</b> or double-click either <b>SELECT KEY</b> . (The system automatically draws a line segment to close the outline.)
Move an existing bounding point	Position the pointer over the bounding point, press and hold a trackball <b>SELECT KEY</b> , then use the trackball to drag the bounding point to a new location.

то:	DO THIS:
Insert a bounding point within a completed outline	Position the pointer over the outline where you want the new bounding point. Then click a trackball <b>SELECT KEY</b> .
Erase the last line segment	Press [BACK UP].
Delete a bounding point	Position the pointer over the bounding point you want to delete, double click a trackball <b>SELECT KEY</b> .
Move the ROI outline	Position the pointer into the center of the ROI, press and hold a trackball <b>SELECT KEY</b> , then use the trackball to drag the outline to a new location.

- 4 Press [END TRACE] to complete the trace.
- **5** Press **[SHOW 3D SURFACE]** to begin the 3-D reconstruction.

The system initially creates the 3-D reconstruction using default settings. As you review the 3-D reconstruction, you can:

- Change the orientation
- Erase parts of the image
- Optimize reconstruction settings
- Redraw the ROI

Press **[EXIT]** at any time to exit the 3-D review function and return to standard Review.



**Changing the Orientation** 

To review the image from different orientations, use the following controls:

CONTROL [SOFT KEY]	FUNCTION
[(())ADJUST ON/OFF]	Turns on or off adjustment controls (third and fourth soft keys).

#### Reviewing the 3-D Reconstruction

	CONTROL [SOFT KEY]	FUNCTION		
	[()FLIP/ROTATE]	When <b>FLIP</b> is selected, move the trackball up or down to flip the image across the horizontal axis. Move the trackball to the left or right to flip the image across the vertical axis.		
		When <b>ROTATE</b> is selected, move the trackball in the direction that you want to rotate the image.		
		When <b>[PAN/ZOOM]</b> is selected, both of these options are deselected.		
	[PAN/ZOOM]	When <b>PAN</b> is selected, move the trackball to move the image around the screen. The image moves in the same direction as the trackball.		
		When <b>ZOOM</b> is selected, move the trackball up or to the right to increase (scale) the image size. Move the trackball down or to the left to decrease the image size.		
		When <b>[PAN/ZOOM]</b> is selected, Flip and Rotate options are deselected.		
Erasing Parts of the Image	As you review the 3- not want included. Y parts of the image.	D reconstruction, you may notice areas that you may (ou can use the Eraser or the Scalpel tool to remove		
	• The Eraser removes the information as you move the eraser over the image in the same way that an eraser works on paper. You can set the depth for the Eraser to erase in three settings.			
	• The Scalpel lets you draw the outline of an area you want to remove, and then remove it. You draw the outline in the same way you draw the ROI, but the results are the opposite; the region you outlined is discarded.			
	To produce a very "clean" 3-D reconstruction, with all of the irrelevant areas removed, may take several iterations. For example, you may want to view the 3-D reconstruction from one angle, use the Scalpel to erase an area, rotate the 3-D reconstruction to view it from a different angle, and then use the Eraser to erase more.			
	To make it easy to flip or rotate the image while you are working with the Scalpel or Eraser, the pointer automatically switches between these functions. When you have the Scalpel or Eraser selected and the pointer is within the 3-D reconstruction, it performs the Scalpel or Erase function. If you move the pointer outside the 3-D representation, it switches to the flip/rotate function.			
	• To select the de	epth of the Eraser:		
	<b>1</b> Click the Eraser	log button to activate the 3-D Eraser tool.		
	2 Move the pointe SELECT KEY to a	r over the Eraser 🔯 button again. Press and hold a display the Eraser depth pop-up menu.		
	<b>3</b> Move the trackb the <b>SELECT KEY</b>	all to highlight the depth you want and then release ' to engage that depth.		

#### • To erase using the Eraser:

- 1 Click the Eraser is button to activate the 3-D Eraser tool. When you move it over the 3-D reconstruction, the pointer changes to an eraser.
- **2** Press and hold the **SELECT KEY** and then use the trackball to move the eraser over the part of the 3-D reconstruction that you want to erase.

To undo or redo the last erasure, the eraser or scalpel tool must be active, and then click the Undo or Redo or Redo or button. Once exiting eraser, the user is no longer able to undo erasures or scalpels.

- To erase using the Scalpel:
- 1 Click the Scalpel Subtraction to activate the Scalpel tool. When you move it over the 3-D reconstruction, the pointer changes to a crosshair ("+").
- **2** Use the trackball and the **SELECT KEYS** to draw an outline of the region you want to remove.

то:	DO THIS:
Mark the bounding points of the outline	Use the trackball to move the pointer to each desired bounding point, then click either <b>SELECT KEY</b> .
Complete the outline	Press <b>[END SCALPEL]</b> or double-click either <b>SELECT KEY</b> . (The system automatically draws a line segment to close the outline.)
Move an existing bounding point	Position the pointer over the bounding point, press and hold a trackball <b>SELECT KEY</b> , then use the trackball to drag the bounding point to a new location.
Insert a bounding point within a completed outline	Position the pointer over the outline where you want the new bounding point, then click a trackball <b>SELECT KEY</b> .
Erase the last line segment	Press [BACK UP].
Delete a bounding point	Position the pointer over the bounding point you want to delete and press <b>[BACK UP]</b> .
Move the outline	Position the pointer into the center of the region defined by the outline, simultaneously press a trackball <b>SELECT KEY</b> , and use the trackball to drag the outline to a new location.

## **3** To remove the area you've outlined, press [**DELETE**] or double-click either **SELECT KEY**.

To undo or redo the last erasure, the eraser or scalpel tool must be active, and then click the Undo or Redo or Button. Once exiting eraser, the user is no longer able to undo erasures or scalpels.

#### • To optimize the 3-D reconstruction, use the following controls:

CONTROL	FUNCTION
THRESHOLD	Use this slider to eliminate noise and low-level echoes from the 3-D reconstruction. Ultrasound information (represented as shades of gray) below the threshold level is not included in the 3-D image Shades of gray below this level appear black (or cut out).
	Drag to the left for a lower threshold level or to the right for a higher threshold level.
TRANSPARENCY	Use this slider to set the degree of transparency in the 3-D reconstruction. Higher transparency setting give the 3-D reconstruction more of an X-ray appearance.
	Drag to the left for a more opaque image or to the right for a more transparent image.
TEXTURE/GRADIENT	Use this slider to control the ratio between texture and gradient rendering. Texture settings produce a smoother image with increased texture emphasis. Gradient settings accentuate the sense of depth or topography.
	Drag toward texture (left) for a smoother image. Drag toward gradient (right) for a more detailed image.
BRIGHTNESS	Use this slider to control the overall brightness of the 3-D reconstruction. It is especially important to adjust this setting when using a Texture setting on the Texture/Gradient slider.
SLICE THICKNESS	Use this slider to control the spacing of the acquired ultrasound images in space and contract or expand the 3-D reconstruction.
	Drag this slider to contract (left) or expand (right) the 3-D reconstruction along the axis of transducer movement.
B-COLOR	Tints the 3-D reconstruction with color, which may enhance contours and the perception of depth. Some color maps enhance soft tissue components well and others enhance extremities and bones. Choose a color map from the pop-up menu.

#### Changing the ROI

Optimizing the 3-D Reconstruction

new ROI.

- To redraw the ROI (Refer to "To draw the ROI while in AEGIS review:" on page 211):
- 1 Click the **SET ROI** button.



- **2** Use the trackball and the **SELECT KEYS** to draw an outline of the region.
- **3** Use **GAIN/FRZ/RUN** to play or scroll through the clip to ensure that the ROI you drew encloses the area that you want to see in three dimensions throughout the clip. If necessary, adjust the ROI.

It is important to set margins to eliminate extraneous information. Set margins to restrict the clip to only those frames you want to include in the 3-D reconstruction.

Use the scroll bar and bookends at the bottom of the display and the following controls:

CONTROL	FUNCTION
GAIN/FRZ/RUN	Press the wheel to freeze the clip, then turn to scroll through the clip frame-by-frame. When the frame is dynamic (not frozen), rotate the wheel left to reduce the playback, and rotate the wheel to the right to increase playback rate.
SCROLL BOX	Shows the location of the current frame within the clip. Click inside the scroll bar to move to a specific frame.
LEFT BOOKEND	Sets the left margin of the reconstruction. Move the pointer over the Left bookend. Press and hold a trackball select button, then use the trackball to drag the bookend to the frame you want to use as the left margin.
RIGHT BOOKEND	Sets the right margin of the reconstruction. Move the pointer over the Right bookend. Press and hold a trackball select button, then use the trackball to drag the bookend to the frame you want to use as the right margin.

**4** When the ROI is complete, click **SET ROI** (or double-click a **SELECT KEY**).

Animating the 3-D View	Animating the image may make it easier to perceive subtle changes in the 3-D construction.		
	♦ To animate the 3-D image:		
	<b>1</b> To begin animation, press <b>GAIN/FRZ/RUN</b> until the keyboard light switches off.		
	<b>2</b> Press <b>GAIN/FRZ/RUN</b> again to stop the animation. The <b>GAIN/FRZ/RUN</b> light is illuminated.		
3-D Multi-Planar Reconstruction	The 3-D Multi-Planar Reconstruction (MPR) feature constructs a cube, a cross-section of which can be viewed in any of three orthogonal planes. You can use the option to create an MPR view of any anatomy.		
	Follow these general steps to create an MPR display:		
	• Capture the anatomy that you want for MPR reconstruction in a 3-D clip. See "3-D and Color 3-D Surface Rendering" on page 209.		
	• Enter the Review function.		
	• Review the 3-D reconstruction created from the 3-D clip. You have several options for optimizing the 3-D reconstruction. See "Reviewing the Multi-Planar Reconstruction" on page 218.		
	<b>NOTE:</b> You can create both 3-D surface renderings ("3-D and Color 3-D Surface Rendering" on page 209) and multi-planar reconstructions from the same 3-D capture. When you switch between these two 3-D views of the same image, changes that you make in the 3-D surface rendered view (including creating a ROI, erasing part of the image, or changing the slice thickness) also apply to the MPR view. If you change the slice thickness in the MPR view, this change also applies to the 3-D surface rendered view.		
Capturing the 3-D Image	<ul> <li>Refer to 3-D Surface Rendering, Capturing the 3-D Image for detailed instructions.</li> </ul>		
Selecting an Image	To select a 3-D image for reconstruction:		
for Reconstruction	<b>1</b> Press <b>AEGIS REVIEW</b> to enter the on-board AEGIS software review function.		
	<b>2</b> Press <b>PAGE</b> up or down to page through captured images and clips		
	until you see the 3-D clip marked with a 🔟 icon.		
	<b>3</b> Assess the quality of the clip before you continue. See "Assessing Image Quality" next.		
Assessing Image Quality	Because there are many variables that affect the acquisition of an image, is a good idea to assess the quality of the acquired image before you use to create a 3-D reconstruction. If an image quality does not meet the following criteria, you should delete it and acquire it again:		
	• The patient (including a fetus) was still during the acquisition.		
	• The transducer was held perpendicular to the skinline throughout the acquisition.		
	• Movement of the transducer was at a constant speed with no twisting or rotation throughout the acquisition.		

Reviewing the Multi-Planar Reconstruction

#### • To view the multi-planar reconstruction, click VIEW PLANES.

The multi-planar reconstruction consists of one image view for each of the three planes. It has these components:

- A reference cube in the lower right area of the display shows the orientation of each of the three planar views.
- Cut plane lines at the side of each view correspond to cut plane lines in the reference cube. Each view is identified by different color cut plane lines.
- A reference dot within each view shows the point of intersection of all three cut planes.
- Colored reference borders and an ACUSON " " in the upper left corner identify the active view. Clicking in a view makes it active.



As you review the multi-planar reconstruction, you can:

- Make adjustments to the image
- Navigate through the cut planes
- Navigate through the clip
- Flip or rotate the reference cube to adjust the display orientation.
- To flip or rotate an MPR the reference cube:
- 1 Press **U/D** to rotate the image from top to bottom (on the X axis).
- **2** Press **L/R** to rotate the image from left to right (on the Y axis).

#### OR

1 Hold down the **SELECT KEY** and use the track ball to flip and rotate the reference cube.

Press **[EXIT]** at any time to exit the 3-D review function and return to standard Review.

Adjusting the Image Appearance You can make adjustments to the appearance of the 3-D image. Use the following controls:

	CONTROL	FUNCTION
	CONTRAST	Use this slider to control the overall contrast of the 3-D reconstruction.
	BRIGHTNESS	Use this slider to control the overall brightness of the 3-D reconstruction.
	SLICE THICKNESS	Use this slider to control the spacing of the acquired ultrasound images in space and contract or expand the 3-D reconstruction.
		Drag this slider to contract (left) or expand (right) the 3-D construction along the axis of transducer movement.
Adjusting Cut Plane Views	Use the following co	ontrols to change your view of the cut planes:
	CONTROL	FUNCTION
	[CENTER]	Centers the reference dot within the active view.
	[SINGLE/QUAD]	Switches between quad display (which shows three cut planes and the reference cube) and single display (where the active quadrant takes up the whole screen).
	[ZOOM]	Lets you change the magnification of the active view. After you press this key, it is highlighted and you can use the trackball to either increase or decrease the magnification. Press this key again or press a trackball <b>SELECT KEY</b> to exit Zoom mode.
Navigating Through Cut Planes	You can navigate th anatomy you captu and the reference cu <b>SELECT KEYS</b> in the	rough the cut planes to see various views of the red. Any time you change one view, the other views ibe update as appropriate. Use the trackball and e following ways:
	• Click and drag within that cut	on an image view (pan) to look at a different region plane.
	• Click and drag on the reference point in an image view to change point of intersection of the three planes. This process allows you t move the intersection and change the rotation of the cut planes.	
	Click and drag change your vie	within the reference cube to rotate the cube and ew of the cut planes.
	CONTROL	FUNCTION
	RESET	Resets all MPR functions including erasures from SR, navigation steps and zoom.
	UNDO/REDO	Undo or redo single step actions in MPR.
	SHOW OVERL	AY Adds or removes Cut Plane lines and Reference Dots from all three quadrants.

## Navigating Through the Clip

Navigating through the clip lets you locate an area of interest within the anatomy that you captured. You can rotate the clip along its x-, y-, or z-axis or adjust the depth of the multi planar reconstruction within the clip. Any changes you make update all of the views and the reference cube. To navigate through the clip, make one of the cut plane views active and then use the following keyboard controls:

CONTROL	FUNCTION
DYN RANGE	Rotates the MPR image around its x-axis.
POSITION	Rotates the MPR image around its y-axis.
DEPTH	Adjusts the depth of the MPR image within the captured clip.
2D GAIN	Rotates the MPR image around its z-axis.

A legend at the lower right side of the display shows the mapping between these navigation options and the keyboard keys.

3-D Multi-Planar/ Echoscan Interface	The sys ser rec Sec	The Echoscan system is an external PC that interfaces with the Sequoia system. Echoscan monitors patient ECG and respiration while collecting a series of 2-D images that the Sequoia system Multi-Planar 3-D option reconstructs into a 3-D rendering. Combining the Echoscan system with Sequoia provides the capability for 3-D imaging.	
	<b>NOTE:</b> This feature is used with the V5M transducer and requires installation by an Siemens Customer Engineer.		
Using 3-D Multi-Planar- Echoscan Interface	•	To enter and exit the 3-D Multi-Planar-Echoscan interface mode:	
		Place the Sequoia in 2-D or color Doppler mode to use the 3-D Multi-Planar/Echoscan function.	
	1	Press <b>PERSPECTIVE</b> to enter the Perspective mode.	
	2	Select [ <b>REMOTE 3D</b> ] to enter the 3-D Multi-Planar-Echoscan function.	

Upon initiation of the Echoscan interface, the Sequoia system displays the following soft key menu:

[SOFT KEY]	FUNCTION
[STEP ANGLE = N]	Sets the V5M step angle degrees between each successive 2-D image (steps must be multiples of 180). The maximum angle is 180×. Pressing this soft key toggles to the next available step increment.
[HOME]	Returns the V5M step angle to zero.
[START 3D]	Begins Sequoia image capture.
[EXIT 3D]	• With capture in progress: ends the Sequoia's participation.
	• No capture in progress: exits this feature.

## **MEASUREMENTS AND CALCULATIONS**

Measurements and Calculations describes how to take measurements<br/>from images and how to use the system's calculation packages. It<br/>includes the following chapters:Chapter 25Measurement Tools225Chapter 26Auto Doppler239Chapter 27Vascular Calculations243Chapter 28Cardiac Calculations253Chapter 29Obstetrical Calculations271Chapter 30Gynecology Calculations279Chapter 31Axius Auto Ejection Fraction287Chapter 32Axius Edge Assisted Ejection Fraction301Chapter 33Axius Quantitative Strain Rate Imaging.311Chapter 34Axius Velocity Vector Imaging.337

# **MEASUREMENT TOOLS**

Caliper Measurements	Calipers are available for taking measurements in each of the major operating modes.		
WARNING!	Do not perform me (using DIMAQ rev display option. Me a DIMAQ review o	easurements on images that have been captured iew or a VCR) with the Perspective advanced asurements performed on reprocessed images from or VCR capture may not be accurate.	
	NOTE:		
	On Sequoia sysmeasurements captured with the perform measurement to not available on	tems: The message "Do not perform off-line on this image" displays on all DIMAQ images ne Perspective advanced display option. If you try to rements on these images, then the system disables the ol and displays the message, "Measurement tools in this image."	
	On off-line wor measurements captured with th measurement to these images ma	<b>*kstations:</b> The message <b>"Do not perform off-line</b> <b>on this image</b> " displays on all DIMAQ images he Perspective advanced display option. Although hols may be available, measurements performed on any not be accurate.	
	• <b>On VCR captures:</b> Although measurement tools may be available, measurements performed on images captured with the Perspective advanced display option may not be accurate.		
	Calipers have the for	llowing requirements:	
	MODE	REQUIREMENT	
	2-D Mode	The display does not have to be frozen.	
	CD Mode	The display must be frozen for velocity measurements.	
	Spectral Doppler Mode, M-mode	The display must be frozen. The system ensures that two calipers in the same set are on the same side of the erase bar.	

#### 2-D, CD, and M-mode Calipers

The following caliper measurements are available in each operating mode:

	SINGLE-CALIPER MEASUREMENTS		TWO-CALIPER MEASUREMENTS	
MODE	DISPLAY	DESCRIPTION	DISPLAY	DESCRIPTION
2-D	Depth	Depth from transducer face along ultrasound line (cm)	Dist	Distance between a set of calipers (cm)
Color Doppler	V	Mean velocity (m/s)	ΔV	Difference in mean velocity (m/s)
	Angle	Incident angle (CDV)	Dist	Distance (cm)
M-mode	Depth	Depth (cm)	ΔDist	Difference in distance (cm)
			ΔΤ	Difference in time (s)
			$\Delta T \rightarrow$	Heart rate (bpm)
			Slope	Velocity slope (cm/s)

#### Spectral Doppler Calipers

You can set up spectral Doppler calipers to report either General Imaging/Vascular measurements or Cardiac measurements. For information on system setup, see Chapter 37 of the *Administrator Manual*.

When displaying two calipers in spectral Doppler mode, you can select what type of information the calipers report. You can choose to display information from each caliper position (**DCAL** option) or you can display the difference measurements between the two caliper positions ( $\Delta$ **DCAL** option). You select an option using the [**DCAL**/ $\Delta$ **DCAL**] soft key, described in "Using the Calipers Function" on page 229. The two-caliper behavior is stored as an Exam Preset.

	SINGLE-CALIPER MEASUREMENTS		ALIPER DCAL TWO-CALIPER EMENTS MEASUREMENTS		△DCAL TWO-CALIPER MEASUREMENTS	
SETUP	DISPLAY	DESCRIPTION	DISPLAY	DESCRIPTION	DISPLAY	DESCRIPTION
GI/ Vascular	v	Velocity (m/s)	V1	Velocity (m/s) for Caliper 1	ΔV	Difference in velocity (m/s)
	PG	Pressure Gradient (mmHG)	V2	Velocity (m/s) for Caliper 2	ΔΤ	Difference in time (s)
	$\pm$ MEAN	Mean Velocity (m/s)	RI	Resistance Index	$\Delta T \rightarrow$	Heart rate (bpm)
			SD	Systolic/Diastolic Ratio	ACCL	Acceleration (m/s <sup>2</sup> )
					$\pm$ TAV	Time Average Velocity (m/s)
Cardiac	v	Velocity (m/s)	V1	Velocity (m/s) for Caliper 1	ΔV	Difference in velocity (m/s)
PG Pressu (mmH	Pressure Gradient (mmHG)	PG1	Pressure Gradient (mmHG) for	ΔΤ	Difference in time (s)	
				Caliper 1	$\Delta T \rightarrow$	Heart rate (bpm)
			V2	Velocity (m/s) for Caliper 2	SLOPE	Slope (m/s)
			PG2	Pressure Gradient (mmHG) for Caliper 2	P1/2T	Pressure half time (msec)

The following measurement options are available when using Spectral Doppler:

#### Data Display Box

The system uses a data display box to display on-screen information from measurements and calculations. You can move the data display box, and save its location.



- To move the data display box:
- 1 Press CODE + DATA POS.
- **2** Use the trackball to move the box to the desired location, or press the leftmost soft key to cycle quickly between five different preset locations and growth directions.
- **3** To choose the number of lines of information to be displayed, press **[8 LINES/12 LINES]** to select either 8 or 12 lines.
- 4 To lock the data display box into place, press [SET].
- **5** To exit, press **[EXIT]**.

#### Using the Calipers Function

#### • To enter and exit the Calipers function:

#### 1 Press CALIPERS ON/OFF or ADD CALIPER.

The active caliper is green. There is only one active caliper at a time, and calipers in an active set appear brighter than the other calipers. Move the trackball to position the active caliper within an image or strip.

**2** Press **CALIPERS ON/OFF** to exit the Calipers function and remove all calipers and measurements from the display.

Use the following keys with the caliper function:

CONTROL	
[SOFT KEY]	FUNCTION
TRACKBALL SELECT	If there is only one caliper showing, press to add a second one. Also toggles between calipers in the active set.
ADD CALIPER	Adds a caliper to the display, up to two calipers per set.
[LOCK SET]	Completes a set.
[SELECT SET]	Activates another caliper set (appears only when there is an inactive caliper set).
[PRIOR DATA]	Restores caliper information from a previous session, when available.
[DCAL/DDCAL]	Switches between display of two-caliper measurements ( <b>DCAL</b> ) and individual single caliper measurements ( <b>DCAL</b> ) when you have two spectral Doppler caliper markers.
	When displaying the $\Delta$ <b>DCAL</b> option, the system can automatically determine a slope between two positioned calipers.
[DELETE SET]	Deletes the current caliper set. When you do so, the previous caliper set becomes active.
ELLIPSE	Activates the ellipse function (for 2-D calipers only). See "Using the Ellipse Function" on page 230.
	You can also press up once to display a connecting line between the two calipers in the active set. Press down to remove the connecting line.
	In M-mode and for Δ <b>DCAL</b> measurements in Spectral Doppler, use <b>ELLIPSE</b> to display a slope line between two generic calipers in an active set.
ANGLE	Press to turn on angle correction for the active PW Doppler caliper.
	Turn to adjust the incident angle of the caliper and the PW Doppler scale.
	Press again to turn off angle correction for the active PW Doppler caliper.

#### Using the Ellipse Function

You can use the Ellipse function to take area and circumference measurements in a 2-D or CD image (using 2-D calipers). Ellipse reports the following measurements in a data display box:

MEASUREMENT	DESCRIPTION
D1	The major axis of the ellipse (distance between the two calipers)
D2	The minor axis of the ellipse
CIRCUM	The circumference of the ellipse
AREA	The area of the ellipse

#### • To use the Ellipse function:

- **1** Position the 2-D calipers where you want the major axis of the ellipse.
- **2** Toggle **ELLIPSE** up to display a connecting line between the two calipers.
  - Hold **ELLIPSE** up or roll the trackball up to expand the size of the ellipse.
  - Hold **ELLIPSE** down or roll the trackball down to decrease the size of the ellipse.
- **3** Move the calipers to adjust the ellipse shape.
- **4** To remove the ellipse, hold **ELLIPSE** down until the ellipse disappears, or exit the Caliper function.

#### Using the Trace Function

You can use the Trace function in 2-D and spectral Doppler modes to trace the outline of an area of interest. In spectral Doppler mode the image must be frozen and the trace cannot cross the erase bar. Measurements appear after you complete the trace. The following trace measurements appear in the data display box for each operating mode:

	TRACE MEASUREMENTS		
MODE	DISPLAY	DESCRIPTION	
2-D	Circum	Circumference, displayed after you end the trace (by pressing [END TRACE]).	
	Perim	Perimeter, displayed while you perform the trace (before pressing <b>[END TRACE]</b> ). When the trace is complete, the circumference measurement replaces this one.	
		You can also double-click the <b>SELECT KEY</b> to conclude a trace.	
	Area	Area, displayed after you end the trace.	
	Depth	Depth, displayed when the trace tool is active and you have not yet begun tracing (by pressing [MARK] or [DRAW]).	
SPECTRAL DOPPLER - CARDIAC	TAMx	Time Average Max (m/s)	
	VTI	Velocity time integral (m)	
	Mn PG	Mean pressure gradient (mmHg)	
SPECTRAL DOPPLER - GENERAL IMAGING	TAMx	Time Average Max (m/s)	
	Max	Maximum velocity (m/s)	
	Min	Minimum velocity (m/s)	
	PI	Pulsatility Index	
	RI	Resistive Index	
	S/D	Systolic to diastolic ratio	

There are two methods for tracing an area: marking and drawing. To mark a trace, you mark points to be connected by the trace line. To draw a trace, you draw the entire trace line itself.

- To select a trace method:
- **1** Press **TRACE** to enter the Trace function.
- 2 Press [MARK] or [DRAW] to select a trace method.
- **3** Use the trackball to trace the outline of interest.
- 4 To conclude the trace, double-click the **SELECT KEY** or select **[END TRACE]**.
- **5** Press **EXIT** to exit the Trace function.

[SOFT KEY]	
CONTROL	FUNCTION
[PRIOR DATA]	Returns traces from the previous session to the display before beginning a new trace.
[ADD]	Adds another trace (up to six traces).
[EDIT]	Press to edit a completed trace.
[BACK UP]	Press to correct a mistake. Release <b>[BACK UP]</b> to stop erasing.
[SELECT SET]	Selects a trace. You can display up to six traces at the same time; only one can be active.
[DELETE]	Deletes a completed trace.
[END TRACE]	Completes a trace.
	In 2-D mode, completing a trace connects the beginning and end points.
	In spectral Doppler mode, completing a trace connects the beginning and end points to the baseline.

Use the following keys with the Trace function:

#### Performing 2-D Volume Calculations

This feature is available on Sequoia 512 systems only. You calculate the volume of a region of interest by measuring the region of interest in three planes, using two scan orientations perpendicular to each other. You can measure the anterior-posterior (depth) and superior-inferior (length) dimensions using the same scan orientation. You can measure the width by moving the transducer to the orthogonal scan plane. You can calculate volume on a live, frozen, or videotaped 2-D image, and in 2-D Cine.

The volume calculation uses the following formula:

Volume = D1 \* D2 \* D3 \*  $\pi/6$ 

where D1, D2, and D3 are the three measurements for the region of interest.

Entered measurements must be in the range of  $0 \le x < 99$  cm.

The calculated volume will be in the range of  $0 \le x < 99999$  cc. Values outside the valid range are displayed as "\*\*\*\*\*\*".

- To measure the volume of a region of interest:
- 1 Press CALC and select VOLUME CALC from the pop-up menu.

The system displays the Data Display Box.

**2** Select a diameter measurement.

The system displays a single caliper.

- **3** Roll the trackball to position the caliper.
- **4** Double-click the **SELECT KEY** or select **[ENTER]** to complete the measurement.

Use the following controls to perform the measurement:

CONTROL [SOFT KEY]	FUNCTION
() (TRACKBALL SELECT KEY)	Displays the second caliper for you to position.
[ENTER]	Records the measurement.
[CLEAR ALL]	Clears all volume calculation measurements.
[SELECT] or TRACKBALL SELECT	Press to choose a measurement option. Double-click to activate.
CALC	Exits the volume calculation function.

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#### Measuring Hip Angle

**NOTE:** You must enable the Hip Angle measurement in the system Setup menu (located on the **Calipers/Trace** setup page).

2-D Hip Angle Measurements are only available on Sequoia 512 systems. Hip angle measurements are used to determine if dysplasia is present in the hip joint of young infants. You measure the hip angle by drawing lines corresponding to the position of bone and cartilage in the hip joint. Hip angle measurements can be taken on real-time or frozen images. The hip angle measurement is not available in strip modes.



The first line drawn is the baseline, followed by the  $\alpha$  and  $\beta$  lines. The angle that the  $\alpha$  line forms with respect to the baseline, and the angle that the  $\beta$  line forms with respect to the  $\alpha$  line, are used to determine the state of joint development.

#### • To perform a Hip Angle measurement:

- 1 Press **CALC** to display the Calculations pop-up menu.
- **2** Select Hip Angle from the pop-up menu to display a caliper.
- **3** Position the caliper where you want to start the baseline.
- 4 Press [ADD CALIPER] or the trackball SELECT KEY to display the line.
- **5** Use the trackball to reposition the caliper, and then double-click to complete the measurement.
- **6** Repeat steps 4 and 5 for the  $\alpha$  (alpha) and  $\beta$  (beta) measurements.
- **7** To exit the hip angle measurement function, press **CALC**.

# **Ratio Measurements** NOTE: You can use the Calipers/Trace Setup menu to enable or disable Ratio Calc measurements, or modify the measurement labels **IC pk** and **CC pk**.

For more information about Calipers/Trace setup, see Chapter 37 of the *Administrator Manual*.

The ratio measurement can be used to report the ratio between any two measurements, but is typically used to report the Internal Carotid/ Common Carotid (IC/CC) peak velocity ratio. It lets you compare any two single-caliper, spectral Doppler measurements.

#### • To perform a ratio measurement:

- **1** Press **CALC** to display the Calculation pop-up menu.
- **2** Select Ratio Calc from the pop-up menu.
- **3** Choose a site: **Left** or **Right** from the Ratio menu.
- 4 Choose IC pk for the numerator measurement or CC pk for dominator measurement.
- **5** Position the caliper and press **[ENTER]**, **IMAGE STORE**, or double-click the trackball **SELECT KEY** to save the measurement results.

Using the Slope Line with Generic Calipers	You can set up the system to automatically display a slope line between an active pair of generic calipers in M-mode and for $\Delta$ <b>DCAL</b> measurements in spectral Doppler.
	Use the system Setup menu to enable the setup option (located on the <b>Calipers/Trace</b> setup page) for a slope line to display in M-mode or Doppler. The display of the slope line within a calculation package is not changed by this system setup option.
	<b>NOTE:</b> You can store the display of the slope line in an Exam Preset. For more information about Exam Presets, see <i>Chapter 37</i> in the <i>Administrator Manual</i> .
	To display a slope line:
	<b>1</b> Activate the measurement function and position two generic calipers in M-mode or for DDCAL measurements in Doppler.
	• If the <b>Display Slope Line</b> setup option is enabled for <b>M-mode</b> , then the system activates the display of a slope line with generic calipers in M-mode and Color M-mode; for example, M-mode DTI.
	<ul> <li>If the Display Slope Line setup option is enabled for Spectral, then the system activates the display of a slope line for ΔDCAL measurements in Spectral Doppler PW, CW, and auxiliary CW.</li> </ul>
	<b>2</b> If the setup option was not enabled, press the <b>ELLIPSE</b> control up to display a slope line; press down to remove the display of a slope line.
Taking Measurements from a Videotaped Exam	You can take all 2-D, spectral Doppler, and M-mode measurements and perform calculations from a videotaped exam. Before you can take measurements or perform calculations from a videotaped exam, you must freeze the image you want to measure and calibrate the measurement tools.
	Calibrating measurement tools allows you to take measurements from images (such as videotape or some uncalibrated AEGIS images). Calibrating allows you to take all measurements from these types of images, except the following:
	Color Doppler caliper measurements
	Doppler angle correction
	Auto Doppler measurements
	• 2-D, M-mode, and Needle Guide depth measurements
	You need to calibrate for each operating mode in which you want to take measurements.

Freezing the Image	To freeze a videota	ped image:
	1 Select <b>SHUTTLE</b> and by frame to the speci	use the <b>GAIN/FRZ/RUN</b> wheel to advance frame ific frame you want to measure.
	2 Press GAIN/FRZ/RUN	wheel.
	The VCR automatica frame and digitally f	ally rewinds and then advances to the selected freezes the image.
	<b>3</b> To leave the freeze fu	unction, press GAIN/FRZ/RUN again.
	The VCR returns to i paused for five minu	its previous function. (If the VCR has been utes, it automatically stops.)
Displaying the Calibration Menu	When you press the <b>CAL</b> keys on an uncalibrated with the options describe	<b>IPERS ON/OFF, ADD CALIPER, TRACE</b> , or <b>CALC</b> image, the Calibration pop-up menu appears ed in the following table.
	OPTION	FUNCTION
	Prior Calibration	Use the last calibration. If you have just turned on the system, there is no prior calibration and this option is dimmed.
	2-D	Set up 2-D calibration.
	Spectral Doppler	Set up spectral Doppler calibration.
	M-mode	Set up M-mode calibration.
	You must set up calibrati to take measurements. T each mode.	ion for each operating mode in which you want 'he following sections describe the procedure for
Setting Up 2-D Calibration	You calibrate 2-D measur and marking that distant	rements by selecting a measurement distance ce with calipers.
	• To set up calibratio	on for 2-D measurements:
	1 Choose <b>2-D</b> from the second-level menu li	e Calibration pop-up menu to display a isting distances you can use for calibration.
	<b>2</b> Choose a distance to	use for the calibration.
	A calibration scale a	nd a single caliper appear.
	<b>3</b> Position the caliper of	on one of the scale markers.
	<b>4</b> Use a trackball <b>SELE</b> the second caliper at first caliper. (Click a calipers and reposition)	<b>CT KEY</b> to display a second caliper, and position the calibration distance you selected from the trackball <b>SELECT KEY</b> to switch between the two on them at the correct distance from each other.)
	The calibration dista	nce appears in a Data Display Box as a reminder.
	5 Press [ENTER] or dou	uble-click to record the calibration.

Setting up Strip Mode Calibration	You the cho (M- by o	a calibrate spectral Doppler and M-mode strip measurements both in vertical and horizontal dimension. You calibrate vertically by osing a calibration speed (spectral Doppler mode) or distance omode) and then measuring it with calipers. You calibrate horizontally choosing a time interval and then measuring it with calipers.
	٠	To set up calibration for spectral Doppler or M-mode strips:
	1	Choose <b>Spectral Doppler</b> or <b>M-mode</b> from the Calibration pop-up menu to display a second-level menu for calibrating vertically.
		If you choose <b>Spectral Doppler</b> , the second-level menu lists calibration units in meters per second. If you choose <b>M-mode</b> , the second-level menu lists distances you can use for calibration.
	2	Choose the calibration units.
		A calibration scale and a single caliper appear.
	3	In spectral Doppler mode, position the caliper on the baseline. In M-mode, position the caliper on one of the scale markers and click.
IMPORTANT:	In ba	spectral Doppler mode, you must position the first caliper on the seline to perform an accurate vertical calibration.
	4	Click to display a second caliper, and position it to measure the calibration units you selected from the second-level pop-up menu. (Click to switch between the two calipers and reposition them at the correct distance from each other.)
		The calibration measurement appears in a Data Display Box as a reminder.
	5	Press <b>[ENTER]</b> or double-click to record the calibration.
		You see a second-level pop-up menu for choosing horizontal calibration units (in seconds).
	6	Choose a calibration units option.
		A calibration scale and a single caliper appear.
	7	Position the caliper on one of the scale markers.
	8	Click to display a second caliper, and position it to measure the time interval you selected from the second-level pop-up menu. (Click to switch between the two calipers and reposition them at the correct distance from each other.)
		The calibration measurement appears in a Data Display Box as a reminder.
	9	Press <b>[ENTER]</b> or double-click to record the calibration.

The Auto Doppler function automatically traces the spectral Doppler waveform and records several measurements on selected general imaging and vascular transducers. You can use the Auto Doppler function on a real-time PW Doppler strip, a Cine PW Doppler strip, or a frozen PW Doppler strip.

#### Entering and Exiting Auto Doppler

#### To enter the Auto Doppler function:

- 1 Display a real-time or frozen spectral Doppler strip while using an abdominal, vascular, or endovaginal transducer.
- 2 Press AUTO MEASURE.



The first V marker on the trace shows the maximum velocity. When measurements are from one side of the baseline (as shown), the second marker shows end diastolic velocity. When measurements are from both sides of the baseline, the second V marker shows the absolute minimum velocity.

#### Auto Doppler Configurations

An Auto Doppler configuration specifies parameter settings and determines which measurements are calculated from the Doppler spectral display. The Sequoia system provides nine preset Auto Doppler configurations: Aorta, Abd Arterial, OB-Non Cardiac, Carotid, PV Arterial, NeoNatal, GYN, Small Parts, and Generic.

You can use the Setup function to modify the preset configurations and add other user-defined configurations. See Chapter 41.

- To select a configuration while in the Auto Doppler function:
- **1** Press **OPTIONS** to display the Auto Doppler Options pop-up menu.
- 2 Choose the configuration you want by pressing [()SELECT].

**NOTE:** The **OPTIONS** key displays only Auto Doppler configurations that have been turned on in Auto Doppler Setup.

#### Auto Doppler Measurements

The measurements that were turned on in the Auto Doppler Configuration Setup appear in the Auto Doppler data display box.

- To record Auto Doppler measurements:
- **1** Press **[HR XXX-YYY]** to select the appropriate heart rate range.
- 2 Press [↑/↓] to specify which side of the Doppler baseline to take measurements from.

OPTION DESCRIPTION

Ø Traces negative portion of waveform (below baseline)	↑	Traces positive portion of waveform (above baseline)
	Ø	Traces negative portion of waveform (below baseline)
$\uparrow/\downarrow$ Traces waveform on both sides of the baseline	$\uparrow/\downarrow$	Traces waveform on both sides of the baseline

When you invert the Doppler strip, Auto Doppler continues to trace the same side of the baseline (positive or negative). The tracking is saved across repeated uses of Auto Doppler.

- **3** Press **[SENSITIVITY]** and roll the trackball left and right to adjust the sensitivity of the waveform trace.
- **IMPORTANT:** Auto Doppler is a tool that can provide measurements and calculations you can perform using generic tools. You need to inspect each Auto Doppler waveform to assure it has correctly drawn the maximum waveform and placed graphic elements prior to accepting measurements as being correct.

## Using Auto Doppler with Cine

If you press Cine while Auto Doppler is active, the Auto Doppler Review mode is entered. Strip size and strip speed can be adjusted.

#### • To use Auto Doppler with Cine:

- **1** Press **PRIORITY** to switch between Cine and Auto Doppler soft keys.
- 2 If you turn the **GAIN/FRZ/RUN** wheel, the maximum derived waveform (MAX DWF) remains displayed and the values in the data display box appear blank. The Cine soft keys appear.
- **3** You can select which side of the baseline to evaluate while a Cine strip is running.

On an Auto Doppler Review display, use the trackball to adjust the position of the two vertical delimiter bars so that they specify the portion of the Doppler strip from which you want to record measurements. The delimiters will not move across the erase bar.

**4** Use the trackball and **[L/R]** to move the delimiters.

## OPTION DESCRIPTION

L/R	The trackball moves both delimiters at the same time
L	The trackball moves the left delimiter
R	The trackball moves the right delimiter

**5** Repeat these steps for each site.

Studies

## **VASCULAR CALCULATIONS**

You can use the vascular calculation package to:

- Take measurements and perform standard vascular calculations.
- Store the measurements and calculations on your system.
- View and print reports with the results of these studies.

See Chapter 41 for information on customizing vascular calculations.

The calculation package consists of the following studies:

STUDY	DESCRIPTION			
CAROTID STUDY	Reports peak systolic (psv) and end diastolic (edv) velocities in the carotid arteries.			
RESISTANCE INDICES	Provides an indication of peripheral resistance by computing the difference between maximum and minimum velocities. You can change the name of the sites in the study.			
VELOCITIES	Reports velocities of your choice. You can change the name of the sites in the study.			
ACCELERATION	Reports rates of change of velocity for a given time. You can change the name of the sites in the study.			
RATIO	Reports the ratio of two velocity measurements of your choice. You can change the name of the sites in the study.			
% STENOSIS AREA	Calculates the percent stenosis of a vessel based on the reduction of the residual lumen cross-sectional area. You can change the name of the sites in the study.			
% STENOSIS DIAM	Calculates the percent stenosis of a vessel based on the reduction of the residual lumen diameter. You can change the name of the sites in the study.			
VOLUME FLOW	Volume Flow evaluates flow states in transplanted organs and grafts. Volume calculations require the performing two separate measurements:			
	• 2-D image area or diameter measurement.			
	<ul> <li>A Time Average Velocity (TAV) from a Spectral Waveform.</li> </ul>			

Measurements

Each study has measurements associated with it. The following table shows the study's measurements, the measurement tool you use, and the imaging mode the measurement is available in.

STUDY	MEASUREMENT	DESCRIPTION	MODE	TOOL
CAROTID STUDY	CCA	Common carotid psv Common carotid edv	Doppler	Caliper
	ICA Prox	Internal carotid Proximal psv Internal carotid Proximal edv	Doppler	Caliper
	ICA Mid	Internal carotid Mid psv Internal carotid Mid edv	Doppler	Caliper
	ICA Dist	Internal carotid Distal psv Internal carotid Distal edv	Doppler	Caliper
	ECA	External carotid psv	Doppler	Caliper
	Vert	Vertebral psv	Doppler	Caliper
	Subclav	Subclavian psv	Doppler	Caliper
	IC/CC	Internal carotid/common Carotid psv	Doppler	Caliper
RESISTANCE INDICES	Max	Maximum velocity	Doppler	Caliper
	Min	Minimum velocity	Doppler	Caliper
	TAMx	Time averaged maximum velocity	Doppler	Trace
	PI	Pulsatility index	Doppler	Trace
	RI	Resistivity index	Doppler	Caliper
	S/D	Systolic to diastolic ratio	Doppler	Caliper
VELOCITY	V1	V1 psv V1 edv	Doppler	Caliper
	V2	V2 psv V2 edv	Doppler	Caliper
ACCELERATION	$\Delta V$	$\Delta V$	Doppler	Caliper(s)
	$\Delta T$	$\Delta T$	Doppler	Caliper(s)
	Accel	Acceleration	Doppler	Caliper(s)
RATIO	NUM	Any velocity	Doppler	Caliper
	DEN	Any velocity	Doppler	Caliper
STUDY	MEASUREMENT	DESCRIPTION	MODE	TOOL
---------------------	-------------	------------------------	---------	------------------
% STENOSIS DIAM	DIAM 1	Diameter 1	2-D	Calipers
	DIAM 2	Diameter 2	2-D	Calipers
% STENOSIS AREA	AREA 1	Cross sectional area 1	2-D	Trace or ellipse
	AREA 2	Cross sectional area 2	2-D	Trace or ellipse
VOLUME FLOW DIAM	DIAM	Diameter	2-D	Caliper
	TAV	Time averaged velocity	Doppler	Trace
VOLUME FLOW AREA	AREA	Cross sectional area	2-D	Trace or ellipse
	TAV	Time averaged velocity	Doppler	Trace

### Entering and Exiting the Vascular Calculation Package

Taking

Measurements

You can enter the calculation package at any time during a study.

- To enter the vascular calculation package:
- **1** From PW Doppler mode press **GAIN/FRZ/RUN** or **CINE** to freeze the Doppler strip.
- 2 Press CALC and then select VASCULAR CALC from the pop-up menu.

The following illustration shows the Vascular Calc display and the steps you follow to take a vascular measurement.

The following illustration shows the Vascular Calc display and the steps you follow to take a vascular measurement.

1. Select the study you want from the pop-up menu.



2. Select the site at which you want to take measurements.



3. Select the measurements you want to take and the measurement tool appears on the screen.



Using the Vascular Calculation Worksheet and Report	The vascular calculation worksheet displays the results of each measurement that you take. The vascular calculation report displays a summary of all vascular measurements and calculations. You can display either the worksheet or report at any time while you are taking measurements.		
	You can save the worksheet or report to the on-board AEGIS system, record it to VCR, or print it to a local printing device. Use the system Setup function to customize settings for your local black and white printer and color printer. See "Customizing Printing" in the <i>Administrator Manual</i> for details.		
	You can send patient demographic data and calculation data to a personal computer or printer connected to the ultrasound system's parallel port. Use the system Setup function to select the format options for sending calculation report data to a printer or for exporting calculation report data to a printer or for exporting calculation report data to a printer or for a PostScript <sup>TM</sup> format. The printer options include printer selections for a PostScript <sup>TM</sup> format. The ultrasound system exports calculation report data to a PC in a commaseparated format. See "Customizing Printing" in the <i>Administrator Manual</i> for details.		
Accessing the Report	٠	To display a report or worksheet:	
or Worksheet	1	Press CALC.	
	2	Select VASCULAR CALC from the pop-up menu.	
	3	Press <b>REPORT</b> .	
	4	To scroll through worksheet pages, select <b>[PAGE UP]</b> and <b>[PAGE DOWN]</b> or toggle the <b>PAGE</b> key.	
	5	To exit the worksheet and display the report, select <b>[GO TO REPORT]</b> .	
	6	To exit the report and display the worksheet, select <b>[GO TO WORKSHEET]</b> .	
	7	To exit the report or worksheet, press <b>REPORT</b> .	
Report and	٠	To edit a measurement in the report or worksheet:	
Worksheet Editing	1	Display the worksheet or report.	
	2	Roll the trackball to position the cursor in an entry field and press the <b>SELECT KEY</b> to activate the field for editing.	
		<b>NOTE:</b> For fields containing numerical data, use valid entry values (0.001 to 9999). For fields containing text, type the text directly in the field.	
	3	Press the <b>RETURN</b> key to complete an entry.	
	4	To exit the worksheet or report, press <b>REPORT</b> .	

### Report and Worksheet Controls and Soft Keys

[SOFT KEY]	FUNCTION
CALC	Activates the Calculation function.
REPORT	Activates Report mode.
	<ul> <li>When Vascular Calcs is active, displays the Vascular report or worksheet.</li> <li>When Vascular Calcs is not active, select [VASCULAR] to display the Vascular report or worksheet.</li> </ul>
	To return to the image from Report mode, press report.
PAGE	Displays additional pages of the report or worksheet.
HOME END	Displays the first page of a report or worksheet. Displays the last page of a report or worksheet.
PRINT	Prints the displayed report or worksheet page.
IMAGE	Displays the live image.
IMAGE STORE	Captures a digital image of a report or worksheet to AEGIS.
[VASCULAR]	Activates the report for the Vascular calculation package. Press <b>REPORT</b> , then select <b>[VASCULAR]</b> .
[GO TO REPORT]	Exits a worksheet and displays the corresponding report.
[GO TO WORKSHEET]	Exits a report and displays the corresponding worksheet.
[PAGE UP]	Scrolls upward through the pages of the report or worksheet.
[PAGE DOWN]	Scrolls downward through the pages of the report or worksheet.
[OUTPUT TO PC]	Sends patient demographic data and calculation data to a personal computer (connected to the ultrasound system's parallel port) for use with an external database or spreadsheet.
[PRINT]	Sends patient demographic data and calculation data to a printer connected to the ultrasound system's parallel port.
	The ultrasound system sends the data in a PostScript ${}^{\rm TM}$ format.
	<b>NOTE:</b> Either the worksheet or Report will be printed

# Using Auto DopplerIf Auto Doppler is active while a vascular calculation measurement is<br/>selected, then vascular measurements are taken from Auto Doppler<br/>directly, and manual tools are not required.

The values in the data display box appear blank if the given result is not produced by the current Auto Doppler configuration.

- To use Auto Doppler with the vascular calculation package:
- **1** Obtain an optimized Spectral strip.
- **2** Enter the Auto Doppler function.
- **3** Press **CINE** to display the Auto Doppler delimiters.
- **4** Use a trackball **SELECT KEY** to position the right and left delimeters on the required flow signal.
- **5** Enter the vascular calculation package.
- **6** Select a study and a vascular measurement from the pop-up menu.

The vascular calculation box appears over the Auto Doppler data display box.

- **7** Store the measurements by pressing **[ENTER]** or double clicking a trackball **SELECT KEY**.
- 8 To exit Auto Doppler, press AUTO MEASURE.

**NOTE:** The vascular study selected must match the Auto Doppler configuration in order to have the desired measurements and calculations.

The Auto Doppler measurements and calculations that appear in the data display box are stored in the vascular worksheet and report.

**NOTE:** You cannot switch between taking manual measurements and Auto Doppler measurements while a measurement is in progress. To take a manual measurement, you must turn off Auto Doppler and then reselect a vascular measurement from the pop-up menu.

If you have other modes, such as **CINE**, active, you may need to use the **PRIORITY** toggle to switch between the modes on the display screen. The soft key menu displays will help you recognize which mode you are in.

Volume Flow	Volume calculations require the performing two separate measurements:			
Measurement	•	2-D image Area or Diameter mea	isurement.	
	•	Time Average Velocity (TAV) from	n a Spectral Waveform.	
Technical Considerations	Volume Flow measurement at a single site is of little diagnostic value, whereas measurements taken at multiple sites along the vessel reflect changes in the hemodynamics of the vessel.			
	• Diameter/Area measurements assume that they are taken perpendicular to the vessel.			
	• Spectral Doppler waveform must be obtained at exact position from which area or diameter measurement is taken.			
Area and Diameter	•	To measure Volume Flow Diam	eter or Area:	
Measurements	<b>1</b> Acquire appropriate 2-D image, freeze.			
	2 Press CALC.			
	<b>3</b> Select <b>VASCULAR CALC</b> from pop-up menu.			
	<b>4</b> Select the desired measurement, <b>DIAMETER</b> or <b>AREA</b> , to complete the next five steps.			
	DI	AMETER MEASUREMENT	AREA MEASUREMENT	
	5	Select VOL FLOW DIAM.	Select VOL FLOW AREA.	
	6	Select <b>SITE 1</b> from pop- up menu.	Select <b>SITE 1</b> from pop-up menu.	
	7	Select <b>DIAM</b> , displaying the first caliper.	Select <b>AREA</b> , displaying the caliper and the following soft key menu: [ ], [MARK], [DRAW], [ ]	
	8	Use the trackball to position the caliper, then use the () keys to anchor the caliper. Anchoring the first caliper displays the second caliper.	Trace the area using the Mark or Draw method utilizing either the soft keys or the (). See "Using the Trace Function" on page 231 of this manual for more information.	
	9	Use the trackball to position the second caliper.	Press (()) or [END TRACE] to end trace and to display area measurement.	

- **10** Press (()) to enter the measurement into a report.
- **11** Press **[RETURN TO MENU]** or **()** to return to the pop-up menu.

#### Time Average Velocity (TAV) Measurement

- 1 Acquire the appropriate spectral Doppler waveform.
- 2 Press CALC.
- **3** Select **VASCULAR CALC** from pop-up menu.
- 4 Select VOL FLOW DIAM.
- **5** Select **SITE 1** from pop-up menu.
- **6** Select **TAV** from pop-up menu.
- **7** A caliper and a light blue trace display overlaying the Doppler waveform. The following soft key menu also displays:

### [ ], [+TAV/-TAV/±TAV], [ ], [RETURN TO MENU].

- **8** Cycle through second soft key selections to choose appropriate waveform directionality.
- **9** Place caliper at peak systolic flow and press () to anchor the caliper. This displays the second caliper.
- **10** Place the caliper at peak systolic flow of next cycle. Press (( )) to enter into calculation. Volume is displayed in ml/min.

Chapter 27 - Vascular Calculations

### **CARDIAC CALCULATIONS**

You can use the cardiac calculation package to:

- Take measurements and perform standard cardiac calculations.
- Store the measurements and calculations on your system.
- View and print reports with the results of these studies.

See Chapter 41 for information on customizing the cardiac calculation package.

Cardiac calculation pop-up menus are divided into two sections. The top, gray section displays a hierarchical navigation history. The bottom section displays a sub-menu of choices that are one hierarchical level below the last item in the navigation history.

- Study
- Category
- Cluster
- Measurement

The cardiac calculation pop-up menu displays submenus that show a list of measurements related to each selection of Study, Cluster and Measurement combination. Each list show measurements that must be performed in the current selection combination, and related measurements in other modes of operation that must also be collected for the current study. Studies with more than one measurement listed on a pop-up menu allow the user to leap frog through the measurement list, with the next measurement starting where the first one ended until all the measurements on the list have been collected. As you navigate through the cardiac calculation pop-up menu, you select items in this order.





### Entering and Exiting the Cardiac Calculation Package

You can enter and exit the calculation package at any time during a study. Calculation data is saved until you end the study. To take cardiac measurements in strip modes, you must first press **FREEZE** or **CINE** to stop the strip.

### • To enter the cardiac calculation package:

- 1 Press CALC.
- 2 Select the item you want from the pop-up menu. When you choose a measurement from the pop-up menu, the pop-up menu disappears, the measurement tool and soft key menu are activated, and the data display box appears.
- **3** Press **CALC** to exit the cardiac calculation package.

Types of Measurements The following table describes the types of measurement the cardiac calculation package contains and general steps for performing the measurement.

### • To perform any measurement:

- **1** Freeze the image and enter the cardiac calculation package.
- **2** Follow the steps below for the type of measurement you want to take.

MEASUREMENT	PROCEDURE		
DISTANCE	1	Select a distance measurement.	
	2	Place the first caliper on the object to be measured.	
	3	Press a select button to place the second caliper on the object to be measured.	
	4	Enter the measurement.	
2-D AREA AND	1	Select an area measurement.	
VOLUME	2	Trace the outline of the area.	
		For LV or RV volume measurements, begin the trace at one side of the annulus and end at the opposite side of the annulus.	
	3	End the trace. <sup>1</sup>	
	4	Enter the measurement.	
VELOCITY TIME	1	Select a VTI measurement.	
INTEGRAL	2	Start the trace at the beginning of the Doppler spectrum to be measured.	
	3	Trace the VTI of the Doppler spectrum to be measured.	
		The tool will automatically correct to baseline if you start above or below the line.	
	4	End the trace. <sup>1</sup>	
	5	Enter the measurement.	
VELOCITY	1	Select a velocity measurement.	
	2	Move the caliper to the velocity you want to measure.	
	3	Enter the measurement.	
COLOR DOPPLER	1	Select a color Doppler velocity or PISA measurement.	
VELOCITY OR PISA	2	Move the caliper to the origin (vena contracta) of the color Doppler jet to be measured near the orifice of the valve.	
	3	Press a select button to place a second caliper at the first color aliasing zone of the PISA.	
	4	Enter the measurement.	

1. You can reposition the axis by using the trackball. Be sure to end the trace after editing.

Basic Measurements Study CATEGORIES	Measurements in the Basic Measurements study are those that you probably do routinely on all patients, regardless of their cardiovascular status. It includes measurements for M-mode, 2-D and spectral Doppler.		
	M mode Cluster	The M mode DV and LV dimension	
	STI Cluster	measurements are set up to autocycle from one to the next.	
2-D DIMENSIONS	PLAX Cluster PLAX, RVIT/RVOT Cluster PSAX, AoV Level Cluster PSAX, Chord Level Cluster PSAX, Pap Level Cluster A4C Cluster A2C Cluster SSN, Long Axis Cluster SSN, Short Axis Cluster Subcostal Long Axis Cluster Subcostal Short Axis Cluster	You use the trace function for 2-D area measurements, and two calipers for 2-D linear measurements. Some area measurements yield linear measurements as well.	
2-D VOLUME/ MASS MEASUREMENTS	LV Volumes Cluster LA Volumes Cluster LV Biplane Volumes Cluster	LV Volumes use Area/Length, Method of Disks (MOD) (single and biplane), and Bullet formulas.	
	RV Volumes Cluster RA Volumes Cluster	For RV Volumes, the system uses a Prolate Ellipse formula. Views recommended for this measurement include the apical four chamber and parasternal long axis of the RVOT. The formula requires an area and length measurement. Choose one view for the area and the other view for the length. The menu for RV volumes allows you to choose the views interchangably. They are labeled View 1 and View 2.	
	LV Mass, Area/Length Cluster LV Mass, TE Cluster	You can configure your system to calculate mass using either the Area/Length (A/L) or Truncated Ellipse (TE) method or both.	
		For the <i>epicardial measurement</i> , use a frozen 2-D image of the PSAX at the level of the papillary muscle in diastole, and trace the epicardial area.	
		For the <i>endocardial measurement</i> , use a frozen 2-D image of the PSAX at the level of the papillary muscle in diastole, and trace the endocardial area.	
BASIC DOPPLER SURVEY	Aortic Valve Measurement Pulmonic Valve Measurement Mitral Valve Measurement Tricuspid Valve Measurement Venous Flow Measurement	Use the trace function to measure VTI, a single caliper to measure Vmax, and two calipers to measure time and slope.	

Pressure	The Pressure Predictions study provides prediction of absolute pressure
Predictions Study	in chambers and vessels. It incorporates externally obtained pressures for
_	systemic and pulmonary side pressure estimates. It also includes the
	simplified and expanded Bernoulli equations for generic pressure
	gradients.

CLUSTER	MEASUREMENT	ТҮРЕ
RVSP VIA TR or VSD	TR Vmax VSD Vmax	The right ventricular systolic pressure is calculated using the simplified Bernoulli equation and the following:
		• Vmax of the tricuspid regurgitation (TR) or the ventricular septal defect (VSD) jet on a Doppler strip
		• Estimate of the right atrial pressure for TR, or systolic blood pressure for VSD
PADP	PR ed vel	The pulmonary artery end-diastolic pressure is calculated using the simplified Bernoulli equation and the following:
		• Peak velocity of the PR jet at end-diastole on a Doppler strip
		Estimate of the right atrial pressure
LVSP	AoV Vmax	The left ventricular systolic pressure is calculated using the simplified Bernoulli equation and the following:
		AoV Vmax from a Doppler strip
		Cuff systolic blood pressure
LVEDP	AR ed vel	The left ventricular end-diastolic pressure is calculated using the following:
		• Vmax of the aortic regurgitation (AR) jet at end-diastole on a Doppler strip
		Cuff diastolic blood pressure
LASP	MR Vmax	The left atrial systolic pressure is calculated using the following:
		<ul> <li>Vmax of the mitral regurgitation (MR) jet from a Doppler strip</li> </ul>
		Cuff systolic blood pressure
SIMPLIFIED BERNOULLI	V2 Vmax	The simplified Bernoulli is calculated using the V2 Vmax from the distal site (Site 2).
EXPANDED BERNOULLI	V1 Vmax V2 Vmax	The expanded Bernoulli is calculated using the following:
		• V2 Vmax from the distal site (Site 2)
		• V1 Vmax from the proximal site (Site 1)

Valve StenosisThe Valve Stenosis study offers methods for quantifying the severity of<br/>valve stenosis. This study provides a comprehensive collection of all the<br/>measurements required to quantify valvular stenosis in the aortic, mitral,<br/>pulmonary, and tricuspid valves. It also includes generic site<br/>measurements for the continuity equation and the PISA calculation.

CATEGORY	CLUSTER	MEASUREMENT
AORTIC VALVE	2-D	Aov Area, planim
	Aortic Doppler	AoV VTI AoV Vmax AoV AT AoV ET
	AoV Continuity Education	AoV VTI AoV Vmax LVOT VTI LVOT Vmax LVOT Diam AoV Vmean LVOT Vmean
	AoV PISA	LVOT PISA Radius LVOT Alias Vel AoV Vmax
MITRAL VALVE	MV 2-D Measurements	MV Area, planim MV Diam, A/P MPV Diam, M/L
	MV Doppler	MV VTI, leaflet tips MV Peak E MV Peak A
	PA Pressures	TR Vmax PR ed vel
	MV Continuity Equation	Site 2 VTI Site 2 Diam MV VTI, leaflet
	MV PISA	MV PISA Radius MV Alias velocity MV Vmax

CATEGORY	CLUSTER	MEASUREMENT
PULMONIC VALVE	PV Doppler	PV VTI PV Vmax PV AT PV ET TR Vmax
	PV Continuity Equation	PV VTI PV Vmax RVOT VTI RVOT Vmax RVOT Diam PV Vmean RVOT Vmean
	PV PISA	RVOT PISA Radius RVOT Alias Velocity PV VMAX
TRICUSPID VALVE	2-D	TV Area, planim TV Diam, A/P TV Diam, M/L
	TV Doppler	TV VTI, leaflet tips TV peak E TV Peak A TV DT
	TV Continuity Equation	Site 2 VTI Site 2 Diam TV VTI, leaflet tips
	TV PISA	TV PISA Radius TV Alias Velocity TV Vmax
GENERIC SITE	Continuity Equation	Site 1 VTI Site 2 VTI Site 1 Diam
	PISA Calculation	Site PISA Radius Site Alias Velocity Site Vmax

## Valve Regurgitation Study

The valve regurgitation study provides a comprehensive collection of all the measurements required to quantify valvular regurgitation of the aortic, mitral, pulmonic and tricuspid valves. It also includes generic site measurements for the PISA calculation.

CATEGORY	CLUSTER	MEASUREMENT
AORTIC VALVE	AR Slope	AR Decel Rate Decel Time
	LVEDP	AR ed vel
	AR CD Jet Ratios	AR Jet Ht LVOT Ht AR Jet Area LVOT Area
	AR Volume by PISA	AR PISA Radius AR Alias Velocity AR VTI AR Vmax LVOT Diam LVOT VTI
	AR Volume by Dop/Dop	LVOT Diam LVOT VTI Site 2 Diam Site 2 VTI AR VTI
	AR Volume by 2-D/Dop	LV Area, A4C, d & s LV Major, A4C, d & s LV Vol, A4C MOD, d & s LV Area, A2C, d & s LV Major, A2C, d & s LV Vol, A2C MOD, d & s Site 2 Diam Site 2 VTI AR VTI

CATEGORY	CLUSTER	MEASUREMENT
MITRAL VALVE	Pulmonary Venous Flow	RUPV measurements RLPV measurements LUPV measurements LLPV measurements
	MR Volume by PISA	MR PISA Radius MR Alias Velocity MR Vmax MR VTI MV Diam MV VTI, annulus
	MR Volume by Dop/Dop	MV Prox Diam MV VTI, Annulus Site 2 Diam Site 2 VTI MR VTI
	MR Volume by 2-D/Doppler	LV Area, A4C, d & s LV Major, A4C, d & s LV Vol, A4C MOD, d & s LV Area, A2C, d & s LV Major, A2C, d & s LV Vol, A2C MOD, d & s Site 2 Diam Site 2 VTI AR VTI
PULMONIC VALVE	PR Volume by PISA	PR PISA Radius PR Alias Velocity PR VTI PR Vmax RVOT Diam RVOT VTI
	PR Volume by Dop/Dop	RVOT Diam RVOT VTI Site 2 Diam Site 2 VTI PR VTI
	PR Volume by 2-D/Doppler	RV Area, vw 1, d & s RV Major, vw 2, d & s Site 2 VTI Site 2 Diam PR VTI

CATEGORY	CLUSTER	MEASUREMENT
TRICUSPID VALVE	TR Volume by PISA	TR PISA Radius TR Alias Velocity TR Vmax TR VTI TV Prox Diam TV VTI, Annulus
	TR Volume by Dop/Dop	TV Prox Diam TV VTI, Annulus Site 2 Diam Site 2 VTI TR VTI
	TR Volume by 2-D/Doppler	RV Area, vw 1, d & s RV Major, vw 2 D & s Site 2 VTI Site 2 Diam TR VTI
GENERIC PISA		Site PISA Radius Site Alias Velocity Site Regurg VTI Site Prox Diameter Site Forward VTI Site Regurg Vmax

Volume Flow and<br/>Shunts StudyVolume Flow and Shunt measurements provide volume flow calculations<br/>from all four valves, including stroke volume, cardiac output, and<br/>indices. In addition, you can calculate shunt ratios, such as Qp/Qs. These<br/>measurements and calculations are made in 2-D and spectral Doppler.

CATEGORY	MEASUREMENT	ТҮРЕ
AORTIC VALVE	LVOT Diam LVOT VTI	For <i>LVOT diameter and area</i> , measure LVOT diameter in systole from the parasternal long axis.
		For <i>cardiac output, cardiac index, stroke volume and stroke index,</i> obtain the LVOT flow with PW Doppler, and measure the LVOT VTI.
MITRAL VALVE	MV Annulus Diam MV VTI, Annulus	For <i>MV annulus diameter and area</i> , measure the MV annulus diameter in diastole.
		For <i>cardiac output, cardiac index, stroke</i> <i>volume and stroke index,</i> obtain the MV Doppler flow at the annulus with PW Doppler, and measure the MV VTI.
PULMONARY VALVE	RVOT Diam RVOT VTI	For <i>RVOT diameter and area</i> , measure RVOT diameter in systole.
		For <i>cardiac output, cardiac index, stroke</i> <i>volume and stroke index,</i> measure RVOT VTI from the RVOT flow.
TRICUSPID VALVE	TV Annulus Diam TV VTI,Annulus	For <i>TV annulus diameter and area</i> , measure the TV annulus diameter in diastole.
		For <i>cardiac output, cardiac index, stroke</i> <i>volume and stroke index,</i> obtain the TV Doppler flow at the annulus with PW Doppler, and measure TV VTI.
SHUNTS	Systemic Diam Systemic VTI Pulmonic Diam Pulmonic VTI	For the <i>Qp/Qs</i> , <i>Qp-Qs</i> , and for <i>cardiac output</i> , <i>cardiac index</i> , <i>stroke volume</i> , <i>and stroke index</i> for each side, measure the systemic diameter and VTI and the pulmonic diameter and VTI.

Coronary Artery Flow Study The Coronary Artery Flow study provides measurements for the quantification of coronary flow reserve, assessment of coronary artery velocities in the LAD, and at a generic site.

CATEGORY	CLUSTER	MEASUREMENT
FLOW RESERVE	LAD	Vmax, s & d
	<ul><li>Baseline</li><li>Peak Hyperemia</li></ul>	<ul> <li>Mean Velocity, s, d, &amp; R-R</li> <li>VTI, s, d, &amp; R-R</li> </ul>
	Generic	Vmax, s & d
	<ul><li>Baseline</li><li>Peak Hyperemia</li></ul>	<ul> <li>Mean Velocity, s, d, &amp; R-R</li> <li>VTI, s, d, &amp; R-R</li> </ul>
VELOCITIES	LAD	Vmax, d
	<ul><li>Site 1</li><li>Site 2</li></ul>	<ul><li>Mean Velocity, d</li><li>VTI, d</li></ul>
	Generic	Vmax, d
	<ul><li>Site 1</li><li>Site 2</li></ul>	<ul><li>Mean Velocity, d</li><li>VTI, d</li></ul>

Ventricular Function<br/>StudyThe ventricular function study groups together the necessary<br/>measurements to calculate systolic and diastolic function for the left and<br/>right ventricles. It includes measurements such as wall stress, ejection<br/>fraction, mean dP/dt, mitral and tricuspid diastolic indices, and<br/>pulmonary and systemic venous flow. These measurements and<br/>calculations are made from 2-D, M-mode, and spectral Doppler images.

CATEGORY	CLUSTER	MEASUREMENT
LV SYSTOLIC	LV Shortening	LV Diam, d & s MV EPSS LVET AoV ET, Dop LVPW, s
	A4C, A/L & MOD	LV Area, A4C, d & s LV Major, A4C, d & s LV Vol, A4C MOD, d & s
	A2C, A/L & MOD	LV Area, A2C, d & s LV Major, A2C, d & s LV Vol, A2C MOD, d & s
	Peak Wall stress, Merid	LV, s LVPW, s
	Peak Wall Stress, Circum	LV, s LVPW, s LV Major A4C, s
	Apical Biplane, A/L & MOD	
	PSAX, Bullet	LV Area, pap, d & s LV Major, d & s
	Doppler	MR dP/dt AoV AT Aov ET
LV DIASTOLIC	MV Flow	MV VTI MV Peak E MV Peak A MV E at A MV DT MV A Dur LV IVRT
	Pulmonary Venous Flow	RUPV measurements RLPV measurements LUPV measurements LLPV measurements

CATEGORY	CLUSTER	MEASUREMENT
RV SYSTOLIC	2-D	RV Area, vw 1, d & s RV Major, vw 2, d & s
	Doppler	TR dP/dt PV AT PV ET
RV DIASTOLIC	TV Flow	TV VTI, leaflet tips TV Peak E TV Peak A TV DT TV A Dur
	System Venous Flow	SVC measurements IVC measurements
RESPIRATORY TRENDS	Mitral Valve	LV IVRT, insp & exp DT, insp & exp Peak, insp & exp Peak A, insp & exp
	Pulmonary Veins	Peak S, insp & exp Peak D, insp & exp Peak A, insp & exp
	Tricuspid Valve	DT, insp & exp Peak E, insp & exp Peak A, insp & exp
	Systemic Veins	IVC Peak S, insp & exp IVC Peak D, insp & exp IVC Peak A, insp & exp SIVC Peak S, insp & exp SVC Peak D, insp & exp SVC Peak A, insp & exp

### Performing Wall Motion Scoring

Wall motion scoring is a method of analyzing a completed stress echocardiography exam. During the stress echo exam, you store the views for all stages (parasternal long axis, parasternal short axis, apical two chamber and apical four chamber views) in the on-board Aegis digital image and data management system. The wall motion scoring package then displays the views with corresponding diagrams. Once you score the diagrams based on the wall motion legend, the system reports a wall motion scoring index.

- To perform Wall Motion Scoring:
- **1** Enter Aegis Review in a staged stress echo protocol.
- **2** Enter the cardiac calculation package.
- **3** Select Wall Motion Scoring.

The Review displays the four view clips for this particular stage. The view in the upper left hand quadrant is automatically selected for scoring.

Use the following keys:

CONTROL [SOFT KEY]	FUNCTION
[SCORE NEXT STAGE]	Moves the scoring diagram to the next stage.
[SCORE NEXT VIEW]	Moves the scoring diagram to the next view.
[HIDE DIAGRAM]	Removes the diagram so that the underlying image may be viewed.
[NEXT VIEW]	Advances to the next view in sequence.
ТАВ	Moves between regions.
TRACKBALL	Repositions current view to each of the four available quadrants.

- 4 Select a stage to score.
- **5** Select a view to score.
- **6** In the diagram that is associated with your selected view, choose the region that you want to score.
- **7** Type a score value between 0 and 5 inclusive for the active region, based on the degree of movement of the region.
  - 0-Unable to score
  - 1—Normal
  - 2—Hypokinetic
  - 3—Akinetic
  - 4-Dyskinetic
  - 5—Aneurysmal

For any stage, each region can have only one score. Typing a new number supersedes any previously entered number. Some regions appear in more than one diagram. For these regions, a score entered in any view will be displayed in all appropriate views. The score that was entered last for that region is considered the correct score.

**8** Score each region of the diagram.

- **9** Repeat steps 5 through 8 for each view.
- **10** Repeat steps 3 through 9 for each stage.

#### Calculations

- The following calculations are available for each stage of the study:Wall score index (sum of scores / number of regions scored)
- Percent normal functioning muscle (number of regions with score of 1 / number of regions scored)
- Ejection fraction (entered manually)
- Sub-score for each of three presumed coronary beds:
  - LAD (left anterior descending artery)
  - LCCA (left circumflex coronary artery)

RMCA (right main coronary artery)

The coronary beds comprise the following regions, as shown in the following illustration:

LAD = regions 1, 2, 7, 8, 13, 14, 15, 16

LCCA = regions 3, 4, 9, 10

RMCA = regions 5, 6, 11, 12



Using the Cardiac Calculation Report	The cardiac calculation report allows you to view and edit all of the measurements you perform and the subsequent calculations results. You can save the report to the on-board AEGIS system, record it to VCR,	
	Yor or cus pri for	u can save the report to the on-board AEGIS system, record it to VCR, print it to a local printing device. Use the system Setup function to stomize settings for your local black and white printer and color nter. See "Customizing Printing" in the <i>Administrator Manual</i> details.
	You con Cal to a pri ult sep <i>Ma</i>	u can send patient demographic data and calculation data to a personal mputer or printer connected to the ultrasound system's parallel port. e the system Setup function to select the format options for sending culation report data to a printer or for exporting calculation report data a personal computer (PC) for use in a database or spreadsheet. The nter options include printer selections for a PostScript <sup>TM</sup> format. The rasound system exports calculation report data to a PC in a comma- parated format. See "Customizing Printing" in the <i>Administrator</i> <i>mual</i> for details.
Accessing the Report	•	To display a report:
	1	Press CALC.
	2	Select <b>CARDIAC CALC</b> from the pop-up menu.
	3	Press REPORT.
	4	To display all of the available measurements and calculations on one page, select <b>[EXPAND]</b> .
	5	To display another page, select <b>[PAGE UP]</b> , <b>[PAGE DOWN]</b> , or toggle the <b>PAGE</b> key.
	6	To exit the report, press <b>REPORT</b> .
Report Editing	•	To edit a report:
	1	Display the report.
	2	Roll the trackball to position the cursor in an entry field and press the <b>SELECT KEY</b> to activate the field for editing.
		For Cardiac reports, the system displays the RESULT WORKSHEET.
	3	To edit a measurement, use the trackball to position the cursor on the measurement and then press a trackball <b>SELECT KEY</b> .
		<b>NOTE:</b> For fields containing numerical data, use valid entry values (0.001 to 9999). For fields containing text, type the text directly in the field.
	4	To delete a measurement, use the trackball to position the cursor on the measurement and then press a trackball <b>SELECT KEY</b> .
	5	Select [CLOSE] to save the changes.
	6	To exit the report, press <b>REPORT</b> .

### Report Controls and Soft Keys

CONTROL [SOFT KEY]	FUNCTION	
CALC	Activates the Calculation function.	
REPORT	Activates Report mode.	
	• When Cardiac Calcs is active, displays the Cardiac report.	
	<ul> <li>When Cardiac Calcs is not active, select [CARDIAC] to display the Cardiac report.</li> </ul>	
	To return to the image from Report mode, press <b>REPORT</b> .	
PAGE	Displays additional pages of the report.	
HOME	Displays the first page of a report.	
END	Displays the last page of a report.	
PRINT	Prints the displayed report page.	
IMAGE	Displays the live image.	
IMAGE STORE	Captures a digital image of a report to AEGIS.	
[CARDIAC]	Displays the report for the cardiac calculation package. Press <b>REPORT</b> , then select <b>[CARDIAC]</b> .	
[EXPAND]	Includes all of the available measurement and calculation headings. Typically, the report displays only values that have been entered or calculated.	
[PAGE UP]	Scrolls upward through the pages of the report.	
[PAGE DOWN]	Scrolls downward through the pages of the report.	
[OUTPUT TO PC]	Sends patient demographic data and calculation data to a personal computer (connected to the ultrasound system's parallel port) for use with an external database or spreadsheet.	
[PRINT]	Sends patient demographic data and calculation data to a printer connected to the ultrasound system's parallel port.	
	The ultrasound system sends the data in PostScript ${}^{\rm TM}$ format.	

### **OBSTETRICAL CALCULATIONS**

Overview	The Obstetrical Calculations (OB Calc) feature allows you to perform studies involving single gestations, twins, or multiple gestation pregnancies with up to six fetuses. Biometric and AFI measurements are used to perform these studies. Enter and change the number of fetuses in the Gestation field at the beginning or anytime during an exam. The Sequoia system saves all gestation entries upon closing the study.	
	<ul> <li>The Sequoia system records and reports separate measurements for each fetus. Multiple gestation reports and worksheets display the measurements and calculations for each fetus, but do not display them together. Each fetus has its own report page and worksheet. Navigate via soft key between fetuses while viewing report pages or worksheets.</li> <li>Similarly, navigate via soft key between report pages and worksheets while viewing any fetus.</li> </ul>	
Customize OB Calc	You can customize the following Exams Presets for OB Calc studies:	
	General Information	
	2-D measurements	
	• Formulas	

See "Customizing the OB Calculations" in the *Administrator Manual* for information using various regression equations. Note that the equations are valid only within the limits provided.

Using the Calculation Package

### • To enter the calculation package:

- 1 Press CALC.
- **2** Select **OB CALC** from the pop-up menu.
- **3** Press **CALC** to exit the OB calculation package.

### Taking Measurements

- To take measurements:
- **1** Enter the OB Calc package.
- **2** Select the Biometry measurement you want from the pop-up menu, or select AFI to take AFI measurements.



**3** Use the following keys to take measurements (for multiple gestations):

**NOTE:** Enter the number of gestations in the Patient Demographic page.

CONTROL	FUNCTION
[SINGLE/A/B]	Select <b>[SINGLE/A/B]</b> until <b>SINGLE</b> is highlighted, or until fetus <b>A</b> or <b>B</b> is highlighted for twin gestations.
	When the gestation number is unknown at measurement onset, the soft key display will default to <b>[SINGLE/A/B]</b> .
[A/B]	Select <b>[A/B]</b> until the corresponding fetus <b>(A</b> or <b>B</b> ) is highlighted. This soft key is displayed only when two gestations are selected on the Patient Demographic page.
[A/B/C/D/E/F]	Multiple gestation exams require that you select each fetus separately for measurement. Select <b>[A/B/C/D/E/F]</b> until the corresponding fetus ( <b>A</b> , <b>B</b> , <b>C</b> , <b>D</b> , <b>E</b> , or <b>F</b> ) is highlighted.
	For multiple gestations with greater than six fetuses, enter the fetus information in the <b>A</b> , <b>B</b> , <b>C</b> , <b>D</b> , <b>E</b> , and <b>F</b> fields, and add the additional fetuses (with corresponding data) in the Comments field.
[ <sup>()</sup> SELECT]	Press to select the measurement you want to perform from the pop-up menu.

CONTROL	FUNCTION
[ <sup>(())</sup> ENTER]	Press to enter the current measurement.
PRINT	Enters the current measurement and prints the display to the selected print device.
IMAGE STORE	Captures a digital image of a report or worksheet to AEGIS.

### Biometric Measurements

The calculation package supports the following biometric measurements. When you select the measurement, the corresponding tool appears.

MEASUREMENT	DESCRIPTION	TOOL
BPD	Biparietal diameter	Caliper pair
HC	Head	Ellipse, Trace, or 2-pair Calipers
	circumference	You must use ellipse to calculate the cephalic index (CI).
AC	Abdominal circumference	Ellipse, Trace, or 2-pair Calipers
FL	Femur length	Caliper pair
CRL	Crown rump length	Caliper pair
OPT1 - OPT4	User-defined	Depends on definition

### AFI Measurements and Calculations

The OB calculation package supports measurement of the amniotic fluid quadrants and reports the amniotic fluid index (AFI). To calculate the AFI, you use the caliper tool to measure the amount of amniotic fluid in the four quadrants of the uterus.

Using the The OB calculation worksheet displays the results of each measurement **OB** Calculation you take. You can select it at any time while taking a measurement, and can edit or delete any measurement result. As an option, use the **TAB** and Worksheet, Report, **RETURN** keys to navigate through the text entry fields within and Growth Curves the worksheet. You can save the worksheet or report to the on-board AEGIS system, record it to VCR, or print it to a local printing device. Use the system Setup function to customize settings for your local black and white printer and color printer. See "Customizing Printing" in the Administrator Manual for details. You can send patient demographic data and calculation data to a personal computer or printer connected to the ultrasound system's parallel port. Use the system Setup function to select the format options for sending calculation report data to a printer or for exporting calculation report data to a personal computer (PC) for use in a database or spreadsheet. The printer options include printer selections for a PostScript<sup>TM</sup> format or OB text report format (ASCII). The output to PC selection exports calculation report data to a PC in a comma-separated format or an OB text report format. See "Customizing Printing" in the Administrator Manual for details. **Report and Worksheet** The OB report displays a summary of the information in the OB Description worksheet. For example, instead of displaying each value you recorded for a measurement, it displays the average of all values. A feature of the OB report is to display Estimated Fetal Weight (EFW) in metric and English units. You can display the OB report at any time from the OB worksheet. When viewing reports, single gestation data displays in one screen. Twins **Multiple Gestations and Reports and Worksheets** display together on the same screen. Multiple gestations display one at a time (like single gestations). For twins worksheet and for multiple gestation worksheet and report, select each gestation by pressing **[SELECT FETUS]** until the desired selection (**A**, **B**, **C**, **D**, **E**, or **F**) is displayed. **Growth Curves** Growth curves show the development of the fetus (or fetuses) graphically Description by plotting measurement data from the current exam and data that you enter from prior exams (see "Entering Previous Exam Data" on page 277). Growth curves are available for all measurements and ratios, with the exception of CI, for which you have entered values. **NOTE:** The system does not support growth curves for labelled linear measurements (LLM). For twin exams, the growth curve plots data points for each twin on the same graph; an X represents a data point for fetus A and a + represents a data point for fetus B.

#### Multiple Gestations and Growth Curves

For multiple gestations, the growth curve plots data points for each gestation on the same graph. Use **[SELECT FETUS]** to move to each gestation, allowing selection and plotting of each fetus individually. An **X** represents a data point for the selected fetus, while all other gestations are represented by a + to display data points.



#### Accessing the Report, Worksheet, or Growth Curves

### • To display a report or worksheet:

- 1 Press CALC.
- 2 Select **OB CALC** from the pop-up menu.
- 3 Press REPORT.
- **4** To scroll through report or worksheet pages, select **[PAGE DOWN]** or toggle the page key.
- 5 To exit the worksheet and display the report, select [GO TO REPORT].
- 6 To exit the report and display the worksheet, select [GO TO WORKSHEET].
- 7 To exit the report or worksheet, press **REPORT**.
- To display growth curves:
- **1** Display the OB report, and press **[PAGE DOWN]** until the growth curve page appears.
- **2** To view a specific curve, select it from the growth curve pull-down menu.
- **3** To select the MA used for the growth curve, select the date from the MA pull-down menu.
- **4** To exit the growth curve display, do one of the following:
  - **[GO TO WORKSHEET]** to return to the OB worksheet.
  - Toggle **PAGE** down to access other report displays.
  - Press **REPORT** to leave the worksheet or report and return to the image.

Worksheet Editing

### • To edit a worksheet:

- **1** Display the worksheet.
- **2** Roll the trackball to position the cursor in an entry field and press the **SELECT KEY** to activate the field for editing.

**NOTE:** For fields containing numerical data, use valid entry values (0.001 to 9999). For fields containing text, type the text directly in the field.

- **3** Press the **RETURN** key to complete an entry.
- 4 To exit the report, press **REPORT**.

Report, Worksheet, and Growth Curves Controls and Soft Keys

CONTROL [SOFT KEY]	FUNCTION
CALC	Activates the Calculation function.
REPORT	Activates Report Mode.
	• When OB Calcs is active, displays the Obstetric report or worksheet.
	• When OB Calcs is not active, select <b>[OB]</b> to display the Obstetric report or worksheet.
	To return to the image from Report mode, press <b>REPORT</b> .
PAGE	Displays additional pages of the report or worksheet.
PRINT	Prints the displayed report or worksheet page.
IMAGE STORE	Captures a digital image of a report or worksheet to AEGIS.
[OB]	Displays the report for the Obstetric calculation package. Press <b>REPORT</b> , then select <b>[OB]</b> .
[SELECT FETUS]	Selects the worksheet and/or report for a multiple gestation (A, B, C, D, E, or F).
[GO TO REPORT]	Exits a worksheet and displays the corresponding report.
[GO TO WORKSHEET]	Exits a report and displays the corresponding worksheet.
[PAGE DOWN]	Scrolls downward through the pages of the report or worksheet.
[OUTPUT TO PC]	Sends patient demographic data and calculation data to a personal computer (connected to the ultrasound system's parallel port) for use with an external database or spreadsheet.
	The ultrasound system sends the data in the format specified in the system Setup menu.

	CONTROL [SOFT KEY]	FUNCTION
	[PRINT]	Sends patient demographic data and calculation data to a printer connected to the ultrasound system's parallel port.
		The ultrasound system sends the data in the format specified in the system Setup menu.
		<b>NOTE:</b> Either the worksheet or report will be printed depending on which is currently displayed.
Entering Previous Exam Data	You can enter data multiple gestations	from previous exams for a single fetus, twins, or s on the Prior Ultrasound Data screen.
	To enter data:	
	<b>1</b> display the pat	ient demographic page.
	2 Enter the prior press [PRIOR S	exam information in the appropriate data fields and <b>TUDY DATA]</b> .
	The Prior Ultra	asound Data screen appears.
	3 If you are perfe between fetuse [SELECT FETU Ultrasound Da	brming a twin exam, press <b>[SELECT FETUS]</b> to switch es. When performing a multiple fetus exam, use <b>S]</b> to select each fetus individually. There is a Prior ta screen for each fetus.
	4 Press [PRIOR M [IMAGE] to retu	<b>IENU]</b> to return to the patient demographic page, or urn to imaging.
	<b>NOTE:</b> To disp OB Calculatior worksheet and Data screen ap	blay the Prior Ultrasound Data screen from within the ns package, press <b>[GO TO REPORT]</b> to display the then press <b>[PAGE DOWN]</b> until the Prior Ultrasound pears.

Chapter 29 - Obstetrical Calculations

### **GYNECOLOGY CALCULATIONS**

Overview	The Gynecology Calculation (GYN Calc) package provides the ability to perform calculations and measurements for Gynecologic, Fertility, and Infertility studies. Upon completing measurements, you can review the results in the Calc reports.
	Use the GYN Calc package to perform distance measurements in 2-D mode and trace measurements in Doppler mode. When using Doppler, measurements are displayed but not selectable until invoking Cine and Freeze modes. In strip mode (PW, CW, Aux CW), only Doppler studies and measurements are displayed.

Use Setup to customize GYN Calc by switching measurements on or off. Only measurements that are switched on are available in the pop-up menus. See the *Administrator Manual* for details.

### Measurement Screens and Menus

2-D Measurement Menu



Doppler Measurement Menu


Using GYN	To enter and exit the GYN Calc package:					
Calculations	1	Press CALC.				
	2	Select GYN CALC	from the pop-up menu.			
	3	Press CALC to exi	t the GYN calculation package.			
Performing Measurements	The GYN Calc package allows you to perform measurements using 2-D or Doppler modes. All 2-D measurements are performed using calipers. All Doppler measurements are performed using a strip trace. For mode-specific measurements, see the <i>Administrator Manual</i> .					
	•	To perform meas	surements:			
	1	1 Enter the GYN Calc package.				
	2	Select an applicat	ple structure from the Structure pop-up menu.			
	3	Select a measurer menu and perfor measurement, the	nent from the corresponding Measurement pop-up m the measurement. (When you select a e pop-up menu disappears and tools are invoked.)			
	4	Select <b>[ENTER]</b> to can also double-c	enter the data into the Calculations package. You lick a trackball <b>SELECT</b> key.			
	Yo me	u can now perform easure menu to sele	the same measurement again or return to the ect another measurement.			
Performing Measurements from AEGIS Review	You can perform measurements on any AEGIS image from quad or full screen views. Pressing <b>IMAGE STORE</b> , or <b>PRINT</b> enters the current measurement into the Calculations package.					
Performing Measurements from VCR	You can perform measurements during VCR playback when you freeze the image by pressing the <b>FREEZE</b> key. To do this you must first perform manual calibration. Pressing <b>PRINT</b> , <b>IMAGE STORE</b> , or a trackball <b>SELECT</b> key enters the current measurement into the Calculations package.					
Performing Measurements from Cine	You can perform 2-D measurements while in Cine play or C freeze modes. Pressing <b>PRINT</b> enters the current measureme Calculations package.		measurements while in Cine play or Cine g <b>PRINT</b> enters the current measurement into the			
	Doppler measurements must be performed while in Cine freeze. Cine settings affect the Doppler measurement availability status. The following table shows these effects:					
	С	INE STATUS	DOPPLER MEASURE MENU			
	F	reeze Invoked	Menu measurements change to available status and display measurement tools.			
	С	ine Play Invoked	Menu measurements change to unavailable status.			
	E	xit Cine	Menu measurements change to unavailable status.			

### Using the GYN Calculation Report

The gynecology calculation report allows you to view and edit all of the measurements you perform and the subsequent calculations results.

You can save the report to the on-board AEGIS system, record it to VCR, or print it to a local printing device. Use the system Setup function to customize settings for your local black and white printer and color printer. See "Customizing Printing" in the *Administrator Manual* for details.

You can send patient demographic data and calculation data to a personal computer or printer connected to the ultrasound system's parallel port. Use the system Setup function (the Printing/PC Setup menu) to select the format options for sending calculation report data to a printer or for exporting calculation report data to a personal computer (PC) for use in a database or spreadsheet. The printer options include printer selections for a PostScript<sup>TM</sup> format. The ultrasound system exports calculation report data to a PC in a comma-separated format. See "Customizing Printing" in the *Administrator Manual* for details.

## Report DescriptionGYN Calc reports display up to three instances for most measurements.<br/>When more than three instances are entered, the oldest value is<br/>overwritten by each new instance.

Each report page has a header at the top of the page. The same header is used for all report pages. Header information is taken from the patient demographic page when the study was initiated.



- **LMP** is entered in the patient demographic page or the GYN Calc Report page. If the LMP is changed or deleted in the patient demographic page or in OB report, it is updated or deleted from the GYN Report page.
- **Day of Cycle:** the LMP date is the first day of a cycle. The Day of Cycle increments by one day for each day after LMP. For example, if the LMP is January 1 and today is January 2, today's Day of Cycle equals 2. Day of Cycle is automatically computed only when LMP is entered.

Day of Cycle has two choices - LMP or Medication. Medication is used to indicate a drug-induced cycle.

Accessing the Report	•	To display a report:
	1	Press CALC.
		Select GYN CALC from the pop-up menu.
		Press REPORT.
		To display another page of the report, select <b>[PAGE UP]</b> and <b>[PAGE DOWN]</b> or toggle the <b>PAGE</b> key.
	5	To exit the report, press <b>REPORT</b> .
Report Editing	•	To edit a report:
	1	Display the report.
	2	Roll the trackball to position the cursor in an entry field and press the <b>SELECT KEY</b> to activate the field for editing.
		<b>NOTE:</b> For fields containing numerical data, use valid entry values (0.001 to 9999). For fields containing text, type the text directly in the field.
	3	Press the <b>RETURN</b> key to complete an entry.
	4	To exit the report, press <b>REPORT</b> .
Report Controls and		

Soft Keys

CONTROL		
[SOFT KEY]	FUNCTION	
CALC	Activates the Calculation function.	
REPORT	Activates Report mode.	
	• When GYN Calcs is active, displays the GYN report.	
	• When GYN Calcs is not active, select <b>[GYN]</b> to display the Gynecology report.	
	To return to the image from Report mode, press <b>REPORT</b> .	
PAGE	Displays additional pages of the report.	
HOME	Displays the first page of a report.	
END	Displays the last page of a report.	
PRINT	Prints the displayed report page.	
IMAGE STORE	Captures a digital image of a report to AEGIS.	
[GYN]	Displays the report for the gynecology calculation package. Press <b>REPORT</b> , then select <b>[GYN]</b> .	
[PAGE UP]	Scrolls upward through the pages of the report.	
[PAGE DOWN]	Scrolls downward through the pages of the report.	
[OUTPUT TO PC]	Sends patient demographic data and calculation data to a personal computer (connected to the ultrasound system's parallel port) for use with an external database or spreadsheet.	

CONTROL [SOFT KEY]	FUNCTION
[PRINT]	Sends patient demographic data and calculation data to a printer connected to the ultrasound system's parallel port.
	The ultrasound system sends the data in a PostScript <sup>™</sup> format.

### **Report Pages**

REPORT PAGE	DISPLAY INFORMATION
UTERUS	2-D measurements and calculations.
	Doppler measurements and calculations.
	Endometrium thickness.
	Cervix length.
RIGHT AND	2-D measurements and calculations.
LEFT OVARY	Doppler measurements and calculations.
RIGHT AND LEFT FOLLICLE	Measurements and calculations for each ovary follicle (up to 16). The data that displays is determined by the selections made in GYN Setup.
	• Volume: displays a single diameter and volume for each follicle.
	• Average Diameter: displays up to three diameters with the average diameter for each follicle. If more than three diameters are measured, the oldest measurement is discarded.
DOPPLER	Doppler measurements and calculations for four generic sites. The site names can be customized in GYN Setup.
COMMENTS	The comment pages display user comments. The first page contains 12 comment lines. Each comment line has a comment label and a comment text field. You can customize the labels in Setup.
	The second comment page has a general comments field where you can add free-form comments. Unlike the OB report, this general comment field is not the same as the comment field in the patient demographic page.

Chapter 30 - Gynecology Calculations

### **AXIUS AUTO EJECTION FRACTION**

Overview	Available on Sequoia C256 Echocardiography Systems, Sequoia C512 Echocardiography Systems, and on Sequoia 512 Ultrasound Systems with the Cardiac Option.
	(Requires software version 10.0 or higher.)
	This option has minimum hardware requirements. Contact your Siemens representative for information regarding the requirements.
	Axius Auto Ejection Fraction technology automatically traces an outline of the endocardial border of the left ventricle for the end-diastolic and end-systolic images (ED and ES images) on an apical four-chamber (A4C) or apical two-chamber (A2C) view of the heart. Axius Auto EF technology also includes methods for manually tracing the border of the left ventricle.
Calculation Data and Measurements	When the border outlines for the ED and ES images are complete, Axius Auto EF generates the following calculation data and measurements:
	End-diastolic volume and end-systolic volume measurements
	• Ejection Fraction (EF)
	• Heart Rate (HR)
	You can enter the calculation data and measurements into the report for the Cardiac Calculation package (Cardiac report).
Contrast Studies	Axius Auto EF includes a guided method for tracing an outline of the border of the left ventricle for contrast studies.
Compatible Clips	You can activate Axius Auto EF for any clip that contains only 2-D mode data. Axius Auto EF is recommended for use only on the apical four-chamber (A4C) or apical two-chamber (A2C) view of the adult heart.
	Axius Auto EF is compatible with clips that are acquired on systems with cathode ray tube (CRT) monitors.

### Example of View Selection Screen

The system displays the view selection screen when you activate Axius Auto EF. The view selection screen prompts you to select the required image view.







#### Controls

The controls used for Axius Auto EF technology consist of soft keys, controls on the keyboard, and on-screen selections.

Soft Keys and Controls on the Keyboard

[SOFT KEY]	
CONTROL	FUNCTION
GAIN/FRZ/RUN	When pressed, begins or stops playback of the clip frames. When rotated, advances or rewinds the clip, frame-by-frame.
[STOP]	Stops playback of the clip frames.
2D GAIN	Changes the gamma curve (brightness) of the active image.
RES	Activates the zoom function for the 2-D images.
TRACE	Hides or displays the outlines and their long axes, including any markers on the images. Calculation data and measurement values continue to display at the bottom of the screen.
[SHOW TRACE]	Redisplays hidden outlines and their long axes, including any markers on the images.
[FLIP LEFT/ RIGHT]	Reorients the image view selection from left-to-right to right-to-left to match the orientation of the clip.
[AUTO/ MANUAL]	Toggles the automatic trace method with the manual trace method for generating an outline.
[GUIDED/ MANUAL]	Available for contrast studies only. Toggles the guided trace method with the manual trace method for generating an outline.
[APPLY]	Available for non-contrast studies only. Applies the Axius Auto EF algorithm to all frames in the clip.
[SET ED]	Selects the currently displayed frame as the representative frame for the End Diastole image.
[SET ES]	Selects the currently displayed frame as the representative frame for the End Systole image.

[SOFT KEY] CONTROL	FUNCTION
[BACK-UP]	Erases the most recent segment or marker of the user-created outline.
[MARK]	Activates the mark function for generating an outline from positioned points along the border.
[MARK 1ST]	Anchors the first marker for the guided trace method.
[MARK 2ND]	Anchors the second marker for the guided trace method.
[MARK LAST]	Anchors the last marker for the guided trace method.
[DRAW]	Activates the trace drawing function for generating and outline.
[() NEXT CYCLE]	Displays the next heart cycle within a multiple-cycle clip.
[(( )) END TRACE]	Completes an outline.
[ENTER]	Enters the calculation data and measurements into the report for the Cardiac Calculation package.
[EXIT]	Exits Axius Auto EF.

### **On-screen Selections**

SELECTION	DESCRIPTION
A4C	Selects the apical four-chamber image view (non-contrast) for the displayed clip.
A2C	Selects the apical two-chamber image view (non-contrast) for the displayed clip.
A4C Contrast	Selects the contrast apical four-chamber image view for the displayed clip.
A2C Contrast	Selects the contrast apical two-chamber image view for the displayed clip.
•	Displays the previous heart cycle.
	Displays the next heart cycle.
1 6 2 7 3 8 4 9 5 10	Indicates the selected heart cycle from multiple-cycle clips.

### Activating and Exiting Axius Auto EF

You can activate Axius Auto EF for a selected, compatible clip in live or restarted studies, previous studies, or teaching files.

When you activate Axius Auto EF, the system prompts you to select an image view. If you select a non-contrast image view, then the system automatically selects and displays representative frames for the End Diastole (ED) image and the End Systole (ES) image, outlines the border of the left ventricle, and generates the calculation data and measurements and the volume graph.

**NOTE:** The system traces an outline within an image sector (the image display area) only; you can adjust the outline outside the sector, if necessary.

When Axius Auto EF is active, you can complete the following standard functions: annotate, print, record to VCR, and store clips and images. For more information on these functions, see Chapter 6 and Chapter 8.

### • To activate Axius Auto EF:

**NOTE:** If the required clip is from a previous study and you plan to store more images, then either restart the study or create and restart a teaching file containing the clip. See "Restarting a Study" on page 35 and/or "Creating a Teaching File" on page 64.

**1** Press **REVIEW** to display the clip in the review screen.

The system displays the stored images and clips.

- **2** Roll the trackball to position the cursor on the required clip. (You can press **QUAD** to display the required clip in full-screen format.)
- **3** Press **AUTO MEASURE**.

If the selected clip is compatible with more than one Axius application, then the system displays a list of applications on the upper right of the screen.

4 If required, select **Auto EF** from the displayed list on the upper right of the screen.

The system displays the selected clip on the screen with image views for your selection.

- **5** To reorient the image views to match the orientation of the clip, select **[FLIP LEFT/RIGHT]**.
- **6** Select the required image view to display the Auto EF screen.
  - For non-contrast studies, you can view the automatically generated outline, calculation data and measurement, and the volume graph after selecting the image view.
  - For contrast studies, you can use the guided method to generate an outline by positioning points along the border of the left ventricle after selecting the image view. See "Using the Guided Method to Generate an Outline from Positioned Points (Contrast Studies Only)" on page 295.
  - For contrast and non-contrast studies, you can manually trace an outline. See "Manually Tracing an Outline of the Border of the Left Ventricle" on page 296.
- 7 Play back the clip. You can optionally activate the zoom function or play the clip back with or without the outline displayed.
  - (a) To begin clip playback, press **GAIN/FRZ/RUN**. Press **GAIN /FRZ/RUN** again to stop clip playback or select **[STOP]**.
  - (b) To hide the outline and the long axis, press TRACE. Press TRACE again or select [SHOW TRACE] to redisplay the outline and the long axis on the image.
  - (c) To activate the zoom function, press **RES**. Press **RES** again to exit the zoom function.
- **8** To exit Axius Auto EF, choose a method:
  - Select [EXIT].
  - Press AUTO MEASURE.
  - Press **REVIEW** (also exits the review screen).
  - Press **DELETE** (also deletes the displayed clip).

## Viewing Frames and<br/>Heart CyclesYou can view clip frames. You can also select heart cycles from multiple-<br/>cycle clips.

**NOTE:** The system displays up to ten heart cycles of a multiple-cycle clip.

When you stop playback of the clip, the system automatically displays the End Diastole image (ED image) on the left of the screen and the End Systole image (ES image) on the right of the screen.

The frame number on the upper left of each image indicates the displayed clip frame. The system displays an indicator at the point on the ECG trace that corresponds to the currently displayed heart cycle.

- To review the frames in the clip:
- Rotate the **GAIN/FRZ/RUN** control.
- To begin or stop playback of the clip:
- Press the **GAIN/FRZ/RUN** control.
- To select another heart cycle from a multiple-cycle clip, choose a method:
- Select a heart cycle button or an arrow button from the lower left of the screen by rolling the trackball to position the cursor on the button and then pressing a trackball **SELECT** key.

### Changing the Representative Frames

You can change the representative frames for the End Diastole image (ED image) and the End Systole image (ES image).

The system places frame corners around the currently selected image (left or right image). The frame number on the upper left of each image indicates the displayed clip frame.

- To change the representative frame for the ED image:
- 1 Roll the trackball to position the cursor on the left image.
- **2** Rotate the **GAIN/FRZ/RUN** control to display the required frame and then select **[SET ED]**.
- To change the representative frame for the ES image:
- 1 Roll the trackball to position the cursor on the right image.
- **2** Rotate the **GAIN/FRZ/RUN** control to display the required frame and then select **[SET ES]**.

Using the Guided Method to Generate an Outline from Positioned Points (Contrast Studies Only)

(For contrast studies only.)

You can generate an outline from positioned points along the border of the left ventricle that indicate the locations of the apex and the mitral annulus boundaries.

When you complete the positioning of points, the system exits the selected outlining function and displays the outline and its long axis on the image. When you complete generated outlines on both representative frames (ED and ES images), the system generates and displays the calculation data and measurement values at the bottom of the screen.

- To generate an outline on a contrast image from positioned points along the border:
- 1 Select [GUIDED/MANUAL] until Guided is highlighted.
- **2** Specify the landmarks (the apex and the left and right boundaries of the mitral annulus) for each representative frame (ED image and ES image):
  - (a) Roll the trackball to position the marker at the first landmark and then select **[( ) MARK 1ST]** to anchor the marker.
  - (b) To erase (undo) the most recent marker (any landmark), select **[BACK-UP]**.
  - (c) Roll the trackball to position the marker at the second landmark and then select **[() MARK 2ND]** to anchor the marker.
  - (d) Roll the trackball to position the marker at the last landmark and then select **[( ) MARK LAST]** to anchor the marker.

**NOTE:** The landmarks are adjustable when the heart cycle is active and calculation data has not been entered into the Cardiac Calculation package.

### Manually Tracing an Outline of the Border of the Left Ventricle

You can manually trace an outline of the border of the left ventricle using either the trace drawing function or the mark function. The outline and the long axis are adjustable. The system generates calculation data and measurements based on the outline and representative frames.

When you complete a traced outline, the system connects the first and last markers with a straight line, exits the trace function, and displays the outline and its long axis on the image. When you complete traced outlines on both representative frames (ED and ES images), the system generates and displays the calculation data and measurement values at the bottom of the screen.

- To manually trace an outline on each representative frame (ED and ES image):
- **1** Select **[AUTO/MANUAL]** or **[GUIDED/MANUAL]** until **Manual** is highlighted.
- **2** To use the trace drawing function:
  - (a) Position the cursor at the left or right boundary of the mitral annulus and then select **[DRAW]** to activate the trace function and anchor the first marker.
  - (b) Roll the trackball to manually trace the border of the left ventricle.
  - (c) To erase (undo) the most recent segments of the outline, repeatedly select **[BACK-UP]**.
  - (d) To anchor the last marker, press a trackball **SELECT** key or select **[(( )) END TRACE]**.
- **3** To use the mark function:
  - (a) Position the cursor at the left or right boundary of the mitral annulus and then select **[MARK]** to activate the trace function and anchor the first marker.
  - (b) For each point, roll the trackball to position the marker at the required location and then select **[MARK]** to anchor the marker.
  - (c) To erase (undo) the most recent marker, select [BACK-UP].
- **4** For non-contrast studies, select **[() APPLY]** to apply the Axius Auto EF algorithm to all frames in the clip.

### Adjusting the Outline and Repositioning the Long Axis

You can adjust the outline and reposition its long axis. The system automatically updates the calculation data and measurements according to your adjustments.

The system indicates that an outline is available for adjustment and a long axis is available for repositioning by coloring the outline green. After the calculation data and measurements are entered into the report for the Cardiac Calculation package, the outline is colored gray on all frames to indicate that adjustment/repositioning is not available.

**NOTE:** The outline and long axis for the current heart cycle cannot be changed after you enter the calculation data and measurements into the report for the Cardiac Calculation package. You can exit and then reactivate Axius Auto EF to recalculate and re-enter calculations into the Cardiac report.

- To adjust the outline of the border for the displayed ED or ES frame only:
- 1 Roll the trackball to position the cursor on or near a segment of the outline and then press and hold a trackball **SELECT** key to select the segment.
- 2 Roll the trackball to reposition the segment and then release the trackball **SELECT** key to deselect the segment.

The system updates the calculation data and measurement values at the bottom of the screen. For non-contrast studies, the system also updates the data for the selected frame in the volume graph.

**3** For non-contrast studies, select **[() APPLY]** to apply the Axius Auto EF algorithm to all frames in the clip.

The system automatically adjusts the outline on all frames in the clip.

#### • To reposition the long axis within the outline:

**NOTE:** The base of the long axis is always at the center of the mitral annulus. You can reposition the long axis.

- **1** Reposition the long axis:
  - (a) Roll the trackball to position the cursor on the dot located on the long axis.

The system changes the color of the dot to green to indicate that the axis is available for selection.

(b) Press a trackball **SELECT** key to select the axis.

The system changes the color of the axis to green to indicate that the axis is available for repositioning.

(c) Roll the trackball to reposition the axis and then press a trackball **SELECT** key.

The system anchors the position of the long axis, updates the calculation data and measurement values at the bottom of the screen, and deselects the axis. For non-contrast studies, the system also updates the data for the selected frame in the volume graph.

**2** For non-contrast studies, select **[() APPLY]** to apply the Axius Auto EF algorithm to all frames in the clip.

The system automatically adjusts the long axis on all frames in the clip.

End-diastolic volume calculated for the

End-systolic volume calculated for the selected view

selected view

Entering Calculation Data and	You can enter Axius Auto EF calculation data and measurements into the report for the Cardiac Calculation package (Cardiac report).				
Measurements into the Cardiac Report	Use the Cardiac report to view and edit calculation data and measurements. The system displays an next to automatically-generated calculation data and measurements and indicates the selected image view. See "Types of Measurements" on page 254 for reporting details.				
Indicators of "Entered" Heart Cycle Data	Graphics on the Auto EF screen indicate when calculation data and measurements for the current heart cycle are already entered into the Cardiac report.				
	• Diagonal lines ar the left ventricula	e positione ar volume.	ed on the image for the calculated area of		
	• A square-shaped indicator displays above the corres cycle number on the lower left of the screen.				
	<b>NOTE:</b> You can exit and then reactivate Axius Auto EF to recalculate a re-enter calculations into the Cardiac report.				
	To enter Axius Auto EF data into the Cardiac report:				
	• Select [ENTER].				
	• To view the Care	diac repor	t:		
	• Press <b>REPORT</b> and then select <b>[CARDIAC]</b> .				
	• To redisplay	the Auto E	EF screen, select [IMAGE].		
Axius Auto EF Calculation Data and					
Measurements	MEASUREMENT	UNIT	DESCRIPTION		
	EF	%	Ejection Fraction calculated for the selected view		
	HR	bpm	Heart rate detected by the system for the selected view		

ml

ml

EDV

ESV

Chapter 31 - Axius Auto Ejection Fraction

### CHAPTER 32

### **AXIUS EDGE ASSISTED EJECTION FRACTION**

Overview	The Axiu border de ventricula Using Ax Diastole ( A2CH vie	s Edge Assi etection that ar volume, e ius Edge As ED) and En ews.	sted Ejectio is used to jection fra- sisted EF, d Systole (	on Fraction (I automate me ction, stroke you can perfe ES) measure	EF) feature prove easurements for volume, and cas form left ventrice ments on A4CH	rides assisted left rdiac output. ular End I or
	The appli identifica can then I frames of on the lef green ind frame and into the C	cation assis tion of Mitr. be entered in up to six he t and ES is of icate curren d non editab Cardiac Calc	ts in tracin al Annuli a n the Card artbeats ar on the righ tly editabl ple cycles. ( ulation pag	g A4CH and and ventricul iac Calculatic e displayed s t. Border trac e features; gr Once heart cy ckage, the fea	A2CH (based o ar apex). The m on package. ED side-by-side. The e and major axi ay indicates the rcle data has been tures are no lor	on landmark leasurements and ES e ED image is s shown in e inactive en entered nger editable.
Display Screens	The Sequ in the dat	oia system c a display bo	lisplays the	e following E	dge Assisted El	F calculations
	• End o	liastolic vol	ume and e	nd systolic v	olume measure	ments
	• Eiecti	on Fraction	(EF)	j		
	<ul> <li>Strok</li> </ul>	e Volume (S	$(\Sigma I)$			
	Cardi	iac Output (	$(\mathbf{O})$			
	• Hoar	t Rato (HR)	00)			
	• Hear	i Kate (IIK)		Interne D	inglass Avaa	
		Fram	e Numb <u>er</u>	Image D	isplay Area	Activo cido
	EF :	\$57076.10227166	5		29 May	Frame Corner
		開#46	a a	開#57	· - 7	(for this particular view)
		ED		ES		, ,
Gray Non Edita Border Tra	ble					—Green Editable border Trace
Heart Cy	cle	Cvcle: 1234	56			— ECG graphic
Data Display E Soft Ke	Box —	EF %: 57.6 EDV (ml): 154.5	SV (ml): 89.0	CO (L/min): 4.18 ESV (ml): 65.5	HR (bpm): 47 View:A4C	- View Indicator

Border Trace	The border trace maps the edge of the left ventricle for both ED and ES measurements. The measurements are based on the placement of a Ventricular Apex landmark and two Mitral Annuli landmarks. The landmarks are adjustable as long as the heart cycle is active and has not been entered into the Cardiac Calculation package. The border trace is either green or gray.
	• Green border trace: represents the active frame with a border trace that can be adjusted.
	• Gray border trace: represents the inactive frame, an active or inactive frame in which the calc data has been entered into the Cardiac Calculations package.
	Adjustments applied to an active border trace update the corresponding calculations displayed in the data display box. See "Adjusting Border Trace" on page 309 for detailed steps to perform a border trace adjustment.
CALC Entered Indicator	When the heart cycle measurements are entered into the Cardiac Calculation package, a white indicator displays above that cycle number. No further edits can be applied to that heart cycle measurement.
	<b>NOTE:</b> Once exiting the Edge Assisted EF application, you can select clips previously entered into the Cardiac Calculations package, and perform new measurements on these clips.
Data Display Box	The data display box is the area on the screen where calculations are displayed. It has two rows of information. The upper row displays derived calculations based on the landmark and border trace placement. The lower row displays ED and ES volume measurements plus the view selection (A4C or A2C). Editing the border trace immediately updates all calculations and measurements.
ECG Graphic	The ECG graphic is synchronized with the active side of the display. As you scroll through a clip, an indicator traces the ECG at the same point that relates to the heart cycle currently displayed. Changes made to the active side are applied accordingly to the ECG display.
Frame Number	The frame number corresponds to the frame being displayed within a clip. It is displayed for each of the ED and ES images in the upper right- hand corner of the image. Only one frame is active at a time. Simply select a frame to make it the active frame (use the trackball and <b>SELECT KEYS</b> ). The active frame is indicated by displaying the frame corners.
Heart Cycle	You can review up to six heart cycles within a captured clip. If a clip contains more than six cycles, only the first six are accepted for review. Heart cycles display as shown in the following depiction:
	Heart Cycle display with four cycles:
	Heart Cycle display with six cycles:

	To select a heart cycle, use one of the following methods:
	• Press <b>PAGE</b> up or down to select another cycle.
	• Use the trackball and <b>SELECT KEYS</b> to click directly on the heart cycle number.
	• Use the keyboard to press the numeric key (1 through 6) that corresponds to the desired heart cycle.
	<ul> <li>Use the trackball and SELECT KEYS to click on the PREVIOUS or NEXT arrows to activate a different heart cycle.</li> </ul>
	<ul> <li>Clicking the <b>PREVIOUS ARROW</b> when the first heart cycle is active, activates the last heart cycle in the clip.</li> </ul>
	<ul> <li>Clicking the NEXT ARROW  when the last heart cycle is active, activates the first heart cycle in the clip.</li> </ul>
	The <b>PREVIOUS</b> and <b>NEXT</b> arrows are inactive when there is only one heart cycle in the clip.
Image Display Area	When you enter Edge Assisted EF both the ED and ES images are frozen. The first time Edge Assisted EF is invoked the application enters Guided mode. Generally, either Guided or Manual mode is highlighted and active at all times. If the image in the active side does not correspond to the generated border trace image, then neither field is highlighted or active. Pressing <b>[GUIDED/MANUAL]</b> in this scenario re-invokes the last used method on the current image. To activate the inactive side of the display, click within the inactive side. Frame corners indicate the active side.

### Controls

CONTROL	FUNCTION		
GAIN/FRZ/RUN	Controls clips in the active side of the display.		
	• Turn the <b>CINE WHEEL</b> :		
	Scrolls through the active frame heart cycle. Border traces and long axis remain displayed for each frame, but are non editable, until the frame used to create them is redisplayed.		
	• Press the <b>CINE WHEEL</b> :		
	Plays the active frame within the heart cycle (from a frozen state). The clip will loop to the beginning upon reaching the end of the clip. Press the <b>CINE WHEEL</b> while a clip is playing to display a frozen clip that has already been traced.		
TRACE	Hide or display border trace, major axis, and landmarks within the active frame. When a display is hidden, measurement values remain displayed.		
	• To hide border trace, major axis, and landmark displays, press <b>TRACE</b> .		
	<ul> <li>To redisplay border trace, major axis, and landmark displays, press TRACE again or select [RE-DISPLAY TRACE].</li> </ul>		
	• When Trace is off, all controls are inactive until the Trace is redisplayed.		
[FLIP L/R]	Flips the image displayed on the <b>VIEW</b> button from $L/R$ to $R/L$ .		
[CANCEL]	Cancels view and orientation selection then returns to Review.		
VIEW BUTTON	Select the A4C or A2CH <b>VIEW</b> button to access Guided and Manual modes.		
[EXIT]	Pressing this soft key exits the Edge Assisted EF mode and returns to the Sequoia state from which Edge Assisted EF was invoked.		
[BORDER/AXIS]	Allows border trace and long axis adjustment. All adjustments and edits update measurements immediately.		

CONTROL	FUNCTION	
[ENTER]	Pressing this soft key enters the current data into the Cardiac Calculation package. Once data has been enter following occurs:	
	• [() NEXT CYCLE] becomes an option if there are cycles remaining that have not been entered into the Cardiac Calculations package.	
	• You cannot make additional edits to the cycle. You may review the clip, but without the ability to scroll through frames in that cycle.	
	<b>Exception:</b> Upon exiting Edge Assisted EF, the application does not retain past clip or cycle data and you can re-open the clip to perform new measurements.	
[( ) NEXT CYCLE]	Selecting this soft key or single-clicking the <b>SELECT KEY</b> or a multi-cycle clip displays the next cycle, in sequence, with the clip.	
	• If the next cycle has already been entered, border trace, major axis, and landmarks display as they were entered, and will not allow changes.	
	• A single cycle clip does not display [() NEXT CYCLE] because it is not available.	

Enabling Edge Assisted EF	•	To enter and use Edge Assisted EF, choose one of the following methods:
	•	During an active study.
	•	Upon restarting a study.
	•	Upon restarting a clip.
	•	From Study Utilities.
During an Active Study	1	Perform a clip capture.
	2	Press <b>REVIEW</b> to enter Review mode.
	3	Select the clip capture by placing the pointer on the clip.
	4	Press AUTO MEASURE to invoke Edge Assisted EF.
Restarting a Study	1	Press <b>BEGIN END</b> .
	2	Select [START NEW PT].
	3	Select [RESTART LIST].
	4	Select a study and select [RESTART].
	5	Select [BEGIN IMAGING] from the patient demographic page.
	6	Perform a clip capture.
	7	Press <b>REVIEW</b> to enter Review mode.
	8	Select the clip capture by placing the pointer on the clip.
	9	Press AUTO MEASURE to invoke Edge Assisted EF.
	You hou or o	a may restart and enter calculations from a clip that is less than 24 ars old. After 24 hours, you may review the clip, but you cannot enter edit data.
From Study Utilities	Stu nev	dy Utilities is a review tool only. Therefore, you cannot enter or store v images and measurements from Study Utilities.
	1	Select a clip to review from Study Utility or MO disk .
	2	Press <b>REVIEW</b> to enter Review mode.
	3	Select the clip capture.
	4	Press AUTO MEASURE to invoke Edge Assisted EF.
	NO The The	<b>TE:</b> The Review hard key illuminates when Review mode is active. e clip capture display changes to a highlighted state upon its selection. e Auto Measure hard key illuminates when Edge Assisted EF is active.

### View and Orientation

After performing or retrieving a clip capture, entering Review, and invoking Edge Assisted EF; the following screen is displayed for you to select the view and orientation of the clip capture.



- To select view and orientation, compare the clip capture image to the A4C and A2C views.
- Match the clip capture image to the corresponding A4C or A2C view button. If the image was scanned inverted from the default VIEW button presentation, the application will automatically invert the VIEW buttons.
- 2 Match the orientation of the **VIEW** buttons to the clip capture image. Select **[FLIP L/R]** to flip the **VIEW** button orientation to match the clip capture image.
- **3** Use the trackball and **SELECT KEYS** to click on the corresponding **VIEW** button.

# PerformingPerform measurements in Guided or Manual mode. Access both modesMeasurementsPerform measurements in Guided or Manual mode. Access both modesthrough one soft key. The soft key displays both modes at all times. The<br/>active mode is highlighted. The first entry into Edge Assisted EF invokes<br/>Guided mode, thus the soft key shows Guided in a highlighted state, as<br/>shown in this example:

#### <mark>Guided</mark> / Manual

Each time the soft key is selected, the display toggles between highlighting Guided and Manual. Changing modes without entering data into the Cardiac Calculations package discards measurements, calculations, and edits made in the previous mode.

Guided ModeGuided mode steps you through placing the measurement landmarks.<br/>Once the landmarks are placed, the border and axis are drawn and may<br/>be edited alternately. To generate new landmarks, border trace and long<br/>axis, exit Guided mode and then re-enter Guided mode.

#### • To enter Guided mode and perform a border trace:

1 Verify that the application has selected the correct ED and ES frames by scrolling through the ECG tracing.

If no ECG tracing is used, use **GAIN/FRZ/RUN** to move to the appropriate heart cycle.

- **2** Guided mode will automatically be selected on the first entry to Edge Assisted EF. Otherwise, select **[GUIDED/MANUAL]** until Guided is highlighted.
- **3** Use the trackball and **SELECT KEYS** to position the first landmark. Select **[() MARK 1ST]** to set the first landmark.
- 4 Use the trackball and **SELECT KEYS** to position the second landmark. Select **[() MARK 2ST]** to set the second landmark.
- **5** Use the trackball and **SELECT KEYS** to position the last landmark. Select **[() MARK LAST]** to set the last landmark.

After setting all landmarks, the LV border trace is displayed, allowing you the option to modify the border or long axis. For details on applying adjustments to border and long axis see "Adjusting Border Trace" on page 309 and "Adjusting Long Axis" on page 309.

- **6** To enter the data into Cardiac Calculations, select **[ENTER]**.
- 7 To view the next cycle select [() NEXT CYCLE], for detailed information see "Heart Cycle" on page 302 and "Controls" on page 305. If there is only one heart cycle or if there are no more unentered cycles, select [EXIT]. If next cycle has already been entered, then advance to the next cycle until all cycles have been entered. When the next cycle has not been entered, Edge Assisted EF returns to step 1 for that cycle.
- 8 Perform **step 3** through **step 7** on both ED and ES for each heart cycle.

Manual Mode	•	To enter Manual mode and perform a border trace:	
	1	Select [GUIDED/MANUAL] until Manual is the selection highlighted.	
		The <b>+ CURS</b>	<b>OR</b> is displayed.
	2	Select [MAR SELECT KEY	<b>K]</b> or <b>[( )DRAW]</b> (you can use the trackball and <b>YS</b> as an option to select the draw function).
	3	Use the trac and Ventric	kball and <b>SELECT KEYS</b> to position both Mitral Annuli ular Apex. Select <b>[MARK]</b> to set the markers.
	4	Select <b>[( )DR</b> and long ax and "Adjust	<b>AW]</b> to draw the border trace points. Edit the border trace is as needed. See "Adjusting Border Trace" on page 309 ting Long Axis" on page 309 for detailed steps.
	5	To enter the	data into Cardiac Calculations select [ENTER].
	6	To view the next cycle select <b>[() NEXT CYCLE]</b> , for detailed information see "Heart Cycle" on page 302 and "Controls" on page 305. If there is only one heart cycle or if there are no more unentered cycles, select <b>[EXIT]</b> . If next cycle has already been entered, then advance to the next cycle until all cycles have been entered. When the next cycle has not been entered, Edge Assisted EF returns to <b>step 1</b> for that cycle.When the next cycle has not been entered, Edge Assisted EF returns to <b>step 1</b> for that cycle.	
	SOFT KEY FUNCTION		FUNCTION
	[E	BACK-UP]	Allows multiple undo of the manual trace points.
	[MARK]		Sets border trace points.
	[( ) DRAW]		Starts border drawing via Trackball.
	[( T	( )) END RACE]	Completes a trace. You can perform the same function by double-clicking the trackball <b>SELECT KEYS</b> .
Adjusting Border Trace	1	To edit the b is highlighte	oorder trace, select <b>[BORDER/AXIS]</b> until Border ed.
	2	Click on the relocates to drawn and a trace positio	e image to reposition the border trace. The border trace where you click on the image. A new border trace is all values are updated corresponding to the new border on.
	3	Select <b>[ENTE</b> package.	<b>ER]</b> to enter the new data into the Cardiac Calculations
Adjusting Long Axis	1	To edit the l	ong axis, select [BORDER/AXIS] until Axis is highlighted.
	2	Click on the to where yo correspondi	image to reposition the long axis. The long axis relocates u click on the image. All values are updated ing to the new long axis position.
	3	Select <b>[ENTE</b> package.	<b>ER]</b> to enter the new data into the Cardiac Calculations

### Exiting Edge<br/>Assisted EFTo exit Edge Assisted EF, use the proper control to produce the<br/>desired result:

CONTROL	FUNCTION
AUTO MEASURE	Exit Edge Assisted EF to Review mode.
[EXIT]	Exit Edge Assisted EF to Review mode.
DELETE	Invokes the clip delete function. Then exits Edge Assisted EF to Review mode.
REVIEW	Exit Edge Assisted EF and Review mode.

Reports

Edge Assisted EF uses the Cardiac Calculation report package to view and edit all of the performed measurements and subsequent calculation results. Report page values display an **T** to indicate an auto-generated measurement. You can save the report to the on-board AEGIS system, record it to VCR, or print it to a local printing device. See "Types of Measurements" on page 254 for reporting details.

- To enter Edge Assisted EF reports:
- 1 Press **REPORT**.
- 2 Select [CARDIAC].

# CHAPTER 33

### **AXIUS QUANTITATIVE STRAIN RATE IMAGING**

### Overview

Axius Quantitative Strain Rate Imaging technology (Axius QSI<sup>TM</sup>) is an optional feature that measures the tissue contraction and relaxation (strain) and its rate of contraction and relaxation (strain rate) for assessment of myocardial deformation. The system computes strain and strain rate from tissue Doppler velocity information in the clip.

By automatically tracking motion of the heart, Axius QSI technology separates the overall heart motion from myocardial contraction to quantify regional systolic and diastolic functions, displaying the locations of myocardial contraction and wall motion dysfunction.

Axius QSI displays graphs and M-mode strips indicating changes of strain rate, strain, velocity, and displacement over time within defined regions of interest (ROIs). After you identify the image frame representing the timing of each heart cycle event, Axius QSI automatically measures the values for peak strain, strain rate, velocity, and displacement; and the end systolic strain. Axius QSI also computes the post-systolic strain indexes for the defined ROI(s). Timing of these events is also reported.

You can enter these measurements to the cardiac report. You can also export the Axius QSI data to a connected storage device.



**Compatible Clips** 

To be compatible with Axius QSI, clips must be stored using one of the following Doppler Tissue Imaging (DTI) options:

- Doppler Tissue Velocity (DTV)
- High Frame Rate Tissue Doppler (HTD)

For more information on HTD or DTV, see Chapter 14.

Recommended	Clip	Store
Prerequisite Ta	sks	

Siemens recommends the following prerequisite tasks for storing clips for use with Axius QSI:

- *Timing Events:* When you measure events to assess valve timing, ensure that the heart rate is approximately the same heart rate for the clip selected for Axius QSI analysis. For example, if the heart rate for the clip used for Axius QSI analysis is 60 bpm, then ensure that the heart rate is near 60 bpm when acquiring images for valve timing. Complete and record the following measurements for use with Axius QSI analysis:
  - R-wave to the opening of the aortic valve
  - R-wave to the closing of the aortic valve
  - R-wave to the opening of the mitral valve

For more information on measurements, see "Measurement Tools" on page 225.

• *Acoustic Capture:* To capture all acoustic frames from CINE to a clip, select an acoustic capture protocol.

**NOTE:** To ensure that all frames are captured when using this protocol, do not adjust clip playback speed or margins in CINE before storing the clip.

#### **Default Acoustic Capture Protocols**

ACOUSTIC CAPTURE PROTOCOL(S) (FACTORY DEFAULT)
1 Beat Ac. Capt
1 Beat Ac. Capt
1 Beat Ac. Capt
<ul> <li>Baseline Ac. Capt</li> <li>Low Dose Ac. Capt</li> <li>Peak Ac. Capt</li> <li>Recovery Ac. Capt</li> </ul>

For more information on acoustic capture protocols, see Chapter 1 of the *Administration Manual*. For information on storing clips with acoustic capture protocols, see "Storing Clips with Acoustic Capture Protocols" on page 60.

• *Image Display with HTD:* To change the image display when using **HTD**, adjust **BALANCE**.

For more information on HTD, see "Doppler Tissue Imaging" on page 117.

For information on capturing clips, see "Storing Clips" on page 59.

Controls

The controls used for Axius QSI consist of soft keys, controls on the keyboard, and menu items on the Axius QSI navigation menu.

### Soft Keys and Controls on the Keyboard

[SOFT KEY] CONTROL	FUNCTION
[(()) MENU]	Displays the Axius QSI navigation menu.
[ADD ROI]	Adds a ROI node at the current cursor location and
	displays the following soft keys:
	[(()) END NODE]
	[() ADD NODE]
	[BACK UP]
	[CANCEL]
	<b>NOTE:</b> This function is available when one or more segment names are available to assign to ROIs.
[(()) END NODE]	Ends the placement of nodes on an ROI.
[() ADD NODE]	Adds a ROI node at the current cursor location.
[BACK UP]	Removes the last node added to a ROI.
[CANCEL]	Cancels all edits and displays the most recently selected ROI.
[() EDIT ROI]	Activates the selected ROI for editing and displays the following soft keys:
	[(()) END EDIT]
	[() ADJUST NODES]
	[RESET ROI]
	[RESET ROI] [DELETE ROI]
	[RESET ROI] [DELETE ROI] NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report.
[NEXT ROI]	[RESET ROI] [DELETE ROI] NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report. Activates the next ROI (if multiple ROIs exist).
[NEXT ROI] [(()) END EDIT]	[RESET ROI] [DELETE ROI] NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report. Activates the next ROI (if multiple ROIs exist). Applies edits to the selected ROI.
[NEXT ROI] [(()) END EDIT] [() ADJUST NODES]	[RESET ROI][DELETE ROI]NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report.Activates the next ROI (if multiple ROIs exist).Applies edits to the selected ROI.Relocates the node that is nearest to the cursor to the designated location.
[NEXT ROI] [(()) END EDIT] [() ADJUST NODES] [RESET ROI]	[RESET ROI][DELETE ROI] <b>NOTE:</b> This function is available when data for one or more ROIs is not yet entered to the cardiac report.Activates the next ROI (if multiple ROIs exist).Applies edits to the selected ROI.Relocates the node that is nearest to the cursor to the designated location.Resets the selected (previously edited) ROI to its original position.
[NEXT ROI] [(()) END EDIT] [() ADJUST NODES] [RESET ROI] [DELETE ROI]	[RESET ROI][DELETE ROI] <b>NOTE:</b> This function is available when data for one or more ROIs is not yet entered to the cardiac report.Activates the next ROI (if multiple ROIs exist).Applies edits to the selected ROI.Relocates the node that is nearest to the cursor to the designated location.Resets the selected (previously edited) ROI to its original position.Deletes the selected ROI.
[NEXT ROI] [(()) END EDIT] [() ADJUST NODES] [RESET ROI] [DELETE ROI] [(()) APPLY]	[RESET ROI][DELETE ROI]NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report.Activates the next ROI (if multiple ROIs exist).Applies edits to the selected ROI.Relocates the node that is nearest to the cursor to the designated location.Resets the selected (previously edited) ROI to its original position.Deletes the selected ROI.Saves new settings.
[NEXT ROI] [(()) END EDIT] [() ADJUST NODES] [RESET ROI] [DELETE ROI] [(()) APPLY]	[RESET ROI][DELETE ROI]NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report.Activates the next ROI (if multiple ROIs exist).Applies edits to the selected ROI.Relocates the node that is nearest to the cursor to the designated location.Resets the selected (previously edited) ROI to its original position.Deletes the selected ROI.Saves new settings.NOTE: This function is available from the Zoom/
[NEXT ROI] [(()) END EDIT] [() ADJUST NODES] [RESET ROI] [DELETE ROI] [(()) APPLY]	[RESET ROI][DELETE ROI]NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report.Activates the next ROI (if multiple ROIs exist).Applies edits to the selected ROI.Relocates the node that is nearest to the cursor to the designated location.Resets the selected (previously edited) ROI to its original position.Deletes the selected ROI.Saves new settings.NOTE: This function is available from the Zoom/ Pan/Margin, Setup, and Stage Mapping screens.
[NEXT ROI] [(()) END EDIT] [() ADJUST NODES] [RESET ROI] [DELETE ROI] [(()) APPLY] [(()) APPLY]	[RESET ROI][DELETE ROI]NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report.Activates the next ROI (if multiple ROIs exist).Applies edits to the selected ROI.Relocates the node that is nearest to the cursor to the designated location.Resets the selected (previously edited) ROI to its original position.Deletes the selected ROI.Saves new settings.NOTE: This function is available from the Zoom/ Pan/Margin, Setup, and Stage Mapping screens.[ZOOM] adjusts image magnification.
[NEXT ROI] [(()) END EDIT] [() ADJUST NODES] [RESET ROI] [DELETE ROI] [(()) APPLY] [ZOOM/PAN]	[RESET ROI]         [DELETE ROI]         NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report.         Activates the next ROI (if multiple ROIs exist).         Applies edits to the selected ROI.         Relocates the node that is nearest to the cursor to the designated location.         Resets the selected (previously edited) ROI to its original position.         Deletes the selected ROI.         Saves new settings.         NOTE: This function is available from the Zoom/Pan/Margin, Setup, and Stage Mapping screens.         [ZOOM] adjusts image magnification.         [PAN] repositions the image.
[NEXT ROI] [(()) END EDIT] [() ADJUST NODES] [RESET ROI] [DELETE ROI] [(()) APPLY] [200M/PAN] [SET LEFT]	[RESET ROI][DELETE ROI]NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report.Activates the next ROI (if multiple ROIs exist).Applies edits to the selected ROI.Relocates the node that is nearest to the cursor to the designated location.Resets the selected (previously edited) ROI to its original position.Deletes the selected ROI.Saves new settings.NOTE: This function is available from the Zoom/ Pan/Margin, Setup, and Stage Mapping screens.[ZOOM] adjusts image magnification.[PAN] repositions the image.Sets the current frame as the left margin of the clip.
[NEXT ROI] [(()) END EDIT] [() ADJUST NODES] [RESET ROI] [DELETE ROI] [(()) APPLY] [ZOOM/PAN] [SET LEFT] [SET RIGHT]	[RESET ROI][DELETE ROI]NOTE: This function is available when data for one or more ROIs is not yet entered to the cardiac report.Activates the next ROI (if multiple ROIs exist).Applies edits to the selected ROI.Relocates the node that is nearest to the cursor to the designated location.Resets the selected (previously edited) ROI to its original position.Deletes the selected ROI.Saves new settings.NOTE: This function is available from the Zoom/ Pan/Margin, Setup, and Stage Mapping screens.[ZOOM] adjusts image magnification.[PAN] repositions the image.Sets the current frame as the left margin of the clip.Sets the current frame as the right margin of the clip.

[SOFT KEY] CONTROL	FUNCTION
[RESTORE DEFAULT]	Restores the factory default settings for the displayed screen.
	<b>NOTE:</b> This function is available from the <b>Setup</b> and <b>Stage Mapping</b> screens.
[DISPLAYS]	Displays a pop-up menu listing the graphs and M-mode strips available for display.
[() TIME MARK]	Places a Time Marker or Time Event and a corresponding marker label at the current cursor location.
[ENTER]	Enters the displayed data (LV Data Summary or RV Data Summary) to the cardiac report for the current live/restarted examination or teaching file.
	<b>NOTE:</b> This function is not available from the <b>Generic Data Summary</b> screen.
	<b>NOTE:</b> This function is not available after data has been entered to the report.
[EXPORT]	Sends the Axius QSI data to a storage device that is connected to a USB port on the Perspective <sup>TM</sup> advanced display option.
	<b>NOTE:</b> This function is available only when a storage device (such as a memory card or MO disk) is connected to the Perspective advanced display option.
GAIN/FRZ/	During Axius QSI:
RUN	Plays or freezes the clip when pressed.
	Cycles through the image frames in the clip when rotated.
RES	During Axius QSI, displays the <b>Zoom/Pan/Margin</b> screen.
	<b>NOTE:</b> This function is not available from the <b>Setup</b> and <b>Stage Mapping</b> screens.
SETUP	During Axius QSI, displays the <b>Setup</b> screen.
	<b>NOTE:</b> This function is not available from the <b>Zoom/</b> <b>Pan/Margin</b> and <b>Stage Mapping</b> screens.
PROTOCOL	Displays a soft key menu for choosing the protocol type. Press again to exit.

Navigation MenuThe Axius QSI navigation menu items display screens and pop-<br/>up menus.

NAVIGATION MENU ITEM	FUNCTION
ROI Placement	Displays the <b>ROI Placement</b> screen.
Analysis	Displays the <b>Analysis</b> screen.
LV Data Summary	Displays the <b>LV Data Summary</b> screen.
RV Data Summary	Displays the <b>RV Data Summary</b> screen.
Generic Data	Displays the <b>Generic Data Summary</b> screen.
Summary	
Set View	Displays the Select Image View
	pop-up menu.
Zoom/Pan/Margin	Displays the <b>Zoom/Pan/Margin</b> screen.
Setup	Displays the <b>Setup</b> screen.
Stage Mapping	Displays the <b>Stage Mapping</b> screen.
Exit	Exits Axius QSI.

Screens and Pop-Up Menus The selections (other than soft keys) displayed in Axius QSI screens and pop-up menus are described below.

**NOTE:** The selections displayed in the **Segment Name** pop-up menu depend on the view label that is assigned to the clip.

SELECTION	ASSIGNS THIS VIEW LABEL TO THE CLIP
A4C	Apical four-chamber view
A3C	Apical three-chamber view
A2C	Apical two-chamber view
PLAX	Parasternal long axis view
PSAX	Parasternal short axis view
Generic	Generic view

ASSIGNED VIEW LABEL	SELECTIONS (AVAILABLE SEGMENT NAMES)*
A4C	Apical Sept
	Mid Sept
	Basal Sept
	Apical Lat
	Mid Lat
	Basal Lat
	Apical RV
	Mid RV
	Basal RV
	Generic 1
	Generic 2
A3C	Apical Sept
	Mid Ant Sept
	Basal Ant Sept
	Apical Post
	Mid Post
	Basal Post
	Generic 1
	Generic 2
A2C	Apical Ant
	Mid Ant
	Basal Ant
	Apical Inf
	Mid Inf
	Basal Inf
	Generic 1
	Generic 2
PLAX	Mid Ant Sept
	Basal Ant Sept
	Mid Post
	Basal Post
	Generic 1
	Generic 2

### Segment Name Pop-Up Menu Selections

0705
Segment Name Pop-Op N	Tenu Selections (Continueu)
ASSIGNED VIEW LABEL	SELECTIONS (AVAILABLE SEGMENT NAMES)*
PSAX	Mid Ant Sept
	Mid Ant
	Mid Lateral
	Mid Post
	Mid Inf
	Mid Sept
	Generic 1
	Generic 2
Generic	Generic 1
	Generic 2
	Generic 3
	Generic 4
	Generic 5
	Generic 6
* Abbreviations:	
Sept: Septum	
Lat: Lateral	
<b>Post</b> : Posterior	
Ant: Anterior	
Inf: Inferior	
RV: Right Ventricle	
LV: Left Ventricle	

Segment Name Pop-Up Menu Selections (Continued)

# **Example of Setup Screen**

BOI	-Velocity
Width: <u>4</u> mm	Algorithm: Median
✓ Axial Tracking	Otrain Rate
- Strain	Δr: <u>10</u> mm
Algorithm: Lagrangian	Algorithm: LeastSquare
Colormap: Temperature	Colormap: Lorikeet
Scale: 40 🔽 %	Scale: 4 🔽 /s
Threshold: 2 🔽 %	Threshold: 0.3 🔽 /s
Smoothing: S1T1	Smoothing: S2T1
())(Apply	Cancel Restore Default

Setup Screen Selections - ROI

SELECTION	FUNCTION	DEFAULT SETTING
Width	Specifies the width of the ROI in millimeters (mm).	4
Axial Tracking	When selected (enabled), the system automatically tracks node positions across frames in the axial direction.	selected (enabled)
	When cleared (disabled), the system does not track node positions across frames.	

# **Setup Screen Selections - Strain**

SELECTION	FUNCTION	DEFAULT SETTING
Algorithm	Specifies the formula used to calculate the strain from the strain rate.	Lagrangian
Colormap	Specifies the color map used to display the strain M-mode strips.	Temperature
Scale	Specifies the scale of the strain color map as a percentage.	40
Threshold	Specifies the minimum threshold value for the strain M-Mode strips, as a percentage.	2

# Setup Screen Selections - Strain (Continued)

SELECTION	FUNCTION	DEFAULT SETTING
Smoothing	Specifies the smoothing applied to M-mode strips. <b>S</b> is spatial smoothing and <b>T</b> is temporal smoothing. Higher values increase the smoothing.	S1T1

# **Setup Screen Selections - Velocity**

SELECTION	FUNCTION	DEFAULT SETTING
Algorithm	Specifies the formula used to calculate the average velocity	Median
	from a range of velocities	
	across the width of the ROI.	

# **Setup Screen Selections - Strain Rate**

SELECTION	FUNCTION	DEFAULT SETTING
Δr	Specifies the distance in millimeters (mm) over which the strain rate is calculated in the strain rate algorithm.	10
Algorithm	Specifies the formula used to calculate the strain rate from the extracted velocity values.	Least Square
Colormap	Specifies the color map used to display the strain rate M- mode strips.	Lorikeet
Scale	Specifies the scale of the strain rate color map.	4
Threshold	Specifies the minimum threshold value for the strain rate M-mode strips.	0.3

SELECTION	FUNCTION	DEFAULT SETTING
Smoothing	Specifies the smoothing applied to M-mode strips. <b>S</b> is spatial smoothing and <b>T</b> is temporal smoothing. Higher values increase the smoothing.	S2T1
Angle Correction	When selected (enabled), the system angle corrects the velocity values that are used to calculate the strain rate. The strain rate is based on the Doppler angle (direction of the ROI relative to the ultrasound beam).	cleared (disabled)

# Setup Screen Selections - Strain Rate (Continued)

#### **Stage Mapping Screen Selections**

**NOTE:** The default settings on the **Stage Mapping** screen correspond to the stages used in the Pharm Stress QSI Exam Preset. For example, the default setting of "2" for **Report Entry S1** corresponds to the "Baseline Acoustic Capture" stage.

SELECTION	FUNCTION	DEFAULT SETTING
Report Entry S1	Specifies the stage protocol to be displayed in "Stage 1" of the "DTI QSI" report pages in the cardiac report.	2
Report Entry S2	Specifies the stage protocol to be displayed in "Stage 2" of the "DTI QSI" report pages in the cardiac report.	4
Report Entry S3	Specifies the stage protocol to be displayed in "Stage 3" of the "DTI QSI" report pages in the cardiac report.	6
Report Entry S4	Specifies the stage protocol to be displayed in "Stage 4" of the "DTI QSI" report pages in the cardiac report.	8

# Activating and Exiting Axius QSI Technology

You can activate Axius QSI for a selected, compatible clip in a live or restarted study or in a teaching file.

When you activate Axius QSI, the system displays the **Select Image View** pop-up menu and the **ROI Placement** screen, listing available cardiac views for selection. The system removes the pop-up menu from the screen when you select a view and then displays two images on the **ROI Placement** screen: a color image on the left and a grayscale image on the right.

While Axius QSI is active, you can display the Axius QSI navigation menu to select a menu item. You can also complete the following standard functions: annotate, print, record to VCR, and store clips and images. For more information on these functions, see Chapter 6 and Chapter 8.

When you exit Axius QSI, the system displays the review screen.

# • To activate Axius QSI:

**NOTE:** If the required clip is from a previous study and you plan to store more images and/or enter measurements from Axius QSI data summaries to the cardiac report, then either restart the study or create and restart a teaching file containing the clip. See "Restarting a Study" on page 35 and/or "Creating a Teaching File" on page 64.

1 Press **REVIEW** to display the clip in the review screen.

The system displays the stored images and clips.

- **2** Roll the trackball to position the cursor on the required clip. (You can press **QUAD** to display the required clip in full-screen format.)
- 3 Press AUTO MEASURE to activate Axius QSI.

The system displays a progress indicator on the screen.

- **4** Select the required cardiac view from the **Select Image View** pop-up menu by rolling the trackball to position the cursor on the required cardiac view and then pressing a trackball **SELECT** key.
- **5** To display another image frame in the clip, rotate **GAIN/FRZ/RUN**.
- 6 To play or freeze the clip, press **GAIN/FRZ/RUN**.
- 7 To display the Axius QSI navigation menu and select a menu item, select [ (( )) MENU], roll the trackball to position the cursor on the menu item, and then press **SELECT**.
- **8** To exit Axius QSI, choose one of the following methods:
  - Press **AUTO MEASURE** or select **Exit** from the Axius QSI navigation menu.
  - Press **DELETE**.

The system also deletes the clip.

• Press **REVIEW**.

The system also exits the review screen.

Generating and Viewing the	Yo an	a can generate and view the Axius QSI analysis data. You can also store image of the Axius QSI analysis data.
Analysis Data	Th for	e system generates the analysis data when at least one ROI is defined the clip.
Viewing and Editing the Clip	Yo clip car	a can stop or start playback, review the clip frame by frame, adjust the pargins, magnify the clip, reposition the clip, and change the diac view.
Reviewing the Clip	٠	To stop or start playback of the clip:
		• Press GAIN/FRZ/RUN.
	٠	To review the clip frame by frame:
		• Rotate GAIN/FRZ/RUN.
Magnifying the Clip	٠	To adjust magnification of the clip:
	1	Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES.
	2	Select <b>[ZOOM/PAN]</b> until <b>ZOOM</b> is highlighted.
	3	To increase magnification, roll the trackball up or to the right.
	4	To decrease magnification, roll the trackball down or to the left.
	5	Select [(()) APPLY] to save changes and exit the <b>Zoom/Pan/Margin</b> screen.
Repositioning the Clip	•	To reposition the clip's image frames:
Repositioning the Clip	◆ 1	To reposition the clip's image frames: Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES.
Repositioning the Clip	<ul><li>♦</li><li>1</li><li>2</li></ul>	To reposition the clip's image frames: Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES. Select [ZOOM/PAN] until PAN is highlighted.
Repositioning the Clip	<ul> <li>1</li> <li>2</li> <li>3</li> </ul>	To reposition the clip's image frames: Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES. Select [ZOOM/PAN] until PAN is highlighted. Roll the trackball to reposition the clip.
Repositioning the Clip	<ul> <li>▲</li> <li>1</li> <li>2</li> <li>3</li> <li>4</li> </ul>	To reposition the clip's image frames: Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES. Select [ZOOM/PAN] until PAN is highlighted. Roll the trackball to reposition the clip. Select [(()) APPLY] to save changes and exit the Zoom/Pan/Margin screen.
Repositioning the Clip Adjusting the Clip Margins	<ul> <li>1</li> <li>2</li> <li>3</li> <li>4</li> <li>You froom</li> </ul>	To reposition the clip's image frames: Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES. Select [ZOOM/PAN] until PAN is highlighted. Roll the trackball to reposition the clip. Select [(()) APPLY] to save changes and exit the Zoom/Pan/Margin screen. A can adjust the left or right clip margins to omit unneeded frames m analysis. Omitted frames remain in the clip. You can add back itted frames by changing the margins again.
Repositioning the Clip Adjusting the Clip Margins	<ul> <li>1</li> <li>2</li> <li>3</li> <li>4</li> <li>You froo own own own own own own own own own o</li></ul>	To reposition the clip's image frames: Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES. Select [ZOOM/PAN] until PAN is highlighted. Roll the trackball to reposition the clip. Select [(()) APPLY] to save changes and exit the Zoom/Pan/Margin screen. a can adjust the left or right clip margins to omit unneeded frames m analysis. Omitted frames remain in the clip. You can add back itted frames by changing the margins again. TE: If you adjust clip margins after placing time markers, then the tem automatically remeasures the peak values, end systolic strain ues, and peak-systole systolic index values for all ROIs that have not en entered to the report.
Repositioning the Clip	<ul> <li>1</li> <li>2</li> <li>3</li> <li>4</li> <li>You froo om</li> <li>NCC system value</li> <li>beet</li> </ul>	To reposition the clip's image frames: Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES. Select [ZOOM/PAN] until PAN is highlighted. Roll the trackball to reposition the clip. Select [(()) APPLY] to save changes and exit the Zoom/Pan/Margin screen. a can adjust the left or right clip margins to omit unneeded frames m analysis. Omitted frames remain in the clip. You can add back itted frames by changing the margins again. TE: If you adjust clip margins after placing time markers, then the tem automatically remeasures the peak values, end systolic strain ues, and peak-systole systolic index values for all ROIs that have not en entered to the report. To change the left or right margin of the clip:
Repositioning the Clip	<ul> <li>▲</li> <li>1</li> <li>2</li> <li>3</li> <li>4</li> <li>You froo om</li> <li>NC system</li> <li>NC system</li> <li>1</li> </ul>	To reposition the clip's image frames: Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES. Select [ZOOM/PAN] until PAN is highlighted. Roll the trackball to reposition the clip. Select [(()) APPLY] to save changes and exit the Zoom/Pan/Margin screen. a can adjust the left or right clip margins to omit unneeded frames m analysis. Omitted frames remain in the clip. You can add back itted frames by changing the margins again. TE: If you adjust clip margins after placing time markers, then the tem automatically remeasures the peak values, end systolic strain ues, and peak-systole systolic index values for all ROIs that have not en entered to the report. To change the left or right margin of the clip: Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES.

	<b>3</b> Select the relevant option at the bottom of the <b>Zoom/Pan/Margin</b> screen:
	• <b>[SET LEFT]</b> sets the selected image frame as the new left margin of the clip.
	• <b>[SET RIGHT]</b> sets the selected image frame as the new right margin of the clip.
	4 Select <b>[(()) APPLY]</b> to save changes and exit the <b>Zoom/Pan/Margin</b> screen.
Changing the	To change the cardiac view:
Cardiac View	<b>NOTE:</b> Changing the cardiac view does not change any ROI segment names that have already been labeled.
	<ol> <li>Select [(()) MENU] to display the navigation menu and then select</li> <li>Set View to display the Select Image View pop-up menu.</li> </ol>
	<b>2</b> Select the required view.
	The system removes the <b>Select Image View</b> pop-up menu from the screen.
Defining and Editing ROIs	You can enable or disable automatic motion tracking and define ROIs on an image frame within a clip by placing nodes to indicate the ROI boundaries. You can also edit ROIs by relocating the node(s).
	The automatic motion tracking setting determines the system response to a newly defined ROI:
	• When automatic motion tracking is enabled, the system adjusts the ROI on other image frames within the clip to compensate for motion.
	• When automatic motion tracking is disabled, the system does not adjust ROI nodes on other image frames within the clip.
Defining ROIs	When you place the first node of a new ROI, the system places a circle (node) at the designated location, places an asterisk to the upper left of the node, and displays new soft keys at the bottom of the screen. For each subsequent node you place, the system places a new circle at the designated location.
	At completion of an ROI, the system prompts you for a segment name. When you select the segment name, the system displays new soft keys at the bottom of the screen.
	The active ROI is highlighted in green; inactive ROIs are gray.
	♦ To define an ROI:
	<b>NOTE:</b> If clip margins require adjusting and/or the cardiac view requires changing, then do so before defining ROIs.
	1 When Axius QSI is active, select [(()) MENU] to display the navigation menu and then select <b>ROI Placement</b> to display the <b>ROI Placement</b> screen.
	<b>2</b> Rotate <b>GAIN/FRZ/RUN</b> to display the required image frame in the clip.
	<b>3</b> To adjust magnification for facilitated placement of nodes:
	<ul> <li>(a) Select [(()) MENU] to display the navigation menu and then select Zoom/Pan/Margin to display the Zoom/Pan/Margin screen. Alternatively, press RES.</li> </ul>

- (b) Select *[()ZOOM/PAN]* until **ZOOM** is highlighted.
- (c) To increase magnification, roll the trackball up or to the right.
- (d) To decrease magnification, roll the trackball down or to the left.
- (e) Select [(()) APPLY] to save changes and exit the **Zoom/Pan/Margin** screen.
- **4** For the first node, roll the trackball to position the cursor over the required location for the first node and then press a trackball **SELECT** key (or select **[()ADD ROI]**).
- 5 For each subsequent node, roll the trackball to position the cursor over the required location and then press SELECT (or select [()ADD NODE]).
- 6 To remove the most recently placed node, select [BACK UP].
- 7 To delete all nodes, select [CANCEL ROI].
- **8** To complete the ROI, roll the trackball to position the cursor over the required location for the last node, select **[(()) END NODE]**, and then select the required segment name from the displayed pop-up menu.



- **9** To confirm motion tracking results, stop or start playback of the clip or review the clip frame by frame:
  - To stop or start playback of the clip, press **GAIN/FRZ/RUN**.
  - To review the clip frame by frame, rotate **GAIN/FRZ/RUN**.

You can edit completed ROIs by relocating one or more nodes. You can also delete ROIs.

When you edit an ROI, the system interpolates data on the image frames between the current frame and the frame containing the original definition of the ROI. If multiple ROI edits exist, then the system interpolates data between each pair of frames containing original or edited ROIs.

The active ROI is highlighted in green; inactive ROIs are gray.

**Editing ROIs** 

# • To edit a completed ROI (relocate nodes):

- 1 Select [(()) MENU] to display the navigation menu and then select **ROI Placement** to display the **ROI Placement** screen.
- 2 To activate another ROI for editing, select [NEXT ROI].
- **3** Select **[EDIT ROI]** to edit the selected ROI.

The system displays editing soft keys.

4 For each node relocation, roll the trackball to position the cursor over the new location and then press a trackball SELECT key (or select [()ADJUST NODES]).

The system relocates the node that is nearest to the cursor to the designated new location.

- **5** To cancel edits, select **[RESET ROI]**.
- 6 Select **[(()) END EDIT]** to save changes to the ROI.

The system removes the editing soft keys from the screen.

- To delete an ROI:
- 1 Select [(()) MENU] to display the navigation menu and then select **ROI Placement** to display the **ROI Placement** screen.
- **2** Select the required ROI to activate it for editing. Alternatively, if multiple ROIs exist, select **[NEXT ROI]** to activate the next ROI for editing.
- **3** Select **[EDIT ROI]** to display editing soft keys.
- 4 Select **[DELETE ROI]** to delete the selected ROI.

You can view the analysis data and display the value of a point on the curve or M-mode strip. You can also select another ROI for analysis, play the clip, review the clip frame by frame, or display the ROI Placement screen again to edit the selected ROI.

**NOTE:** You can edit ROIs to automatically regenerate the analysis data. For information on editing ROIs, see "Editing ROIs" on page 324.

On the left of the **Analysis** screen, the system displays the ROI(s) on the color and grayscale images representing the currently selected image frame within the clip. The active ROI is highlighted in green; inactive ROIs are gray. The previously assigned segment name is listed above the representative images.

Viewing the Analysis Data On the right of the **Analysis** screen, the system displays the following information (as configured on the Displays pop-up menu) for the selected (active) ROI:

- Velocity (Vel) M-mode strip and color map
- Strain rate (**SR**) M-mode strip and color map
- Strain (Str) M-mode strip and color map
- Velocity (**Vel**) curve
- Strain rate (**SR**) curve
- Strain (Str) curve
- Displacement (**Disp**) curve
- ECG trace (the first R-wave is at the left margin of the clip; the last R-wave is at the right margin of the clip)

For instructions on selecting the types of analysis data displayed, see "Selecting the Types of Analysis Data Displayed" on page 328.



#### **Example of Analysis Screen**

**Color Maps** 

The system displays the color map related to each displayed M-mode strip. For example, the system displays the Strain Rate color map when the Strain Rate M-mode strip is displayed.

COLOR MAP	INDICATIONS
STRAIN	Positive strain (lengthening): colors on the upper portion of the color map.
	Negative strain (shortening): colors on the lower portion.
STRAIN RATE	Positive strain (lengthening): blue colors on the upper portion of the color map.
	Negative strain (shortening): yellow colors on the lower portion.

	COLOR MAP IND	ICATIONS	
	VELOCITY Flo upp	w toward the transducer: colors on the portion.	
	Flo low	w away from the transducer: colors on the rer portion.	
	Lov	v velocity: darker shades.	
	Hig	h velocity: lighter shades.	
Orientation Point	The asterisk displayed to the upper left of the active ROI and each M-mode strip indicates orientation. The top of each M-mode strip aligns with the asterisked node of the active ROI.		
Using the Analysis Screen	To display the A	nalysis screen:	
	<ul> <li>Select [(()) MENU]</li> <li>Analysis.</li> </ul>	to display the navigation menu and then select	
	то	DO THIS:	
	Display the value of point on the curve o M-mode strip	<ul><li>a Roll the trackball to position the cursor on the</li><li>r required location of the curve or M-mode</li><li>strip.</li></ul>	
	Select another ROI for analysis	Select [NEXT ROI].	
	Stop or start playbac of the clip	k Press GAIN/FRZ/RUN.	
	Review the clip fram by frame	e Rotate GAIN/FRZ/RUN.	
	Display the <b>ROI</b> <b>Placement</b> screen again to edit the selected ROI	Roll the trackball to position the cursor on one of the representative images located on the left of the screen and then press a trackball <b>SELECT</b> key. Alternatively, select <b>[(()) MENU]</b> to display the navigation menu and then select <b>ROI Placement</b> .	

#### Selecting the Types of Analysis Data Displayed

You can select the types of graphs or M-mode strips displayed and change preferences for the **Analysis** screen.

Preferences include strain and strain rate settings such as color map and scale selections, ROI width and tracking, and the velocity algorithm.

# • To enable or disable display of a graph or M-mode strip:

1 Select [(()) MENU] to display the navigation menu and then select **Analysis** to display the **Analysis** screen.

# 2 Select [DISPLAYS].

The system displays a pop-up menu listing the available graphs and M-mode strips. A check mark is displayed to the left of each graph or M-mode strip currently enabled for display.

**3** To enable or disable display of a graph or M-mode strip, roll the trackball to position the cursor over the graph or strip name and then press a trackball **SELECT** key.

The system removes the pop-up menu from the screen and updates the analysis data to display the enabled graphs and M-mode strips.

# • To change preferences for the Analysis screen:

- 1 While Axius QSI is active, press **SETUP** to display the **Setup** screen. Alternatively, select **[(()) MENU]** and then select **Setup**.
- **2** Change settings as required.
- 3 To discard changes and exit the Setup screen, select [CANCEL].
- 4 To restore the factory default settings, select [RESTORE DEFAULTS].
- **5** To save changes and exit the **Setup** screen, select **[(()) APPLY]**.

# Generating and Viewing the Measurements

Identifying Heart Cycle Events You can generate measurements (automatically measured values) for peak strain, strain rate, velocity, displacement, and the end systolic strain for the selected ROI by identifying each heart cycle event using time markers. The system also computes the post-systolic strain index for the selected ROI. You can also view these measurements on the related data summaries, including the timing of peak measurements.

You can identify the image frame representing each heart cycle event by placing time markers on the analysis data, located on the right of the **Analysis** screen. You can adjust existing time markers.

**NOTE:** If a one-beat acoustic capture protocol (such as **1 Beat Ac.Capt**) was used to acquire the clip, then the system automatically places the R-wave markers on the analysis data.



Example of Analysis Screen with Time Markers

**NOTE:** Time markers cannot be placed on omitted frames (from adjusted clip margins). Time markers cannot be adjusted after the data is entered to the cardiac report.

When you place a time marker on the analysis data, the system displays a pop-up menu listing available time marker labels.

TIME MARKER LABEL	DESCRIPTION
R	R-wave
AO	Aortic valve opening
AC	Aortic valve closing
MO	Mitral valve opening
Mid D	Mid diastole

Labels are available only in the correct sequence (**R**, **AO**, **AC**, **MO**, **Mid D**, **R**). For example, if you place a time marker to the right of the time marker labeled **Mid D**, then only the **Mid D** and **R** labels are available. If you place a time marker between the time markers labeled **AO** and **AC** (to adjust an existing time marker), then only the **AO** and **AC** labels are available. When you select a time marker label, the system displays the time marker as a vertical line on the right of the **Analysis** screen and also displays the time marker label below the ECG trace.

For each pair of time markers you place on the analysis data, the system places an intervening time event marker label above the M-mode strips and graphs to mark the related cardiac calculation. For example, when you place the **AO** and **AC** time markers, the system places the **S** time event marker between them (at the top of the screen) to indicate aortic valve opening to aortic valve closing (systole).

TIME EVENT MARKER LABEL	DESCRIPTION
IVC	R-wave to AO (isovolumic contraction)
S	AO to AC (systole)
IVR	AC to MO (isovolumic relaxation)
E	MO to Mid D (E-wave)
Α	Mid D to next R-wave (A-wave)

When all time markers have been placed, the system automatically measures peak values, timing values, and the end systolic strain value. The system also computes the post-systolic strain index. These automatically measured values are displayed in the related data summary (**LV**, **RV**, or **Generic**).

# To place time markers (identify the image frame representing each event in a heart cycle):

**NOTE:** If the clip contains multiple heart cycles, then for each cycle, consecutively place the time markers and enter the data to the cardiac report. The Cardiac Calculations package averages the data results. See "Cardiac Calculations" on page 253 for more information regarding Cardiac Calculations.

- 1 Select **[(()) MENU]** to display the navigation menu and then select **Analysis** to display the **Analysis** screen and view the data.
- **2** For each time marker (in the order of heart cycle occurrence, left to right):
  - (a) Roll the trackball to position the cursor at the location on the ECG trace or velocity curve that represents the required image frame.
  - (b) Press a trackball **SELECT** key (or select [()TIME MARK]).

The system updates the representative images to display the selected image frame.

- (c) Roll the trackball to position the cursor on the required label from the displayed pop-up menu and then press **SELECT**.
- **3** To adjust an existing time marker, roll the trackball to position the cursor on the new location, press **SELECT** (or select **[()TIME MARK]**), roll the trackball to position the cursor on the required label from the displayed pop-up menu, and then press **SELECT** again.

Viewing the Measurements	You can view the automatically measured values for left ventricular, right ventricular, and generic wall segments.
	<b>NOTE:</b> Data summaries are available for review when all time markers have been placed for at least one related view and segment.

The data summaries include automatically measured peak values, times, and end systolic strain values and computed post-systolic strain indexes for left ventricular, right ventricular, and generic ROIs. These values are derived from the time markers and time event markers placed for each ROI.

# • To display a data summary screen:

- Select **[(()) MENU]** to display the Axius QSI navigation menu and then select the option for the required data summary:
  - **[LV DATA SUMMARY]**: Displays the data for all left ventricular ROIs.
  - **[RV DATA SUMMARY]**: Displays the data for all right ventricular ROIs.
  - **[GENERIC DATA SUMMARY]**: Displays the data for all ROIs that are labeled Unspecified.

**Example of LV Data Summary** 

	View	A4C		
F	Segment	Mid		
F	Wall	Sept		
	Stage	1:1		
	ES Str(%)	-14.4		
	Pk Str(%)	-18.5		
	T Pk Str(ms)	425		
	PSI(%)	23		
	Pk S SR(/s)	-1.15		
	T Pk S SR(ms)	287		
	Pk E SR(/s)	2.89		
	T Pk E SR(ms)	470		
	Pk A SR(/s)	1.26		
	Pk S Vel(cm/s)	5.5		
	T Pk S Vel(ms)	104		
	Pk E Vel(cm/s)	-5.8		
	Pk A Vel(cm/s)	-3.5		
	Pk Disp(mm)	8.7		
	T Pk Disp(ms)	346		

#### **Measurement Definitions**

MEASUREMENT	DEFINITION	DETAILS
<b>ES Str</b> (End systolic strain)	ε <sub>ES</sub>	Strain at end of mechanical systole (at aortic valve closure).
<b>Pk Str</b> (Peak strain)	ε <sub>MAX</sub>	Maximum (in magnitude) of strain.
<b>T Pk Str</b> (Time to Peak strain)	<b>Τ</b> - ε <sub>MAX</sub>	Time from the first R-wave to the maximum of strain.
<b>PSI</b> (Post systolic strain index)	100* (ε <sub>MAX</sub> - ε <sub>ES</sub> ) / ε <sub>MAX</sub>	Fraction of the maximum strain that is not present at the end of systole, or percentage of peak strain that occurs at aortic valve closure. Expressed as a percentage.
<b>Pk S SR</b> (Peak systolic strain rate)	sr <sub>MAX</sub>	Maximum (in magnitude) of strain rate, prior to peak strain.
<b>T Pk S SR</b> (Time to Peak systolic strain rate)	T - sr <sub>MAX</sub>	Time from the first R-wave to the maximum of strain rate.
<b>Pk E SR</b> (Peak E strain rate)	sr <sub>E</sub>	Maximum (in magnitude) of strain rate between mitral valve opening and mid-diastole.
<b>T Pk E SR</b> (Time to Peak E strain rate)	T - sr <sub>E</sub>	Time from the first R-wave to the maximum of strain rate between mitral valve opening and mid- diastole.
<b>Pk A SR</b> (Peak A strain rate)	sr <sub>A</sub>	Maximum (in magnitude) of strain rate between mid-diastole and the following R-wave.
<b>Pk S Vel</b> (Peak systolic velocity)	V <sub>SYS</sub>	Maximum (in magnitude) of velocity between aortic valve opening and aortic valve closure.
<b>T Pk S Vel</b> (Time to Peak Systolic Velocity)	T - v <sub>SYS</sub>	Time from the first R-wave to the maximum velocity between aortic valve opening and aortic valve closure.
		<b>NOTE:</b> The <b>T Pk S Vel</b> measurement is displayed in the data summaries only. This measurement is not included in data entered to the cardiac report.
<b>Pk E Vel</b> (Peak E velocity)	v <sub>E</sub>	Maximum (in magnitude) of velocity between mitral valve opening and mid-diastole.

ACUSON Sequoia Systems

MEASUREMENT	DEFINITION	DETAILS
<b>Pk A Vel</b> (Peak A velocity)	v <sub>A</sub>	Maximum (in magnitude) of velocity between mid-diastole and the following R-wave.
<b>Pk Displ</b> (Peak displacement)	d <sub>PK</sub>	Computed as the integral of the velocity, from the R-wave. The peak value (the value with the largest absolute value) is reported, along with the time of this event, measured from the previous R-wave.
<b>T Pk Displ</b> (Time to Peak displacement)	T - d <sub>PK</sub>	Time from the first R-wave to Peak Displacement.

# Entering the Measurements to the Report

You can enter the automatically measured values in the left ventricular and right ventricular data summaries to the cardiac report and view the cardiac report. You can also map specific stage protocols (within the sequence defined for the exam preset used for storing clips) to stages within the cardiac report. For example, you can map the second stage protocol to the first stage within the cardiac report.

**NOTE:** You can enter each measurement for each wall segment up to ten times by editing ROIs, adjusting time markers, and/or analyzing additional clips (with the same stage) using the same cardiac view and wall segment names. The system automatically averages multiple measurements for a wall segment.

When you enter the measurements to the cardiac report, the system adds gray shading to the entered measurements on the data summaries and displays hatchmarks ("#") on the related ROIs on the **Analysis** screen to indicate that they (and their time markers) cannot be changed.

**NOTE:** The **T Pk S Vel** measurement is displayed in the data summaries only. This measurement is not included in data entered to the cardiac report.

The cardiac report displays the entered data in the column for the report stage corresponding to the stage protocol, as configured in the **Stage Mapping** screen. The data for each wall segment is displayed on a separate page of the report.

**NOTE:** When editing "DTI -- QSI" report pages, you can enter negative values.

ardi	iac Ronarte						DTI –	osi	15 Jan U4 1.24 nm
BSA	m <sup>2</sup>	Ht.	cm	Wt.	ka	Ade		BP	
				A	Candum				
A40		Staao 1	Stano2	Арісаі	Septum		Stano 2	Stanod	
	ES Strain	Juger	Judger	z		FC Strain	Judgeo	Juger	r 0 <u>7.</u>
	Pk Strai	n		/0 ኤ		Pk Strain			/0 0%
	T Pk Strai	n		/0 ms	т	Pk Strain			ms
	PS	i	i	%		PSI			%
	Pk S SF	2		í/s		Pk S SR			1/s
	T Pk S SF	2	1	ns		T Pk S SR			ms
	Pk E SF	2		1/s		Pk E SR			1/s
	T Pk E SF	2	1	ns		T Pk E SR			ms
	Pk A SF	2		1/s		Pk A SR			1/s
	Pk S Ve			cm/s		Pk S Vel			cm/s
	Pk E Ve	1		cm/s		Pk E Vel			cm/s
	Pk A Ve			cm/s		Pk A Vel			cm/s
	Pk Disp		l l	mm		Pk Displ			mm
		1	I	ns		I PK Dispi			ms
Don	ot perform	off-line_m	easureme	ents on th	is imaae.				
Pa	ge Up	Pa	ge Down					Ex	pand

**Example of Cardiac Report** 

- To map stage protocols to the stages displayed in the cardiac report:
- 1 Select [(()) MENU] to display the QSI navigation menu and then select [STAGE MAPPING] to display the Stage Mapping screen.
- **2** For each stage in the cardiac report, select the required stage protocol.

For example, to map the second stage protocol to the first stage within the cardiac report, select **2** (representing the second stage protocol) from the drop-down list for **Report Entry S1** (representing the first stage within the cardiac report).

#### **Example of Stage Mapping**

Report Entry S1:	2	T	Report Entry S3:	6	•
Report Entry S2:	4	Ŧ	Report Entry S4:	8	•

- **3** Select **[(()) APPLY]** to save changes and exit the **Stage Mapping** screen.
- To enter data from the displayed data summary to the cardiac report:

**NOTE:** Data from the generic data summary cannot be entered to the cardiac report.

- 1 If required, change the mapping of stage protocols to report stages.
- 2 Select [ENTER].

#### • To view the cardiac report for the current examination:

**NOTE:** The system displays the "DTI -- QSI" report pages and fields as configured in **Setup** under **Cardiac Calc**. For more information about cardiac reports, see Chapter 28.

- 1 Press the **REPORT** key and then select **[CARDIAC]**.
- 2 To display another page of the report, select [PAGE UP] or [PAGE DOWN] or press PAGE.
- **3** Select **[EXPAND]** to enable or disable display of data for report stages 3 and 4.
- **4** To exit the cardiac report, press the **REPORT** key again.

# Exporting the Axius QSI Data to a Connected Device

You can export the Axius QSI data to a storage device that is connected to a USB port on the Perspective advanced display option. The exported data can be viewed using spreadsheet applications or any other software that can display comma-separated value (CSV) formatted data.

The Axius QSI data consists of the analysis data and the information used to create the Axius QSI data, which includes ECG information, timing information, frame timestamps, R-wave timestamps, and the locations of ROI nodes and ROI sample positions on each frame. The analysis data consists of strain, strain rate, velocity, and displacement values for all locations along the ROIs on all image frames.

When you export the Axius QSI data, the system stores each wall segment to its own comma-separated value (CSV) formatted file named with the related view and wall segment (for example, A4C\_Mid\_Sept for the mid septal wall segment in the A4C view). The system places these files on the root directory of the connected storage device, using the following path (where <date\_time> is the subdirectory named with the date and time of export): \QSI\<date\_time>\

- To export the Axius QSI data to a connected storage device:
- 1 Select **[(()) MENU]** to display the Axius QSI navigation menu and then select an option for a data summary.
- 2 Select [EXPORT].

For information on compatible devices, see "Exporting Data" on page 74.

# CHAPTER 34

# **AXIUS VELOCITY VECTOR IMAGING**

	Available on Sequoia C256 Echocardiography Systems, Sequoia C512 Echocardiography Systems, and on Sequoia 512 Ultrasound Systems with the Cardiac Option.
	This option has minimum software and/or hardware requirements. Contact your Siemens representative for information regarding the requirements.
Overview	Axius Velocity Vector Imaging (Axius VVI) is an optional feature that tracks and estimates tissue velocity at selected points on a user-defined outline (trace) of a structure. Axius VVI illustrates tissue velocity by placing velocity vectors (arrows) on the trace. These velocity vectors (along with the velocity reference point) are the source of the derived quantitative data, such as velocity curves.
Compatible Clips	You can activate Axius VVI for any clip that contains only 2-D mode data.
	Clips acquired on systems with cathode ray tube (CRT) monitors are compatible.
Controls	The controls used for Axius VVI consist of soft keys, controls on the keyboard, and on-screen selections.
Soft Keys and Controls on	

the Keyboard

[SOFT KEY] CONTROL	FUNCTION
[EXIT]	Exits Axius VVI.
GAIN/FRZ/RUN	When pressed, begins or stops clip playback. When rotated, advances or rewinds the clip frame by frame.

On-screen Selections -VVI Screen

ICON	SELECTION	FUNCTION
	Long Axis	Selects the <b>Long Axis</b> algorithm for processing the trace.
	Short Axis	Selects the <b>Short Axis</b> algorithm for processing the trace.
	Generic Curve	Selects the <b>Generic Curve</b> algorithm for processing the trace.
	Average Heart Cycle	When selected (enabled), calculates and applies the average heart cycle to each heart cycle in the clip.
		<b>NOTE:</b> This selection is available for multiple-cycle clips, after processing only.

ICON	SELECTION	FUNCTION		
	Gamma	Adjusts the gamma image setting (changes both brightness and contrast).		
	Delete	Removes the currently displayed trace from the screen.		
	(slider below clip)	Positions the clip frame within the clip window.		
	Reset PinPoints	Removes all selected points on the parametric velocity M-mode graph.		
		<b>NOTE:</b> This selection is displayed when you position the cursor on the parametric velocity M-mode graph and then double-click a trackball <b>SELECT</b> key.		
		Restores the original gamma image setting.		
P	Process Images	Calculates velocity vector data for the selected trace.		
	New Trace	Activates the tracing (outlining) function and removes the displayed trace (if any) from the screen.		
	Edit Trace	Activates or deactivates the editing function. When the editing function is active, points within the trace are available for repositioning.		
	Set the "Heart Rate" Value	Displays the <b>Heart Rate</b> dialog box for defining the heart rate and number of heart beats.		
	MMode for Plot Background	Displays the M-mode Background screen to define an M-mode background for display on plots, behind curves. The background is defined using a "free-form M-mode trace."		
	Strain/Velocity Measurement Window	Displays velocity, strain, and strain rate information in the Strain/Velocity Measurement screen.		
	Global Measurements Window	Displays ejection fraction (EF), Dmin, Dmax, volume, and segmental volume information in the Global Measurement screen.		
		<b>NOTE:</b> This selection may not be available for traces processed using the <b>Generic Curve</b> processing algorithm.		

ICON	SELECTION	FUNCTION		
	Dyssynchrony analysis	Displays timing information (such as time- to-peak values) as related to strain, strain rate, velocity, or displacement in the Dyssynchrony screen.		
		<b>NOTE:</b> This selection may not be available for traces processed using the <b>Generic Curve</b> processing algorithm.		
	Shorter Arrows	Decreases the length of the velocity vectors in two-pixel increments.		
	No Arrows	Cycles through display settings for velocity vectors:		
		<ul> <li>Display velocity vectors</li> <li>Hide velocity vectors and trace (contour)</li> </ul>		
<b>*</b>	Longer Arrows	Increases the length of the velocity vectors in two-pixel increments.		
	Restore the Graphs aspect	Displays all curves on the curve plot.		
	Toggle Original Border Points to Equispaced Points x4	Toggles display of the user-defined trace points with display of the system-generated trace points.		
	Toggle Filtered/ Unfiltered Plots	Adjusts the smoothing in curves on all curve plots (all screens).		
	Distance Calibration	Displays the Distance Calibration screen to change manual calibration settings (drawn line and distance value) for clips retrieved from videotapes.		
		<b>NOTE:</b> This selection is available for clips retrieved from videotapes only.		
	Average Cycle Calculation	Selects one or more heart cycles within a multiple-cycle clip for processing and display as a representative heart cycle.		
		<b>NOTE:</b> This selection is available for multiple-cycle clips, before processing only.		
	Export	Exports images, clips, and/or data to a storage device that is connected to a USB port on the system.		
		<b>NOTE:</b> This selection may not be available unless a storage device is connected.		

#### On-screen Selections -Heart Rate Dialog Box

SELECTION		FUNCTION	
Heart Rate		Changes the heart rate.	
Entire recording corresponds to heartbeats		Changes the number of heart beats represented by the clip.	
Reset		Clears the current value for the following selections: <b>Heart Rate</b> and <b>Selected trace corresponds to</b> heartbeats.	
Selected trace corresponds to heartbeats		Selects a segment of the clip for use with Axius VVI and changes the number of heart beats represented by the selected segment.	
Select all		Selects the entire ECG trace.	
ОК		Saves changes and exits the dialog box.	
SELECTION	FUNCTION		
Gamma	Adjusts the gamma image setting (changes both brightness and contrast).		
<u>د</u>	Restores the original gamma image setting.		

<>	Restores the original gamma image setting.
Reset	Removes the currently displayed "free-form M-mode trace."
Reverse colors	Toggles black-on-white display with white-on-black display.

On-screen Selections -All Measurement Screens

On-screen Selections -M-Mode Background

Screen

ICON	SELECTION	FUNCTION
	MMode for Plot Background	Displays the M-mode Background screen to define an M-mode Background for display on plots, behind curves. The background is defined using a "free-form M-mode trace."
	Export	Exports images, clips, and/or data to a storage device that is connected to a USB port on the system.
	Close	Exits the displayed screen and redisplays the VVI screen.

On-screen Selections -Strain/Velocity Measurement Screen

SELECTION	FUNCTION
Row by Row	Displays curves for all points in the parametric velocity M-mode graphs.
Delete Stored Points	Removes all selected points from the parametric velocity M-mode graphs and associated curves.
Zoom	Magnifies the selected curve plots to a full-screen display.
Velocity	Selects the velocity curve plot for magnification.
Strain	Selects the strain curve plot for magnification.
Strain Rate	Selects the strain rate curve plot for magnification.
<b>3d</b>	Displays the 3D screen including the 3D rendering of information in the related parametric velocity M-mode graph.

On-screen Selections -3D Screen and Magnification Screen The following selections are displayed on the 3D screen and the magnification screen accessed from the Strain/Velocity Measurement screen.

ICON	SELECTION	FUNCTION
	Export	Exports images, clips, and/or data to a storage device that is connected to a USB port on the system.
	Close	Exits the displayed screen and redisplays the VVI screen.

On-screen Selections -Global Measurement Screen

SELECTION	FUNCTION
Vol./Area	When selected (checked), displays curves for all traces.
Plot	When cleared, displays curves for the current
[Current] / [AII]	trace only.

#### On-screen Selections -Dyssynchrony Screen

SELECTION	FUNCTION		
Time To:	Computes and displays values for the selected time parameter:		
	<ul> <li>Peak (time to peak)</li> <li>75% (time to 75 percent)</li> <li>50% (time to 50 percent)</li> </ul>		
Velocity	Computes, displays, and depicts values for the selected parameter:		
	<ul><li>Tangential (tangential velocity)</li><li>Radial (radial velocity)</li></ul>		
Strain	Computes, displays, and depicts values for strain.		
Strain Rate	Computes, displays, and depicts values for strain rate.		
Displacement	Computes, displays, and depicts values for the selected parameter:		
	<ul> <li>Tangential (tangential displacement)</li> <li>Radial (radial displacement)</li> </ul>		
All Curves	When selected (enabled), displays all curves. When cleared (disabled), displays selected curves only.		
	<b>NOTE:</b> Data on the screen includes values for the displayed curves only.		

# Activating and Exiting Axius VVI Technology

You can activate Axius VVI for a selected, compatible clip in live or restarted studies, previous studies, or teaching files.

When you activate Axius VVI, the system displays the selected clip in the VVI screen.

While Axius VVI is active, you can obtain and view velocity vector data based on a traced structure. You can also complete the following standard functions: annotate, print, record to VCR, and store clips and images. For more information on these functions, see Chapter 6 and Chapter 8.

When you exit Axius VVI, the system displays the review screen.

# • To activate Axius VVI:

**NOTE:** If the required clip is from a previous study and you plan to store more images, then either restart the study or create and restart a teaching file containing the clip. See "Restarting a Study" on page 35 and/or "Creating a Teaching File" on page 64.

1 Press **REVIEW** to display the clip in the review screen.

The system displays the stored images and clips.

- **2** Roll the trackball to position the cursor on the required clip. (You can press **QUAD** to display the required clip in full-screen format.)
- **3** Press **AUTO MEASURE**.

If the selected clip is compatible with more than one Axius application, then the system displays a list of applications on the upper right of the screen.

**4** If required, select **VVI** from the displayed list on the upper right of the screen.

The system briefly displays a message on the screen indicating activation of Axius VVI.

If the selected clip was retrieved from a videotape, then the system prompts you to manually calibrate the clip by displaying the Distance Calibration screen.

- **5** If required, manually calibrate the clip:
  - (a) Roll the trackball to position the cursor on the clip.
  - (b) Press and hold a trackball **SELECT** key to anchor the first marker.
  - (c) Roll the trackball to position the last marker and then release the trackball **SELECT** key to anchor the marker.
  - (d) To change the number of millimeters represented by the drawn line, roll the trackball to the **Draw a line for a distance** representation of \_\_\_ mm text box and use the keyboard to edit the existing value.
  - (e) Select **OK** to save changes and exit the Distance Calibration screen.

If the selected clip does not have an ECG tracing, then the system prompts you for the heart rate by displaying the **Heart Rate** dialog box.

- **6** If required, enter or change the heart rate:
  - (a) For each digit representing the heart rate, roll the trackball to position the cursor on the required button to the right of the Heart Rate text box in the displayed Heart Rate dialog box and then press a trackball SELECT key.
  - (b) To clear the current heart rate value, select the **R** button to the right of the **Heart Rate** text box.
  - (c) Change the other settings as required. For more information on changing heart rate information, refer to "Changing Heart Cycle Information" on page 349.
  - (d) To close the Heart Rate dialog box, select OK.
- **7** To exit Axius VVI, choose a method:
  - Select [EXIT].
  - Press AUTO MEASURE.
  - Press **REVIEW** (also exits the review screen).
  - Press **DELETE** (also deletes the displayed clip).

Obtaining Velocity Vector Data	You can obtain velocity vector data by processing a trace (contour). You can also change the heart rate information used for the velocity vector data.		
	When you process a trace, the system illustrates tissue velocity using velocity vectors (arrows). The system also derives quantitative data from the velocity vectors and the placement of the velocity reference point.		
	The velocity vectors indicate the direction and velocity of tissue motion for each clip frame. Vector length illustrates the magnitude of velocity (speed) while vector arrowheads illustrate direction.		
	Quantitative data derived from the velocity vectors includes velocity, strain, strain rate, ejection fraction (EF), Dmin, Dmax, segmental volume, and timing information, such as time-to-peak values. This data is depicted as curves, parametric velocity M-mode graphs, and/or parametric segmental diagrams.		
Positioning the Clip Frame	You can position the clip frame within the clip window. Changing the position of the clip frame allows you to view information such as detected heart rate.		
	To position the clip frame:		
	1 If required, select <b>Close</b> on the upper right of the displayed screen to display the VVI screen.		
	<b>2</b> Roll the trackball to position the cursor on the slider below the clip, press and hold a trackball <b>SELECT</b> key, roll the trackball to reposition the selected slider, and then release the trackball <b>SELECT</b> key.		

Tracing Structures	You	a can create a trace (contour) to process for velocity vector data.
(Creating Traces)	Wh	en the tracing function is active and the cursor is positioned on the
	clip	b, the system changes the cursor shape to a crosshair ("+").
	•	To create a trace:
	1	If required, select <b>Close</b> on the upper right of the displayed screen to display the VVI screen.
	2	If the clip is playing, then press <b>GAIN/FRZ/RUN</b> to stop playback; rotate <b>GAIN/FRZ/RUN</b> to display the required clip frame.
		<b>NOTE:</b> Siemens recommends selecting the systolic clip frame for tracing.
	3	To adjust the gamma image setting (to change both brightness and contrast), roll the trackball to position the cursor on the <b>Gamma</b> slider on the right of the screen, press and hold a trackball <b>SELECT</b> key, roll the trackball to reposition the selected slider, and then release the trackball <b>SELECT</b> key.
	4	To restore the original gamma image setting, select the < > icon to the right of the <b>Gamma</b> slider.
	5	To change the heart rate information, select the <b>Set the "Heart Rate" Value</b> icon to display the <b>Heart Rate</b> dialog box, change the settings as required, and then select <b>OK</b> to redisplay the previous screen.
		<b>NOTE:</b> For more information on changing heart rate information, refer to "Changing Heart Cycle Information" on page 349.
	6	Roll the trackball to position the cursor on the clip.
		<b>NOTE:</b> Siemens recommends anchoring the first marker at the following locations: for long axis traces, on the left; for short axis traces, at the top. Siemens recommends anchoring at least one marker for each wall segment; to evaluate differences in motion within a wall segment, anchor several markers.
	7	Press a trackball <b>SELECT</b> key to anchor the first marker.
	8	For each segment of the trace, roll the trackball to outline the structure and then press a trackball <b>SELECT</b> key to anchor the marker and end each segment.
	9	To complete the trace, roll the trackball to position the last marker and then double-click a trackball <b>SELECT</b> key.
		<b>NOTE:</b> Roll the trackball to position the last marker before double- clicking. Clicking the last marker three times begins a new trace.

Editing	and	Deleting
Traces		

You can edit and delete processed traces (contours).

- To edit the currently displayed trace:
- 1 If required, select **Close** on the upper right of the displayed screen to display the VVI screen.
- 2 Select the **Edit Trace** icon on the right of the screen to activate the editing function.
- **3** Roll the trackball to position the cursor on the required marker of the trace, ensure that the cursor has changed its shape to indicate that the marker is selected, and then press a trackball **SELECT** key to select the marker.
- **4** Roll the trackball to reposition the selected marker and then press a trackball **SELECT** key again to deselect the marker.
- **5** To exit the editing function, select the **Edit Trace** icon again.
- To delete the currently displayed trace:
- 1 If required, select **Close** on the upper right of the displayed screen to display the VVI screen.
- 2 Select **Delete** on the left of the screen.

You can select one or more heart cycles within a multiple-cycle clip for processing by designating clip frames. The selected heart cycles are displayed as a single representative heart cycle.

• To select one or more heart cycles within a clip for processing:

**NOTE:** This function (the **Average Cycle Calculation** icon) is available for multiple-cycle clips, before processing only.

- 1 If the VVI screen is not displayed, then select **Close** on the upper right to exit the currently displayed screen.
- 2 Select the **Average Cycle Calculation** icon on the lower right of the VVI screen.

The system displays the **Average Cycle Calculation** dialog box with the **Period Selector** graph at the top.

- **3** Reposition the left and/or right vertical bar of the **Period Selector** graph to designate the included clip frames:
  - (a) Roll the trackball to position the cursor on the vertical bar and then press a trackball **SELECT** key to select the bar.
  - (b) Roll the trackball to reposition the selected bar and then press a trackball **SELECT** key to confirm the new location.
- **4** Select **Build New Loop** to confirm the designated clip frames and exit the dialog box.

**NOTE:** To use the **Average Cycle Calculation** icon again, exit and then activate Axius VVI again for the selected clip.

Selecting Heart Cycles for Processing

Processing Traces	You can process traces (contours) to obtain velocity vector data.			
		When you process a trace, the system generates four equally spaced points for every user-defined marker in the trace (except when using the <b>Generic Trace</b> processing algorithm) and then plays back the clip, displaying arrows to indicate the velocity vector data. The size of the velocity vectors is indicated on the lower right of the screen.		
	The system displays a button for each processed trace in the <b>History</b> section on the left of the VVI screen.			
	٠	To process a trace for velocity vector data:		
	1	If required, select <b>Close</b> on the upper right of the displayed screen to display the VVI screen.		
	2	Either create a trace or select an existing trace from the <b>History</b> section on the left of the screen.		
	3	Select the required trace processing algorithm selection (such as <b>Long Axis</b> ) on the right of the screen.		
	4	Select the <b>Process Images</b> icon.		
		The system plays back the clip, displaying the velocity vectors (arrows).		
Repositioning the Velocity Reference Point	Υοι	a can reposition the velocity reference point on the clip.		
	The location of the velocity reference point determines the component of the 2D velocity vector displayed in the curves and the parametric velocity M-mode graphs for all screens except the Dyssynchrony Analysis screen which references the local direction of the trace (not the velocity reference point). The velocity vectors (arrows) are not affected by the velocity reference point.			
	•	To reposition the velocity reference point (when Axius VVI is active):		

- **1** If the clip is playing, then press **GAIN/FRZ/RUN** to stop playback and display the velocity reference point.
- **2** Roll the trackball to position the cursor on the velocity reference point and then press a trackball **SELECT** key.
- **3** Roll the trackball to reposition the velocity reference point and then press a trackball **SELECT** key to confirm the new location.

# Changing Heart Cycle Information

You can change the heart rate, the number of heart beats represented by the clip, and the number of heart beats represented by a selected segment of the ECG trace.

- To change the heart cycle information:
- 1 If the VVI screen is not displayed, then select **Close** on the upper right to exit the currently displayed screen.
- 2 To view the system-detected heart rate on the clip, roll the trackball to position the cursor on the slider below the clip, press and hold a trackball SELECT key, roll the trackball to reposition the selected slider until the heart rate is visible, and then release the trackball SELECT key.
- 3 Select the **Set the "Heart Rate" Value** icon on the right of the VVI screen to display the **Heart Rate** dialog box.
- 4 To change the heart rate, select the R button to the right of the Heart Rate text box (if required to clear the current value) and then select the required digits in sequence from the buttons to the right of the Heart Rate text box.

**NOTE:** To cancel changes and redisplay the original heart rate, select **Reset**.

- 5 To change the number of heart beats in the clip, roll the trackball to position the cursor in the Entire recording corresponds to \_\_\_\_\_\_ heartbeats text box, press a trackball SELECT key, and then use the numeric keys on the keyboard to edit the current value.
- **6** To select a segment of the clip for use with Axius VVI and change the number of heart beats for the segment:
  - (a) Roll the trackball to position the cursor at the beginning of the segment in the ECG trace graph (located above the Selected trace corresponds to \_\_\_ heartbeats text box) and then press and hold a trackball SELECT key.
  - (b) Roll the trackball to position the cursor at the end of the segment in the ECG trace graph and then release the trackball **SELECT** key.

The system highlights the selected segment of the ECG trace.

(c) Repeatedly select the up or down arrow next to the Selected trace corresponds to \_\_\_\_ heartbeats text box to edit the current value.

**NOTE:** To cancel changes and redisplay the original number of heart beats for the segment, select **Reset**.

7 To save changes and exit the Heart Rate dialog box, select OK.

You can apply the calculated average heart cycle to each heart cycle in the clip.

• To apply the calculated average heart cycle to each heart cycle in the clip:

**NOTE:** This function is available for multiple-cycle clips, after processing only.

• Select the **Average Heart Cycle** check box on the right of the VVI screen.

Applying the Average Heart Cycle After Processing

#### Changing Manual Calibration Settings

You can change the manually calibrated distance line or value for a clip retrieved from a videotape.

#### • To change manual calibration settings:

- 1 If the VVI screen is not displayed, then select **Close** on the upper right to exit the currently displayed screen.
- 2 Select the **Distance Calibration** icon on the right of the screen.

**NOTE:** This selection is available for clips retrieved from videotapes only.

The system displays the Distance Calibration screen. The anchored markers of the drawn line intermittently illuminate, indicating that they are available for repositioning.

- **3** To reposition an anchored marker for the drawn distance line:
  - (a) Roll the trackball to position the cursor on one of the markers and then press and hold a trackball **SELECT** key to select the marker.
  - (b) Roll the trackball to reposition the selected marker and then release the trackball **SELECT** key to anchor the marker at the current location.
- 4 To change the distance value (the number of millimeters represented by the drawn line), roll the trackball to the Draw a line for a distance representation of \_\_\_ mm text box and use the keyboard to edit the existing value.
- **5** Select **OK** to save changes and exit the Distance Calibration screen.

# **Playing Back Clips**

You can begin or stop playback of the displayed clip. You can also cycle through the image frames in the clip.

- To begin or stop playback of the displayed clip:
- Press GAIN/FRZ/RUN.
- To cycle through the image frames of the displayed clip:
- Rotate GAIN/FRZ/RUN.

# Viewing Derived Data

You can view data derived from the velocity vector data for the currently displayed trace.

- To view data derived from the velocity vector data:
- 1 If required, select **Close** on the upper right of the displayed screen to display the VVI screen.

The system displays velocity vector data in the VVI screen.

**2** Select an icon to view the derived data:

TO VIEW:	SELECT THIS ICON FROM THE VVI SCREEN:
Velocity	Strain/Velocity Measurement Window
Strain	Strain/Velocity Measurement Window
Strain rate	Strain/Velocity Measurement Window
Ejection fraction	Global Measurements Window
Dmin and Dmax	Global Measurements Window
Volume	Global Measurements Window
Segmental volume	Global Measurements Window
Timing information as related to strain, strain rate, velocity, or displacement	Dyssynchrony analysis

**3** To redisplay the previous screen, select **Close**.

You can display derived data for previously created traces (contours).

- To display derived data for a previous trace (when Axius VVI is active):
- Select the required button in the **History** section on the left of the screen.

Displaying Derived Data for Other Traces

#### Defining an M-Mode Background for Curve Plots

You can define an M-mode background for display behind each curve plot. The user-created drawing for the M-mode background can include multiple segments. An M-mode background provides additional timing information.

- To define and display an M-mode Background (when Axius VVI is active):
- 1 Display the required image frame for definition of the free-form M-mode background.
- 2 Select the **MMode for Plot Background** icon on the upper right of the screen to display the M-mode Background screen.
- **3** Roll the trackball to position the cursor on the clip and then press a trackball **SELECT** key to anchor the first marker.
- **4** For each segment of the M-mode free-form drawing, roll the trackball to create the segment and then press a trackball **SELECT** key to anchor the marker and end each segment.
- **5** To anchor the last marker and complete the drawing, double-click a trackball **SELECT** key.
- **6** To remove the free-form drawing from the screen and restore default settings, select **Reset**.
- 7 Change the settings as required.

TO:	DO THIS:
Adjust the gamma image setting (change both brightness and contrast)	<ul> <li>(a) Roll the trackball to position the cursor on the Gamma slider and then press and hold a trackball SELECT key to activate the slider.</li> <li>(b) Roll the trackball to reposition the slider and</li> </ul>
	(b) Roll the trackball to reposition the shder and then release the trackball <b>SELECT</b> key to deactivate the slider.
Restore the original gamma image setting	Select the < > icon on the right of the screen.
Toggle the black and white display settings	Select the <b>Reverse colors</b> check box on the right of the screen.

8 Select **Close** to exit the M-mode Background screen and redisplay the previous screen.
# Changing the Data<br/>DisplayYou can change the velocity vector display, render 3D images of<br/>parametric velocity M-mode graphs, and display curves on the curve<br/>plots.Changing the Velocity<br/>Vector DisplayYou can change the display of velocity vectors, such as the length and<br/>density. The length of the velocity vectors is displayed on the right of the<br/>screen. For example, x10 indicates that the velocity vectors are ten times<br/>the original length.

#### • To change the velocity vector display:

- 1 If required, select **Close** on the upper right of the displayed screen to display the VVI screen.
- **2** Choose a method:

TO:	DO THIS:
Adjust the length of the velocity vectors (arrows)	Select the <b>Shorter Arrows</b> icon or the <b>Longer Arrows</b> icon on the right of the screen.
	<b>NOTE:</b> Use the same arrow length when comparing multiple sets of data.
Change the density of points and velocity vectors displayed	Select the <b>Toggle Original Border</b> <b>Points to Equispaced Points x4</b> icon on the right of the screen.
Display or hide the velocity vectors	Select the <b>No Arrows</b> icon to cycle through the display settings.

You can render 3D images of the parametric velocity M-mode graphs displayed in the Strain/Velocity Measurement screen.

#### To render 3D images of a parametric velocity M-mode graph (when Axius VVI is active):

- 1 Select the 3D icon on the lower right of the parametric velocity M-mode graph.
- **2** The system displays the 3D rendering in the 3D screen.
- **3** Change the display settings as required.

TO:	DO THIS:	
Rotate the 3D image	<ul><li>(a) Roll the trackball to position the cursor on the image and then press a trackball SELECT key.</li></ul>	
	<b>NOTE:</b> Position the cursor at the center of the 3D image for optimal control.	
	(b) Roll the trackball to rotate the rendering	3.
	(c) To exit the rotation function, press a trackball SELECT key again.	

Rendering 3D Images of Parametric Velocity M-mode Graphs (Strain/Velocity Measurement Screen) **Displaying Curves on the** 

**Curve Plots** 

TO:	DO THIS:
Magnify the 3D image	(a) Roll the trackball to position the cursor on the <b>ZOOM</b> slider and then press and hold a trackball <b>SELECT</b> key as you roll the trackball to the required level of magnification.
	(b) Release the trackball SELECT key to confirm the current level of magnification.
Restore the original settings for orientation and magnification	Select <b>Reset</b> on the right of the screen.

4 Select **Close** to redisplay the Strain/Velocity Measurement screen.

You can display curves for selected target point(s) on the trace (contour), selected point(s) on the parametric velocity M-mode graph, or specified timing parameters. Available methods depend on the displayed screen.

You can also display values for data points on curves, change the time interval or scale of the curve plots, and magnify the curve plots.

The system displays curves on the curve plots in the displayed screen. The system assigns a unique color to each point selected on either the parametric velocity M-mode graph or the trace; each curve uses the color of the selected point.

FOR:	DO THIS:
A selected target point on the trace	1 If the clip is playing, then press <b>GAIN/FRZ/RUN</b> to stop playback.
(VVI screen)	<b>2</b> Roll the trackball to position the cursor at the required location on the trace and then press a trackball <b>SELECT</b> key to confirm the position.
A selected point on the parametric velocity M-mode graph (VVI screen or	Roll the trackball to position the cursor at the required location on the parametric velocity M-mode graph and then press a trackball <b>SELECT</b> key to confirm the position.
Strain/Velocity Measurement screen)	<b>NOTE:</b> You can select up to ten uniquely colored points.
All points on the	Select <b>Row by Row</b> on the right of the screen.
parametric velocity M-mode graph (Strain/Velocity Measurement screen)	<b>NOTE:</b> To remove all curves from the screen, select <b>Delete Stored Points</b> on the right of the screen.
All traces (Global Measurement screen)	Select (check) the Vol./Area Plot [Current] / [All] check box.
The current trace only (Global Measurement screen)	Clear the Vol./Area Plot [Current] / [All] check box.

#### TO DISPLAY A CURVE

TO DISPLAY A CURVE FOR:	DO THIS:
Specified timing parameters	Select the required timing parameters on the right of the screen.
(Dyssynchrony screen)	<b>NOTE:</b> To display all curves, select the <b>All</b> <b>Curves</b> check box. To display selected curves, clear the <b>All Curves</b> check box and then select the check boxes for the required curves. Data on the screen includes values for the displayed curves only.

- To remove all selected points on the parametric velocity M-mode graph (VVI screen):
- 1 Roll the trackball to position the cursor on the parametric velocity M-mode graph and then double-click a trackball **SELECT** key.

The system displays a pop-up menu.

2 Select **Reset Pinpoints** from the pop-up menu.

Adjusting Smoothing for Curves	You can adjust the smoothing for curves on all curve plots (all screens). The system displays a curvy line above each curve plot when smoothing is adjusted			
	<ul> <li>To adjust the smoothing for curves on the curve plot:</li> </ul>			
	<ol> <li>If required, select <b>Close</b> on the upper right of the displayed screen to display the VVI screen.</li> </ol>			
	2 Select the <b>Toggle Filtered/Unfiltered Plots</b> icon.			
Displaying Values for Data	You can display the value for a data point on a curve.			
Points on Curves	When you position the cursor on a data point, the system displays a connector line from the selected data point to the value, listed above the curve's plot. The value and connector line are updated according to the position of the cursor. The system removes the value and connector line when you exit the screen.			
	To display the value for a data point on a curve (when Axius VVI is active):			
	• Roll the trackball to position the cursor on the required data point.			
Changing the Time Interval of the Curve Plots (Strain/Velocity Measurement Screen and	You can change the time interval of the curve plots by selecting a segment of the ECG trace (Strain/Velocity Measurement screen only) or repositioning the left or right frame markers within the plots (Strain Velocity Measurement screen or Dyssynchrony Analysis screen).			
Screen)	The system changes the cursor shape to a horizontal double-arrow to indicate that a vertical bar is available for selection and repositioning.			
	To select a segment of the ECG trace for the curve plots on the Strain/Velocity Measurement screen (when Axius VVI is active):			
	1 Roll the trackball to position the cursor on the left or right vertical bar of the <b>Period Selector</b> graph at the top of the screen and then press a trackball <b>SELECT</b> key to select the bar.			
	<b>2</b> Roll the trackball to reposition the selected bar and then press a trackball <b>SELECT</b> key to confirm the new location.			
	<ul> <li>To reposition the frame markers within the curve plots (when Axius VVI is active):</li> </ul>			
	1 Roll the trackball to position the cursor on the left or right vertical bar (frame marker) of a plot and then press the trackball <b>SELECT</b> key to select the bar.			
	<b>2</b> Roll the trackball to reposition the selected bar and then press the trackball <b>SELECT</b> key again to confirm the position.			
Changing the Scale of the Curve Plots (Strain/	You can change the scale of curve plots on the Strain/Velocity Measurement screen.			
velocity Measurement Screen)	To change the scale of a curve plot (Strain/Velocity Measurement screen only):			
	1 Roll the trackball to position the cursor on the vertical slider bar to the left of the curve plot and then press and hold a trackball <b>SELECT</b> key as you roll the trackball to reposition the bar.			

**2** Release the trackball **SELECT** key to confirm the current position.

Magnifying Curve Plots (Strain/Velocity Measurement Screen) You can magnify the curve plots displayed on the Strain/Velocity Measurement screen.

Magnified curve plots display in a full-screen format.

- To magnify curve plots (when Axius VVI is active):
- 1 Select the check box (located on the right of the screen) for each required curve plot.
- **2** Select **Zoom** on the right of the screen.

The system magnifies the curve plots in a new screen.

**3** To redisplay the Strain/Velocity Measurement screen, select **Close** on the upper right of the screen.

### Exporting Images, Clips, and Data to a Connected Device

You can export Axius VVI images, clips, and data to a storage device that is connected to a USB port on the system. Exported image files contain the displayed screen (without the on-screen selections). Exported clip files contain the clip in motion, as displayed within its clip window. Exported data files include information about the trace points, such as velocity.

For information on compatible devices, see "Exporting Data" on page 74.

The system stores exported files on the root directory of the connected storage device, using the following path (where <patient> is the patient name): \VVI\<patient>\

The file name format for exported Axius VVI files is (XXXX) MMDDYYYY-HHMMSS, where XXXX is the code indicating the exported screen and MMDDYYYY-HHMMSS is the date and time of export; MM is the month, DD is the day, YYYY is the year, HH is the hour, MM is the minute, and SS is the second. The file name extension for image files is JPG; for clip files, AVI; and for data files, DAT. You can view DAT files using a spreadsheet program such as Microsoft Excel. The file name codes are described below.

- MAIN: VVI screen.
- REG: Strain/Velocity Measurement screen.
- REGz: Full-screen display of magnified curve plot(s).
- 3D: Full-screen display of 3D rendering (parametric velocity M-mode graph).
- GLO: Global Measurement screen.
- CRT: Dyssynchrony Analysis screen.
- To export an image file from Axius VVI:
- 1 To export a data file with the image file, display the VVI screen; if required, select **Close** on the upper right of the displayed screen.
- 2 If the VVI screen is displayed and the clip is playing, then press **GAIN/FRZ/RUN** to stop playback.
- **3** To change the clip frame displayed for the image file, rotate **GAIN/FRZ/RUN**.
- 4 Select the **Export** icon or button.
- To export a clip file and a data file from Axius VVI:
- 1 If required, select **Close** on the upper right of the displayed screen to display the VVI screen.
- **2** Ensure that the clip is playing. If required, press **GAIN/FRZ/RUN** to begin playback.
- **3** Select the **Export** icon.

The system displays the Video Compression dialog box.

**NOTE:** Siemens recommends low or medium compression, if any.

- 4 Select the required option from the drop-down menu at the top of the dialog box; if required, select **Configure** to change configuration and/or reposition the **Compression Quality** slider to specify the quality factor.
- **5** Select **OK** to save compression settings and complete the export operation.

#### Field Descriptions for Exported Data Files

FIELD	DESCRIPTION
Axis	Selected processing algorithm, such as Long Axis.
Bpm	Heart rate, in beats per minute.
PixelDimension (mm.)	Number of millimeters per pixel.
ProbeXY (pixel)	Coordinates (x-axis and y-axis) of the velocity reference point, in pixels.
ProbeXY (mm.)	Coordinates (x-axis and y-axis) of the velocity reference point, in millimeters.
TracedPointsXY (pixel)	Coordinates (x-axis and y-axis) of user-defined trace points, in pixels.
TracedPointsXY (mm.)	Coordinates (x-axis and y-axis) of user-defined trace points, in millimeters.
FramesDelay (msec.)	Time between clip frames, in milliseconds.
Velocity (cm/sec.)	Velocity for all points along the trace, for each clip frame, in centimeters per second.
Strain (%)	Strain (percentage) for all points along the trace, for each clip frame.
StrainRate (1/s)	Strain Rate (per second) for all points along the trace, for each clip frame.
tX (pixel coord)	Coordinates (x-axis) of all points along the trace, for each clip frame, in pixels.
tY (pixel coord)	Coordinates (y-axis) of all points along the trace, for each clip frame, in pixels.
tVx (cm/sec.)	Total velocity (x-axis) of the tissue along the trace, for each clip frame, in centimeters per second.
tVy (cm/sec.)	Total velocity (y-axis) of the tissue along the trace, for each clip frame, in centimeters per second.
tVxe (cm/sec.)	Velocity (x-axis) of the tissue relative to the trace points, for each clip frame, in centimeters per second.
tVye (cm/sec.)	Velocity (y-axis) of the tissue relative to the trace points, for each clip frame, in centimeters per second.

FIELD	DESCRIPTION
Area (cm^2)	Short axis area for each clip frame, in squared centimeters. ( <b>Short Axis</b> processing algorithm only.)
Seg.Area (cm^2)	Segmental areas, in squared centimeters. ( <b>Short Axis</b> processing algorithm only.)
Vol. (ml.)	Modified method of disk volume for each clip frame, in milliliters. ( <b>Long Axis</b> and <b>Generic</b> processing algorithms only.)
Seg.Vol (ml.)	Segmental volumes, in milliliters. ( <b>Long Axis</b> and <b>Generic</b> processing algorithms only.)
DMin (mm.)	The maximum distance (diameter) across the chamber, parallel to the mitral plane, for all clip frames, in millimeters. ( <b>Long Axis</b> processing algorithm only.)
DMax (mm.)	Distance from the mitral plane to the apex for all clip frames, in millimeters. ( <b>Long Axis</b> processing algorithm only.)

## **CARDIOVASCULAR FEATURES**

Cardiovascular Features describes special features for cardiovascular exams. These features are available on Sequoia C256 Echocardiography Systems, Sequoia C512 Echocardiography Systems, and on Sequoia 512 Ultrasound Systems with the Cardiac Option. This part includes the following chapters:

Chapter 35	Stress Echo Studies	363
Chapter 36	fourSight TEE View	373
Chapter 37	Transesophageal Transducers	401

# **STRESS ECHO STUDIES**

**Overview** Performing a stress echocardiography (stress echo) study involves storing clips of several views of the heart in various stages of rest and activity, under a stress echo protocol in the AEGIS digital image and data management system. Wall motion scoring is then used to analyze the completed stress echo study. The stored view clips are displayed while scoring is performed, and once you've scored the views for each stage you can review the calculation results in the cardiac calculation report.

**NOTE:** You perform wall motion scoring in the cardiac calculation package, and view the calculation results in the cardiac calculation report. For more information on the cardiac calculation package, see Chapter 26 of the *Administrator Manual*.

You can use the Physio Module ECG using a single lead or import a lead from your 12-lead ECG system for triggering. If you are importing the ECG signal from an auxiliary ECG system:

- 1 Use the special connector cable and plug the modified ECG cable into the Physio Module ECG connector on the Sequoia system.
- **2** Turn the ECG on.

## Recalling the Stress Echo Exam Preset

Siemens provides the following stress echo Exam Presets:

- Exercise Stress
- Pharm Stress 4
- Pharm Stress 7
- Pharm Stress QSI

You can also create your own stress echo Exam Presets. For more information about Exam Presets, see the *Administrator Manual*.

To recall a stress echo Exam Preset, press EXAM PRESETS and choose the stress echo Exam Preset from the pop-up menu.

#### Exercise Stress Exam Preset

The Exercise Stress Exam Preset has the following stages.

ITEM	REST	PEAK	
Frame Rate	30 Hz	30 Hz	
Clip Size	ROI	ROI	
JPEG Compression	Low	Low	
Display Stage Timer	off	on	
Save on Capture	off	off	
Auto Review	on	off	
Auto-Delete	off	off	
Clip Settings			
Clips per Capture	4	indefinite capture	
Segments per Clip	1	1	
Segment Length	400 msec	280 msec	
Alt Segment Length	280 msec	400 msec	
R-Wave Gated Capture	on	on	
R-Wave Delay	0 msec	0 msec	
Trig Clip Settings			
Segment Length	10 ultrasound frames	10 ultrasound frames	
Alt. Segment Length	100 ultrasound frames	100 ultrasound frames	

Acquiring Rest Clips in the Exercise Stress Exam Preset

#### • To acquire rest clips in the exercise stress Exam Preset:

- 1 Acquire the Rest stage, starting with the PLAX view. Press **CLIP STORE**, or use the footswitch.
- **2** Highlight the quad you wish to select for the PLAX REST image, and then press **[SELECT]**.
- **3** Select the view name from the pop-up list.
- 4 Exit **REVIEW**.
- **5** Repeat steps 1-4 for PSAX, A4C, and A2C.
- 6 After you have collected all four views, press [SHOW: ALL/ SELECTED] and highlight SELECTED.

The four views for the Rest Stage (Stage 1) appear.

7 Exit **REVIEW**.

Acquiring and Reviewing Immediate Post Clips in the Exercise Stress Exam Preset

#### To acquire and review immediate post clips in the exercise stress Exam Preset:

- 1 After the patient completes the exercise phase, press **PROTOCOL**, select the **POST** stage, and use the soft keys to select the capture length appropriate for the patient's achieved heart rate: 280 msec or 400 msec.
- 2 Press [ALT SEGMENT LENGTH] to switch between the two options.
- **3** Begin collecting images in any sequence by pressing **CLIP STORE** or the footswitch. The protocol is set up to continuously capture clips. You can stop and restart capturing at anytime. This is referred to as indefinite length capture or full disclosure.
- **4** Once you have collected all the images (usually within two minutes), end the capture by pressing **CLIP STORE** again or the footswitch.
- **5** Press **REVIEW**. The last collected image will appear on the screen.

The system requires that you select the images in the same sequence as the REST images (for example, PLAX, PSAX, A4C, A2C) or review the images and then manually identify each view.

- 6 Press HOME to move to the first images of the Post stage or END to move to the last images of this stage. Advance through the pages by toggling PAGE and select the appropriate images by view.
- 7 Press [SHOW: ALL/SELECTED] and highlight SELECTED. You see the four views selected for the Post stage.

Upon completion of selecting all stages, you can compare the same stage by view. For example, you may want to compare the REST and POST images.

- 1 Press **REVIEW**.
- 2 Press [SHOW: ALL/SELECTED] and highlight SELECTED.
- **3** Press **[STAGE/VIEW]** and highlight **VIEW**. This will display the final page of the exam (A4C and A2C views side-by-side).
- **4** Toggle **PAGE** up to see the PLAX and PSAX comparisons.
- **5** The images will be playing back in a loop align mode. If you turn the **GAIN/FRZ/RUN** wheel, you can change the playback speed of all the clips simultaneously. It is reflected as a percentage of speed in the data field.
- **6** You can use the trackball to highlight any image and review it individually. You may:
  - Freeze and review frame by frame via the **GAIN/FRZ/RUN** wheel.
  - Set margins.
  - Switch review by view or stage.

Comparing Stages by View

### Pharm Stress 4 Exam Preset

The Pharm Stress 4 Exam Preset has the following stages:

ITEM	BASELINE	LOW DOSE	PEAK	RECOVERY	
Stage Settings					
Frame Rate	30 Hz	30 Hz	30 Hz	30 Hz	
Clip Size	ROI	ROI	ROI	ROI	
JPEG Compression	Low	Low	Low	Low	
Display Stage Timer	off	on	on	off	
Save on Capture	off	off	off	off	
Auto Review	on	on	on	on	
Auto-Delete	off	off	off	off	
Clip Settings					
Clips per Capture	4	4	4	4	
Segments per Clip	1	1	1	1	
Segment Length	400 msec	400 msec	360 msec	400 msec	
Alt Segment Length	360 msec	360 msec	400 msec	360 msec	
R-Wave Gated Capture	on	on	on	on	
R-Wave Delay	0 msec	0 msec	0 msec	0 msec	
Trig Clip Settings					
Segment Length	10	10	10	10	
	ultrasound frames	ultrasound frames	ultrasound frames	ultrasound frames	
Alt Segment Length	100 ultrasound frames	100 ultrasound frames	100 ultrasound frames	100 ultrasound frames	

During the exam, you can choose which Stages you want to select for the quad screen format. Typically users select the Baseline, a Low Dose Stage, Peak Stage (varies with patient response), and Recovery.

## Pharm Stress 7The Pharm Stress 7 Exam Preset has the following stages.Exam Preset

ITEM	BASELINE	LOW DOSE	20 MCG	30 MCG	40 MCG	40 MCG+ ATROPINE	RECOVERY
Stage Settings							
Frame Rate	30 Hz						
Clip Size	ROI						
JPEG	Low						
Display Stage Timer	off	on	on	on	on	on	off
Save on Capture	off						
Auto Review	on						
Auto-Delete	off						
Clip Settings							
Clips per Capture	4	4	4	4	4	4	4
Segments per Clip	1	1	1	1	1	1	1
Segment Length	400 msec	360 msec	400 msec				
Alt Segment Length	360 msec	400 msec	360 msec				
R-Wave Gated Capture	on						
R-Wave Delay	0 msec						
Trig Clip Settings	S						
Segment Length	10 ultra- sound frames						
Alt Segment Length	100 ultra- sound frames						

#### Acquiring Clips in the Pharmacologic Stress 7 Exam Preset

## • To acquire clips in the Pharmacologic Stress 7 Exam Preset:

BASELINE AND LOW DOSE STAGE		20- ST/	40 MCG + ATROPINE AGES	RECOVERY STAGE		
1	Recall the Pharmacologic Stress Exam Preset.	1	Cycle <b>[PROTCOL]</b> to <b>[20</b> <b>MCG]</b> and so on.	1	Cycle [PROTCOL] to [RECOVERY].	
2	Press the <b>PROTOCOL</b> key on the keyboard. The soft key	2	Acquire each view in sequence (PLAX, PSAX, $AAC = A2C$ )	2	Acquire each view in sequence as before.	
3	Acquire the Rest stage, starting with the PLAX view. Press <b>CLIP STORE</b> .	For example, if your patient has made it through to 40 mcg + atropine, you will have performed clip stores for 20 mcg, 30 mcg, 40 mcg stages, however you won't have selected any images to this point. These images remain in memory and can be reviewed at anytime before ending		3	Press <b>REVIEW</b> and select the appropriate images for this set in order (PLAX, PSAX,	
4	Four images appear on the screen with the REST label in the data field. Use the trackball to highlight which quad you wish to select for the PLAX Baseline image. Press <b>[SELECT]</b> .				A4C and A2C).	
5	Exit <b>REVIEW</b> .	the	exam.			
6	Repeat steps 1-4 for PSAX, A4C, and A2C.					
7	After you have collected all four view, press <b>[SHOW: ALL/</b> <b>SELECTED]</b> and highlight <b>SELECTED</b> . The four views for the Baseline Stage (Stage 1) appear.					
8	Exit <b>REVIEW</b> .					
9	Cycle <b>[PROTCOL]</b> to <b>[LOW</b> <b>DOSE]</b> . Repeat for Low Dose Stage, steps 2-8.					

Comparing	by	View
or Stage		

#### • To compare by view or stage:

#### 1 Press **REVIEW**.

- 2 Press [SHOW: ALL/SELECTED] and highlight SELECTED. The four views selected for the four stages that were selected (in this case Baseline, Low Dose, 40 mcg + atropine and Recovery) appear.
- **3** You can review by View, which will display all the PLAX on one page and so on for each view. You can also review the images by Stage. This selection displays all the Baseline images together, and so on for each Stage.
- **4** You can use the trackball to highlight any image and review it individually. You may:
- Freeze and review frame by frame via the **GAIN/FRZ/RUN** wheel.
- Set margins.

Switch review by view or stage.

## Pharm Stress QSIThe Pharm Stress QSI Exam Preset (pharmacologic stress Exam Preset for<br/>Axius Quantitative Strain Rate Imaging) has the following stages.

**NOTE:** When using the **Pharm Stress QSI** Exam Preset, Siemens highly recommends using the default "sh" ("shortest") **Playback Speed** setting of **50% sh** instead of the **Playback Speed** setting of **50%**. (The system lists the "sh" playback speed settings when you select the **Loop-aligned** playback mode.) For more information on "sh" playback speeds, see Chapter 41.

**NOTE:** Playback speeds may need to be altered for each clip when reviewing a **Pharm Stress QSI** exam on the KinetDX<sup>TM</sup> workstation.

ITEM	BASELINE	BASELINE AC.CAPT	LOW DOSE	LOW DOSE AC.CAPT	PEAK	PEAK AC.CAPT	RECOVERY	RECOVERY AC.CAPT
Stage Settings								
Frame Rate	30 Hz	30 Hz	30 Hz	30 Hz	30 Hz	30 Hz	30 Hz	30 Hz
Clip Size	ROI	Full	ROI	Full	ROI	Full	ROI	Full
JPEG Compres- sion	Low	Low	Low	Low	Low	Low	Low	Low
Display Stage Timer	off	off	on	off	on	off	off	off
Save on Capture	off	on	off	on	off	on	off	on
Auto Review	on	off	on	off	on	off	on	off
Auto- Delete	off	off	off	off	off	off	off	off
Clip Settings								
Clips per Capture	4	1	4	1	4	1	4	1
Segments per Clip	1	1	1	1	1	1	1	1
Segment Length	400 msec	400 msec	400 msec	400 msec	360 msec	360 msec	400 msec	400 msec
Alt Segment Length	360 msec	360 msec	360 msec	360 msec	400 msec	400 msec	360 msec	360 msec
CINE R-R Capture	off	1	off	1	off	1	off	1
R-Wave Gated Capture	on	on	on	on	on	on	on	on
R-Wave Delay	0 msec	0 msec	0 msec	0 msec	0 msec	0 msec	0 msec	0 msec

ITEM	BASELINE	BASELINE AC.CAPT	LOW DOSE	LOW DOSE AC.CAPT	PEAK	PEAK AC.CAPT	RECOVERY	RECOVERY AC.CAPT
Trig Clip Settings								
Segment Length	10 ultra- sound frames							
Alt Segment Length	100 ultra- sound frames							

# fourSIGHT TEE VIEW

Overview	Available with the Se	Available with the Sequoia C256 or C512 systems.				
	Requires Perspective TEE View option.	Requires Perspective advanced display option II with the <i>four</i> Sight TEE View option.				
	Use <i>four</i> Sight TEE Vie the ultrasound syster cardiac diseases such sources.	<ul> <li>Use <i>four</i>Sight TEE View to acquire and display 3-D volume datasets on the ultrasound system. <i>four</i>Sight TEE View can facilitate evaluation of cardiac diseases such as valvular disease and detection of embolic sources.</li> <li>Each 3-D volume dataset represents a complete heart cycle. A 3-D volume dataset is also referred to as a <i>phase loop</i>. A phase loop contains a <i>phase,</i> or volume, for each point in the heart cycle.</li> </ul>				
	Each 3-D volume dat dataset is also referre or volume, for each p					
Transducers	Use the V5M transes (datasets) for display	ophageal transducer to acquire 3-D volumes with <i>four</i> Sight TEE View.				
Presets	Use the <b>TEE</b> exam pr	eset for acquisition.				
Controls - 3-D Acquisition	CONTROL					
	[SOFT KEY]	FUNCTION				
	PERSPECTIVE	Displays soft keys for access to the Perspective advanced display option options that are enabled on the system. If only one Perspective advanced display option is enabled, then activates that option.				
	[3D CARDIOLOGY] or [CARDIOLOGY]	Displays the <b>[TEE VIEW]</b> soft key for access to the <i>four</i> Sight TEE View feature.				
	[TEE VIEW]	Displays soft keys for 3-D setup and acquisition.				
	[EXIT]	Exits <i>four</i> Sight TEE View.				
	[STEP ANGLE]	Specifies the step angle rotation increment for acquisition of each heart cycle.				
	[GATING SETUP]	Displays soft keys for heart rate gating setup.				
	[START]	Begins acquisition.				
	[PRIOR]	Displays the previous menu of soft keys.				
	[R-GATING ON/ OFF]	<b>ON:</b> Rejects each heart cycle that does not have the expected heart rate and then automatically acquires the set of frames for that angle at the next appropriate heart cycle.				
		<b>OFF:</b> Does not reject heart cycles if the heart rate is within the factory-default acceptable range (20 to 200 BPM [beats per minute]).				

CONTROL [SOFT KEY]	FUNCTION
[()HR MIN/MAX]	<b>MIN:</b> Adjusts the minimum heart rate acceptable for acquisition.
	<b>MAX:</b> Adjusts the maximum heart rate acceptable for acquisition.
	Possible settings: 20 to 200 BPM (beats per minute).
[AUTOSET]	Automatically sets the acceptable range for the heart rate based on the patient's current heart rate (the minimum is ten percent below; the maximum is ten percent above).
	For example, if the patient's current heart rate is 70 BPM, then the system specifies the following values: <b>HR MIN 63, HR MAX 77</b> .
[CANCEL]	Cancels acquisition and deletes any acquired data.
[RECONSTRUCT]	Displays the acquired 3-D volume dataset in the <b>TEE</b> review screen.
[POSTPONE]	Displays the acquisition soft keys for another 3-D volume dataset acquisition, delaying the viewing of the acquired dataset.
[DELETE]	Deletes the acquired 3-D volume dataset.

The system displays the following selections on the toolbar at the top of the **TEE** review screen.

ICON	SELECTION	FUNCTION
ŝ	Undo	Removes the most recent edit.
C	Redo	Cancels the most recent edit removal.
<b> ++</b>	Reset	Restores the initial orientation for all quadrants; displays the first phase; retrieves any removed data; deletes measurements, annotations, arrows; and clears the memory buffer.
	Pivot/Orbit	Orients (pivots or tilts) the cut plane when the cut plane or a plane quadrant is selected.
		Rotates the volume when a portion of the volume quadrant outside the volume is selected.
G	Rotate	Rotates the selected quadrant (plane or volume) in the clockwise or counterclockwise direction. When the volume quadrant is selected, rotates the volume around its center. When a plane quadrant is selected, rotates the plane around the location of the cursor.

Controls - TEE Toolbar (Review Screen)

ICON	SELECTION	FUNCTION
$\Leftrightarrow$	Pan	Shifts the image (plane or volume) in the selected quadrant.
$\sim$	Slice	Positions the cut plane by traversing the active plane quadrant through the volume along the orthogonal axis. Traversing the active plane is also called stepping through the volume.
Q	Zoom	Magnifies the plane or volume in the selected quadrant.
R	D↑Art	Activates the D $\uparrow$ Art function to display only the segment of interest in the volume quadrant. The segment of interest is defined by the selected plane (MPR).
$\mathcal{O}$	Synchronize VR view with active MPR view	Aligns the orientation of the volume quadrant (VR view, or Volume Rendered view) to that of the selected plane quadrant (MPR view, or Multi-Planar Rendered view).
		<b>NOTE:</b> When this selection is active, the following selections are available for the planes only (not for the volume): <b>Pivot/Orbit</b> , <b>Rotate</b> , <b>Pan</b> , <b>Slice</b> , and <b>Zoom</b> .
	Show Tissue	Displays only the 2-D data within the volume.
		<b>NOTE:</b> This selection is available for volumes that contain both 2-D data and Color Doppler data.
$\bigcirc$	Show Color	Displays only the Color Doppler data within the volume.
		<b>NOTE:</b> This selection is available for volumes that contain both 2-D data and Color Doppler data.
	Show Color and Tissue	Displays both the 2-D data and the Color Doppler data within the volume.
		<b>NOTE:</b> This selection is available for volumes that contain both 2-D data and Color Doppler data.
36	Clip Tissue	Activates the cut plane for 2-D data in the volume.
x	Clip Color	Activates the cut plane for Color Doppler data in the volume.
		<b>NOTE:</b> This selection is available for volumes that contain both 2-D data and Color Doppler data.
₿₽-	Tissue ROI	Adjusts the wireframe boundaries of the volume for 2-D data.

ICON	SELECTION	FUNCTION
₿ł.	Color ROI	Adjusts the wireframe boundaries of the volume for Color Doppler data.
		<b>NOTE:</b> This selection is available for volumes that contain both 2-D data and Color Doppler data.
đ	Show Decorations	Displays a gray wireframe around the volume.
	Play Phase Loop	Starts or stops playback of the phase loop.
•	Previous Phase	Displays the previous phase.
₩	Next Phase	Displays the next phase.

Controls - TEE Selections (Review Screen) The system displays **Tools**, **Measurements**, or **Render Settings** selections depending on the selected control on the upper right of the **TEE** review screen.

#### ICON SELECTION FUNCTION

\_

Ø	Tools	Displays the selections in the <b>Tools</b> group.
	Measure- ments	Displays the selections in the <b>Measurements</b> group.
Ľ	Render Settings	Displays the selections in the <b>Render Settings</b> group.

The system displays the following selections when you select the **Tools** control from the upper right of the **TEE** review screen.

ICON	SELECTION	FUNCTION
-Ò-	Brightness	Lightens or darkens shades or colors (plane quadrants only).
$  \Phi  $	Contrast	Adjusts the difference between the light and dark shades or colors (plane quadrants only).
	Play Phase Loop	Starts or stops playback of the phase loop.
•	Previous Phase	Displays the previous phase.
₩	Next Phase	Displays the next phase.

#### Tools

ICON	SELECTION	FUNCTION
*	Set Phase Animation Speed	Adjusts the speed of playback for the phase loop and/or the automatic rotation (animation).
		The triangle below the slider indicates the heart rate at acquisition relative to the speed of playback/rotation.
r	Play Animation	Automatically rotates the currently displayed phase in a rocking motion around its center point at the selected angle and speed.
Ì	Slow Motion	Enables or disables slow motion for automatic rotation of the volume.
$\sim$	Set Angle	Adjusts the vertical axis motion angle for automatic rotation of the volume.
		The total rotation is two times the motion angle setting. For example, the total rotation for a 45-degree motion angle is 90 degrees.
	Scalpel	Removes the outlined section of data from the volume.
X	Remove Erasings	Retrieves data that was removed using <b>Scalpel</b> .
	Toggle Lines of Intersection	Displays or hides the axes on the planes, which indicate the main axes through the volume.
<u>.</u> 9	Export Animation or Still	If the phase loop is playing, then exports the dataset as an AVI-formatted clip to external media.
	Image	If the phase loop is not playing, then exports the displayed quadrant(s) in bitmap (BMP) format to external media.
a s	Export Clip	Exports the entire 3-D volume dataset in DICOM format to external media.

#### Measurements

The system displays the following selections when you select the **Measurements** control from the upper right of the **TEE** review screen.

ICON	SELECTION	FUNCTION
1	Distance	Makes a distance measurement.
ħ,	Angle	Makes an angle measurement.
$\langle \zeta \rangle$	Area	Makes an area measurement.
A	Annotation	Annotates the selected plane or volume.

ICON	SELECTION	FUNCTION
$\mathbb{Z}$	Arrow	Places an arrow on the selected plane or volume.
×	Delete selected annotation or measurement	Deletes the selected annotation, measurement, or arrow. If there is not a selected annotation, measurement, or arrow, then deletes all annotations, measurements, and arrows.

The system displays the following selections when you select the

#### **Render Settings**

<b>Render Settings</b> control from the upper right of the <b>TEE</b> review screen.		
ICON	SELECTION	FUNCTION
Ś	Threshold Tissue	Eliminates darker gray shades, background noise, and "snow" from the 2-D data in the volume by removing voxels with values below the selected threshold.
	Transparency Tissue	Adjusts the level of surface transparency for the 2-D data in the volume. Higher values "smooth" the data while lower values "solidify" the data.
F	Threshold Color	Applies a unique color to each velocity direction in the Color Doppler data, then eliminates lower amplitude data and background noise from the Color Doppler data in the volume by removing voxels with values below the selected threshold

	values below the selected threshold.	
Transparency	Adjusts the level of surface transparency for	
Color	the Color Doppler data in the volume. Higher	
	values "smooth" the data while lower values	
	"solidify" the data and display data of	
	higher velocities.	
Gradient	Applies a mixture of gradient shading and	
Mada	tautum also din a to the 2 D date swithin the	

U	Mode	texture shading to the 2-D data within the volume.
	Gradient/ Gradient Mode	Applies a mixture of gradient shading and texture shading to the 2-D data and color Doppler data within the volume.
	Gradient- Texture Ratio	Mixes and adjusts gradient shading and texture shading.
	Texture Intensity	Adjusts the concentration of texture shading.
M	Max IP Mode	Displays only the maximum intensity
2	(Tissue)	(highest value) 2-D data within the volume.
M	Max IP Mode	Displays only the maximum intensity
Ŕ	(Color)	(highest value) Color Doppler data within the volume.
	No 3D Filter	Increases the structural detail of the volume.

1

ICON	SELECTION	FUNCTION
اللي.	Smooth 3D (normal)	Applies a mild, low-pass filter to the volume for a display that emphasizes both structural detail and smoothness.
	Smooth 3D (heavy)	Applies a moderate, low-pass filter to the volume for a display that emphasizes smoothness.
	Smooth 3D (massive)	Applies a strong, low-pass filter to the volume for a display that strongly emphasizes smoothness.
	Invert Tissue	Inverts bright and dark voxel values of the 2-D data within the volume.
()	Show Beutel	Toggles display of the volume (surface rendering) with display of the most recently calculated volume measurement.

The system displays the following selections on the toolbar at the top of the **TEE** volume measurement screen.

#### ICON SELECTION FUNCTION

ю	Undo	Removes the most recent edit.
CH	Redo	Cancels the most recent edit removal.
<b> ++</b>	Reset	Restores the initial orientation for all quadrants; displays the first phase; retrieves any removed data; deletes measurements, annotations, arrows; and clears the memory buffer.
	Play Phase Loop	Starts or stops playback of the phase loop.
•	Previous Phase	Displays the previous phase.
•	Next Phase	Displays the next phase.
e	Export Animation or Still Image	If the phase loop is playing, then exports the dataset as an AVI-formatted clip to external media.
		If the phase loop is not playing, then exports the displayed quadrant(s) in bitmap (BMP) format to external media.
2º	Export Clip	Exports the entire 3-D volume in DICOM format to external media.

Controls - TEE Toolbar (Volume Measurement Screen)

User Manual

The system displays the following selections (on the  $\ensuremath{\mathsf{TEE}}$  volume **Volume Measurements** measurement screen) when you press [VOL MEASURE].

ICON	SELECTION	FUNCTION
-Ò-	Brightness	Lightens or darkens shades or colors (plane quadrants only).
$  \Phi  $	Contrast	Adjusts the difference between the light and dark shades or colors (plane quadrants only).
2. <sup>44</sup>	Previous plane pair	Displays the previous plane pair in the upper two quadrants.
₿ <sub>XX</sub>	Next plane pair	Displays the next plane pair in the upper two quadrants.
	Double number of planes	Displays two times the originally displayed plane pairs.
⊁	Halve number of planes	Reduces the displayed plane pairs by one-half.
	Calculate Volume	Calculates the traced volume (measurement).
×	Delete volume	Deletes the traced volume measurement.

#### Setting Up for Acquisition

When you activate *four*Sight TEE View, the system displays an acquisition ROI (region of interest) on the live image and displays soft keys for volume acquisition and setup at the bottom of the screen. The system indicates each detected heart beat with a colored vertical marker on the ECG trace. A yellow marker indicates a heart beat inside the acceptable range; a blue marker indicates a heart beat outside the acceptable range.

When 3-D volume datasets are stored for the current patient examination, the system displays the **V** data field to indicate the quantity of stored 3-D volume datasets.

Acquisition setup includes positioning the acquisition ROI, defining the step angle, and adjusting settings for R-wave gating.

- To set up for 3-D acquisition:
- **1** Begin a new examination, select the **TEE** Exam Preset (or user-defined Exam Preset based on **TEE**), and select the V5M transesophageal transducer.
- **2** Confirm stability of the ECG leads.
- **3** Press the **PERSPECTIVE** key to activate the Perspective advanced display option.

If multiple features of the Perspective advanced display option are enabled, then the system lists a soft key for each feature. The system displays either **[CARDIOLOGY]** or **[3D CARDIOLOGY]** depending on the features enabled.

4 Press [CARDIOLOGY] or [3D CARDIOLOGY], then press [TEE VIEW] if displayed.

The system activates *four*Sight TEE View and displays an acquisition ROI on the live image and soft keys at the bottom of the screen for R-wave gating setup and the step angle.

- **5** To adjust the vertical position of the acquisition ROI:
  - (a) Push the **PRIORITY** key to select the ROI.

The system highlights the ROI.

- (b) Roll the trackball to adjust the vertical position.
- (c) Push the **PRIORITY** key again to de-select the ROI and redisplay the TEE View soft keys.
- **6** To change the transducer's step angle, press **[STEP ANGLE]** until the system displays the required angle.

**NOTE:** Siemens recommends using the default value of **5** for **[STEP ANGLE]**.

7 View the colored vertical markers on the ECG trace to determine whether a different range of acceptable heart rates is required (R-wave gating setup).

A yellow marker indicates a heart beat inside the acceptable range; a blue marker indicates a heart beat outside the acceptable range.

**8** To confirm and/or change settings for R-wave gating:

**NOTE:** Siemens recommends that R-wave gating be enabled for 3-D acquisition.

- (a) Press [GATING SETUP] and ensure that the system displays ON for [*R*-GATING ON/OFF].
- (b) To automatically set the minimum and maximum acceptable heart rates, select **[AUTOSET]**.
- (c) To manually set the minimum acceptable heart rate, ensure that the system displays **MIN** for **[()HR MIN/MAX]** and then use the trackball to adjust the minimum setting displayed in the data field.
- (d) To manually set the maximum acceptable heart rate, ensure that the system displays **MAX** for *[()HR MIN/MAX]* and then use the trackball to adjust the maximum setting displayed in the data field.
- **9** To display the soft key for 3-D acquisition, press **[PRIOR]**.

#### Acquiring a 3-D Volume Dataset

When you begin acquisition, the system displays a soft key for canceling acquisition and begins advancing the angle indicator. The angle indicator displays the current step angle for the transducer.

When the angle indicator stops advancing, the system displays a message on the screen indicating that data is being stored. The system stores the acquired 3-D volume dataset to its hard disk and transfers the dataset in DICOM format to the Perspective advanced display option.

During 3-D volume acquisition, the system acquires one set of frames per heart cycle that is within the range of acceptable heart rates. After each acquired set of frames, the transducer rotates to the next step angle for acquisition of the next set.

If Color Doppler was active when you activated *four*Sight TEE View, then the system acquires both 2-D data and Color Doppler data. Each set of data (2-D data and Color Doppler data) is maintained separately, enabling you to view a 3-D volume using either or both sets of data.

The time required to acquire the dataset depends on the patient's heart rate, the step angle, and the gating setup. The step angle determines the number of frames acquired. The gating setup determines the range of acceptable heart rates. Each heart cycle outside the range of acceptable heart rates increases acquisition time because acquisition must pause until the next acceptable heart cycle occurs.

#### • To acquire a 3-D volume dataset:

- **1** Set up for 3-D acquisition.
- **2** If required, press **[PRIOR]** to exit 3-D acquisition setup and display the 3D acquisition soft key menu.
- **3** Press **[START]**, holding the transducer steady until acquisition is complete (or you cancel the acquisition).

**NOTE:** The **[START]** soft key is temporarily unavailable when you select **[POSTPONE]** or **[DELETE]** for a previous acquisition.

The system begins acquisition. The transducer rotates to the zerodegree position to begin acquiring a set of frames at the selected step angle. Rotations continue until the transducer has acquired a set of frames for each angle. When acquisition is complete, the system displays soft keys for viewing the acquired dataset, delaying view of the dataset, and deleting the dataset.

- 4 To cancel the acquisition, press [CANCEL].
- **5** To view the acquired dataset on the **TEE** review screen, press **[RECONSTRUCT]**.
- **6** To delay viewing of the acquired dataset and display the acquisition soft keys for acquisition of another dataset, press **[POSTPONE]**.
- **7** To delete the acquired dataset and display the acquisition soft keys for acquisition of another dataset, press **[DELETE]**.

#### Viewing the 3-D Volume Dataset

You can view a 3-D volume dataset from the current examination or from previous examinations.



A 3D TEE icon is displayed on each 3-D volume in the review screen.

When you view a 3-D volume dataset after acquisition or when you retrieve a dataset from a previous examination, the system initially displays the volume and its orthogonal planes in a 4:1 display format on the **TEE** review screen, displays the wireframe on the volume, and plays the phase loop. The system displays the **Single Tiling** display format icon on the upper right of each quadrant.



The **Single Tiling** display format icon is displayed on each quadrant in the **TEE** review screen when the 4:1 display format is selected.

The lower-right quadrant contains the volume (also referred to as the Volume Rendering quadrant or VR quadrant). The other quadrants contain planes of the volume, initially oriented at the center of the volume; each plane is orthogonal to the other two planes. The planes are also referred to as Multi-Planar Reformatting (MPR) quadrants. The system indicates points of intersection between planes by placing uniquely colored axis lines on each plane. For example, the magenta-identified plane contains blue and yellow axis lines.

When you change the orientation of a plane quadrant, the system updates the other plane quadrants to maintain their orthogonal relationships.

You can display the acquired 2-D data and/or Color Doppler data, render the volume, remove data from the volume to help differentiate and clarify anatomical structures, and play the phase loop. You can orient, position, and magnify the volume and planes.

- To display a 3-D volume dataset in the TEE review screen immediately after acquisition:
- Press [RECONSTRUCT].
- To display a previously acquired 3-D volume dataset in the TEE review screen:
- 1 If you plan to store additional images or clips and the study was stored more than 24 hours ago, then create and restart a teaching file.
- **2** If you plan to store additional images or clips and the study was stored less than 24 hours ago, then restart the study.
- 3 Press the **REVIEW** key to display the dataset in the review screen.

The system displays stored 3-D volume datasets, images, and clips. The system indicates each 3-D volume dataset with a 3D TEE icon.

**4** Roll the trackball to position the cursor on the 3D TEE icon displayed on the required dataset and then press a trackball **SELECT** key on the keyboard.

The system displays the selected 3-D volume dataset in the **TEE** review screen.

Displaying the Review Screen

#### Selecting a Display Format

**Displaying the Wireframe** 

Intersection Lines on the

Selecting a Quadrant

**Canceling the Previous** 

Operation

on the Volume

**Displaying the** 

Planes

## To display the TEE review screen (after *four*Sight TEE View is activated):

• Press [REVIEW].

You can toggle the default 4:1 display format with the full-screen display format on either **TEE** screen (**TEE** review screen or **TEE** volume measurement screen).

The **Single Tiling** display format icon is displayed on each quadrant in the **TEE** review screen when the 4:1 display format is selected.

The **Quad Tiling** display format icon is displayed on the **TEE** review screen when the full-screen display format is selected.

#### • To toggle display formats:

• Roll the trackball to position the cursor on the display format icon displayed on the upper right of the required quadrant and then press a trackball **SELECT** key.

The wireframe indicates the boundaries of the displayed volume data. When the wireframe is displayed, each plane within the volume is indicated by a unique color.

- To display the wireframe:
- Select the **Show Decorations** button from the toolbar at the top of the **TEE** review screen.

You can display dashed intersection lines on the planes. The intersection lines on each plane indicate the main axes through the volume.

#### • To display intersection lines on the planes:

- 1 Select the **Tools** button on the upper right of the **TEE** review screen to display the **Tools** selections.
- 2 Select the **Lines of Intersection** button on the right of the screen.

You can select a quadrant for rotation or other manipulation.

- To select a quadrant:
- Roll the trackball to position the cursor on the required quadrant and then press a trackball **SELECT** key.

You can cancel the most recent operation.

#### • To cancel the most recent operation:

- 1 Select **Undo** from the toolbar at the top of the **TEE** review screen (or at the top of the **TEE** volume measurement screen).
- **2** To cancel several previous operations, repeatedly select **Undo**.
- **3** To perform the canceled operation again, select **Redo** from the toolbar.

**Restoring Initial Settings** You can restore the initial settings for all quadrants. These settings include:

- Orientation
- Display of the first phase
- Retrieval of any removed data
- Deletion of measurements, annotations, arrows
- Clearing of the memory buffer
- To restore initial settings:
- Select the **Reset** button from the toolbar at the top of the **TEE** review screen (or at the top of the **TEE** volume measurement screen).

Displaying and PlayingTIPhase Loopsqu

- The system lists the current phase number on the lower right of each quadrant.
- To display another phase:
- Select either the **Previous Phase** button or the **Next Phase** button from the toolbar at the top of the **TEE** review screen. Alternatively, select **Previous Phase** or **Next Phase** on the right of the **TEE** review screen (when **Tools** is selected) or at the top of the **TEE** volume measurement screen.
- To play the phase loop:
- Select the **Play Phase Loop** button from the toolbar at the top of the **TEE** review screen. Alternatively, select **Play Phase Loop** on the right of the **TEE** review screen (when **Tools** is selected) or at the top of the **TEE** volume measurement screen.
- To adjust the speed of playback:
- 1 Select the **Tools** button on the upper right of the **TEE** review screen.
- 2 Roll the trackball to position the cursor on the **Set Phase Animation Speed** slider bar located on the right of the screen.
- **3** Press and hold a trackball **SELECT** key, roll the trackball in the required direction until the required speed is selected, and then release the trackball **SELECT** key.

#### **Rendering the Volume**

You can render the volume by adjusting shading, smoothing, or opacity to change its surface appearance. You can also invert bright and dark values of the 2-D data within the volume.

- To display the current value for a "slider" rendering selection:
- Roll the trackball to position the cursor over the slider.
- To adjust the shading of the volume:
- **1** Select the **Render Settings** button on the upper right of the **TEE** review screen to display the rendering selections.
- **2** Choose one or more of the following methods to adjust shading:

TO:	DO THIS:
Apply a mixture of gradient shading and texture shading to the 2-D data within the volume	Select the <b>Gradient Mode</b> button.
Apply a mixture of gradient shading and texture shading to both the 2-D data and color Doppler data within the volume	Select the <b>Gradient/Gradient Mode</b> button.
Mix and adjust gradient shading and texture shading	Roll the trackball to position the cursor on the <b>Gradient-Texture Ratio</b> slider, press and hold a trackball <b>SELECT</b> key, roll the trackball to adjust the setting, and then release the trackball <b>SELECT</b> key.
Adjust the concentration of the texture shading	Roll the trackball to position the cursor on the <b>Texture Intensity</b> slider, press and hold a trackball <b>SELECT</b> key, roll the trackball to adjust the setting, and then release the trackball <b>SELECT</b> key.

#### • To adjust the smoothing of the volume:

- **1** Select the **Render Settings** button on the upper right of the **TEE** review screen to display the rendering selections.
- **2** Choose one or more of the following methods to adjust smoothing:

то:	SELECT THIS BUTTON:
Increase the structural detail	No 3D Filter
Apply a mild, low-pass filter	Smooth 3D (normal)
Apply a moderate, low-pass filter	Smooth 3D (heavy)
Apply a strong, low-pass filter	Smooth 3D (massive)

- To adjust the opacity of the volume:
- 1 Select the **Render Settings** button on the upper right of the **TEE** review screen to display the rendering selections.
- **2** To display only the maximum intensity (highest value) 2-D data within the volume, select the **Max IP Mode (Tissue)** button.
- **3** To display only the maximum intensity (highest value) Color Doppler data within the volume, select the **Max IP Mode (Color)** button.
- **4** Choose one or more of the following methods to further adjust opacity:

то:	ROLL THE TRACKBALL TO POSITION THE CURSOR ON THE FOLLOWING SLIDER, PRESS AND HOLD A TRACKBALL SELECT KEY, ROLL THE TRACKBALL TO ADJUST THE SETTING, AND THEN RELEASE THE TRACKBALL SELECT KEY.
Eliminate darker gray shades, background noise, and "snow" from the 2-D data	Threshold Tissue
Adjust the level of surface transparency for the 2-D data	Transparency Tissue
Apply color to each velocity direction in the Color Doppler data and then eliminate lower amplitude data and background noise	Threshold Color
Adjust the level of surface transparency for the Color Doppler data	Transparency Color

- To invert bright and dark voxel values of the 2-D data within the volume:
- 1 Select the **Render Settings** button on the upper right of the **TEE** review screen to display the rendering selections.
- 2 Select the **Invert Tissue** button.

You can toggle display of the volume with display of the most recently calculated volume measurement. Volume measurements are calculated on the **TEE** volume measurement screen.

- To toggle display of the volume with display of the most recently calculated volume measurement:
- 1 Select the **Render Settings** button on the upper right of the **TEE** review screen to display the rendering selections.
- 2 Select the **Show Beutel** button.

Displaying the Volume Measurement on the Review Screen
### Adjusting the Brightness and Contrast

You can adjust the brightness and contrast of the planes.

- To adjust brightness:
- 1 Select the **Tools** button on the upper right of the **TEE** review screen to display the **Tools** selections.
- **2** Roll the trackball to position the cursor on the **Brightness** slider bar located on the right of the screen.
- **3** Press and hold a trackball **SELECT** key, roll the trackball in the required direction until the required speed is selected, and then release the trackball **SELECT** key.
- To adjust contrast:
- 1 Select the **Tools** button on the upper right of the **TEE** review screen to display the **Tools** selections.
- **2** Roll the trackball to position the cursor on the **Contrast** slider bar located on the right of the screen.
- **3** Press and hold a trackball **SELECT** key, roll the trackball in the required direction until the required speed is selected, and then release the trackball **SELECT** key.

**Rotating the Volume** Volume rotation can help you visualize anatomical structures. You can rotate the volume manually or automatically. The volume is always rotated around its center point.

Automatic rotation occurs in a rocking motion for the currently displayed phase at the selected speed and angle of rotation. Manual rotation can be in any direction or can be limited to the clockwise and counterclockwise directions.

- To manually rotate the volume (any direction):
- 1 Select the **Pivot/Orbit** button from the toolbar at the top of the **TEE** review screen.
- **2** Roll the trackball to position the cursor on a portion of the volume quadrant outside the volume.
- **3** Press and hold a trackball **SELECT** key and then roll the trackball in the required direction.
- To manually rotate the volume (clockwise or counterclockwise direction):
- 1 Select the **Rotate** button from the toolbar at the top of the **TEE** review screen.
- **2** Roll the trackball to position the cursor in the volume quadrant, on the plane around which to rotate the volume.
- **3** Press and hold a trackball **SELECT** key and then roll the trackball in the required direction.

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	٠	To automatically rotate the volume:
	1	Select the <b>Tools</b> button on the upper right of the <b>TEE</b> review screen.
	2	To select the angle of rotation:
		(a) Roll the trackball to position the cursor on the <b>Set Angle</b> slider bar located on the right of the screen.
		(b) Press and hold a trackball <b>SELECT</b> key, roll the trackball in the required direction until the required angle is selected, and then release the trackball <b>SELECT</b> key.
	3	If required, adjust the speed by selecting <b>Set Phase Animation</b> <b>Speed</b> on the right of the screen.
	4	To toggle fast motion with slow motion, select the <b>Slow Motion</b> button on the right of the screen.
	5	Select the <b>Play Animation</b> button on the right of the screen.
Aligning Orientation of the Volume to a Plane	You sele con plan	a can align the orientation of the volume (VR view) to that of the ected plane (MPR view). When you align the volume's orientation, npleted measurements are displayed on both the volume and the ne to which the volume is aligned.
	٠	To align the volume to the selected plane:
	•	Select the <b>Synchronize VR view with active MPR view</b> button from the toolbar at the top of the <b>TEE</b> review screen.
Panning the Volume	You vol	a can pan (shift) the volume to locate the anatomy of interest on the ume surface.
	٠	To pan (shift) the volume:
	1	Select the <b>Pan</b> button from the toolbar at the top of the <b>TEE</b> review screen.
	2	Roll the trackball to position the cursor on the volume.
	3	Press and hold a trackball <b>SELECT</b> key and then roll the trackball in the required direction.
Rotating the Planes	Wh ortl	en you rotate a plane, the system rotates all planes to maintain their nogonal relationships.
	•	To rotate a plane in the clockwise/counterclockwise directions:
	1	Select the <b>Rotate</b> button from the toolbar at the top of the <b>TEE</b> review screen.
	2	Roll the trackball to position the cursor on the plane for rotation.
	3	Press and hold a trackball <b>SELECT</b> key and then roll the trackball in the required direction.

Panning the Planes		You can pan (shift) a plane to locate the anatomy of interest. When you pan the plane, the system automatically updates the other planes to display the corresponding views of the anatomy of interest.		
	•	To pan (shift) a plane:		
	1	Select the <b>Pan</b> button from the toolbar a screen.	at the top of the <b>TEE</b> review	
	2	Roll the trackball to position the cursor	on the plane for panning.	
	3	Press and hold a trackball <b>SELECT</b> key the required direction.	and then roll the trackball in	
Magnifying a Quadrant	W] usi	nen you magnify a plane, the system also ing the same magnification factor.	o magnifies the other planes	
	•	To magnify a quadrant:		
	1	Select the <b>Zoom</b> button from the toolba screen.	ar at the top of the <b>TEE</b> review	
	2	Roll the trackball to position the cursor	on the required quadrant.	
	3	Press and hold a trackball <b>SELECT</b> key the required direction.	and then roll the trackball in	
Displaying 2-D and Color Doppler Data Within the	You can display acquired 2-D and/or Color Doppler data within the volume.			
Volume	Use buttons on the toolbar at the top of the <b>TEE</b> review screen.			
		TO DISPLAY THIS SET OF DATA WITHIN THE VOLUME:	SELECT:	
		2-D data only	Show Tissue	
		Color Doppler data only	Show Color	
		2-D and Color Doppler data	Show Color and Tissue	
Removing Data from the Volume	NC vo	<b>OTE:</b> For an optimal view of the volume lume.	after removing data, rotate the	
	Re no to	moving data from the volume can help y t located on the surface of the volume an the volume.	you visualize anatomy that is ad understand its relationship	
	Fo vo cai ou rer	r example, if the anatomy of interest is a s lume, then the lesion is not visible on the n orient and position the cut plane, adjust tline a section of the volume for removal naining indicates the lesion's location in	small lesion in the center of the e surface of the volume. You t the wireframe boundaries, or . The amount of volume data relation to the volume.	
Activating the Cut Plane	Yo wi	u can activate the cut plane for 2-D data a thin the volume.	and/or for Color Doppler data	
	WI the ha qu pla	hen you activate the cut plane, the system e selected types) in front of the cut plane. s the same position and orientation of the adrant. If the wireframe is displayed, the one in the volume.	n removes the volume data (of The cut plane in the volume e most recently selected plane en the system displays the cut	

#### • To activate the cut plane:

- **1** Select the plane quadrant containing the anatomy of interest.
- **2** To activate the cut plane for 2-D data, select the **Clip Tissue** button from the toolbar at the top of the **TEE** review screen.
- **3** To activate the cut plane for Color Doppler data, select the **Clip Color** button from the toolbar at the top of the **TEE** review screen.
- 4 To de-activate the cut plane, select the relevant button again (**Clip Tissue** or **Clip Color**).

You can orient (pivot or tilt) and position ("step through") the cut plane to clarify anatomical structures.

When you orient and position the cut plane, the system updates the orientation and position of the volume quadrant and active plane quadrant and also updates the other plane quadrants to maintain their orthogonal relationships to the active plane quadrant.

#### • To orient the cut plane (after activating the cut plane):

- 1 Choose one of the following methods:
  - Roll the trackball to position the cursor on an axes of the required plane quadrant.

The system changes the cursor to a double-arrow graphic.

- Select the **Pivot/Orbit** button from the toolbar at the top of the **TEE** review screen and then roll the trackball to position the cursor on the required plane quadrant or on the cut plane within the volume quadrant.
- **2** Press and hold a trackball **SELECT** key and then roll the trackball in the required direction.
- To position the cut plane (after activating the cut plane):
- **1** Select the **Slice** button from the toolbar at the top of the **TEE** review screen.
- **2** Select the required quadrant.
- **3** Press and hold a trackball **SELECT** key and then roll the trackball in the required direction.

Orienting and Positioning the Cut Plane

Adjusting the Wireframe Boundaries		You can remove 2-D data and/or Color Doppler data from the volume by adjusting the wireframe boundaries. The wireframe does not need to be displayed.		
	When you adjust a wireframe boundary, the system removes the volur data (of the selected types) in front of the adjusted boundary. This adjustment does not affect the orientation or position of the cut plane of plane quadrants.			
	٠	To adjust a wireframe boundary:		
	1	To display the wireframe within the volume quadrant, select the <b>Show Decorations</b> button from the toolbar at the top of the <b>TEE</b> review screen.		
	2	To remove 2-D data, select the <b>Tissue ROI</b> button from the toolbar at the top of the <b>TEE</b> review screen.		
	3	To remove Color Doppler data, select the <b>Color ROI</b> button from the toolbar at the top of the screen.		
	4	Roll the trackball to position the cursor on the required wireframe boundary within the volume quadrant.		
	5	Press and hold a trackball <b>SELECT</b> key and then roll the trackball in the required direction.		
	6	To retrieve the data removed through boundary adjustment, select the relevant button again ( <b>Tissue ROI</b> and/or <b>Color ROI</b> ).		
Removing an Outlined Section of Data	Yo <sup>.</sup> sec	u can remove 2-D data and Color Doppler data within an outlined stion of the volume to help clarify anatomical structures.		
	٠	To remove an outlined section of data from the volume:		
	1	Select the <b>Tools</b> button on the upper right of the <b>TEE</b> review screen.		
	2	Select the <b>Scalpel</b> button on the right of the screen.		
		The cursor changes to a crossmark.		
	3	Roll the trackball to position the cursor at the starting point on the volume and then press and hold a <b>SELECT</b> key as you roll the trackball to draw a freeform shape around data to be removed.		

- **4** Release the **SELECT** key to automatically close the shape and remove the outlined section from the volume.
- **5** To retrieve data removed using **Scalpel**, select the **Remove Erasings** button from the toolbar at the top of the screen.

Navigating the Volume Using a Plane (D  $\uparrow$  Art)

You can use a plane (MPR) to navigate the volume by activating the  $D\uparrow$  Art function to display only the segment of interest. When this function is active, an arrow indicates the length and direction to use when extracting the segment.

#### • To navigate the volume using a plane:

- 1 Select the **DArt** button from the toolbar at the top of the **TEE** review screen.
- **2** Select a plane quadrant and define the region of interest.
  - (a) Roll the trackball to position the trackball pointer at the location of the arrow's base (anchor point) and then press a trackball SELECT key.
  - (b) Roll the trackball to position the trackball pointer at the location of the arrow's tip (indicating direction) and then press a trackball SELECT key.

On the selected plane quadrant, the system displays the region of interest as two parallel dashed lines enclosing an arrow. On the volume quadrant, the system removes volume data outside of the two dashed lines.

- **3** To shift the region of interest:
  - (a) Roll the trackball to the arrow's ray (between the ends of the arrow) and then press a trackball **SELECT** key to select the ray.
  - (b) Roll the trackball to position the arrow and then press a trackball **SELECT** key.
- **4** To change the anchor point of the arrow:
  - (a) Roll the trackball to the arrow's base (anchor point) and then press a trackball **SELECT** key.
  - (b) Roll the trackball to reposition the anchor point and then press a trackball **SELECT** key.
- **5** To expand or contract the region of interest, or to change the arrow's direction:
  - (a) Roll the trackball to the arrow's tip (indicating direction) and then press a trackball **SELECT** key.
  - (b) Roll the trackball to reposition the arrow's tip and then press a trackball **SELECT** key.
- **6** To view the volume from other angles, rotate the volume.

**NOTE:** For more information about rotating the volume, see "Rotating the Volume" on page 389.

7 To exit the D  $\uparrow$  Art function, select the **D** $\uparrow$ **Art** button again.

Making Measurements	<b>NOTE:</b> To display completed measurements on aligned plane, first align the orientation of the voor of the plane. For instructions, see "Aligning Oriena Plane" on page 390.	both the volume and an olume to the orientation entation of the Volume to
	You can make distance, angle, and area measure calculate volume measurements. You can also ac arrows. You can delete measurements, annotatic	ements on planes and dd annotations and ons, or arrows.
	Volume measurements are available from the <b>TE</b> screen. All other measurement functions are ava review screen.	<b>E</b> volume measurement iilable from the <b>TEE</b>
	The system displays values for completed measure left of the plane quadrant.	urements on the upper
	TO DISPLAY THE FOLLOWING (AFTER <i>four</i> SIGHT TEE VIEW IS ACTIVATED):	DO THIS:
	The <b>TEE</b> review screen	Press [REVIEW].
	The <b>TEE</b> review screen The general measurement selections on the <b>TEE</b> review screen	Press <b>[REVIEW]</b> . Select the <b>Measurements</b> button from the upper right of the screen.
	The <b>TEE</b> review screen The general measurement selections on the <b>TEE</b> review screen The <b>TEE</b> volume measurement screen	Press [REVIEW]. Select the Measurements button from the upper right of the screen. Press [VOL MEASURE].

	DISTANCE	AREA	ANGLE	VOLUME
MEASUREMENT RANGE	Measured distance >20% of the image quadrant diagonal	Measured area >20% of the entire image quadrant area	Measured area >20% of the entire image quadrant area	Measured area >20% of the entire image quadrant area and at least four measurement planes
TOLERANCE	± 5%	± 5%	± 5%	± 5%

Making and Editing Distance, Angle, and Area Measurements When you select a measurement tool, such as the **Distance** button, the system changes the cursor to a crossmark shape.

You can cancel a measurement at any time by rolling the trackball outside the quadrant and pressing a trackball **SELECT** key.

#### • To make a distance measurement:

- 1 Select the **Measurements** button on the upper right of the **TEE** review screen.
- 2 Select the **Distance** button on the right of the screen.
- **3** Roll the trackball to position the crossmark at the starting point and then press a trackball **SELECT** key.
- **4** Roll the trackball to position the crossmark at the end point and then press a trackball **SELECT** key.

#### • To make an angle measurement:

- **1** Select the **Measurements** button on the upper right of the **TEE** review screen.
- 2 Select the **Angle** button on the right of the screen.
- **3** For each point in sequence (the vertex, first vector, and second vector), roll the trackball to position the crossmark and then press a trackball **SELECT** key.
- To make an area measurement:
- 1 Select the **Measurements** button on the upper right of the **TEE** review screen.
- 2 Select the **Area** button on the right of the screen.
- **3** Roll the trackball to position the crossmark at the starting point and then press a trackball **SELECT** key.
- **4** For each subsequent point, roll the trackball to position the crossmark and then press a trackball **SELECT** key.
- **5** To add points to the area spline, roll the trackball to position the crossmark on the line displayed between two points and then press a trackball **SELECT** key.
- **6** To indicate completion of the area measurement, roll the trackball to position the crossmark near the starting point.

The system automatically closes the shape and displays the measurement value.

**7** Press a trackball **SELECT** key to accept the displayed measurement value.

#### To edit a measurement:

1 Roll the trackball to position the cursor on the measurement on the **TEE** review screen.

The system changes the color of the measurement to indicate that it is selected.

- **2** Press and hold a trackball **SELECT** key and then roll the trackball in the required direction.
- **3** Release the trackball **SELECT** key.

Calculating Volume Measurements	You for strume <b>NC</b> car you pla	<ul> <li>u can use 3-D volume measurements to draw splines in several planes calculation of volumes of ventricle, jets, and other anatomical uctures. Volume measurements are available from the <b>TEE</b> volume assurement screen.</li> <li>DTE: The orientation and position of the 3-D volume and planes prot be changed within the <b>TEE</b> volume measurement screen. After u calculate a volume, you can rotate the 3-D volume and the lower left ine quadrant.</li> </ul>
Calculating a Volume	Yo dis	u can calculate a volume for each pair of planes. The system initially plays only one pair of planes for volume calculation.
	•	To calculate a volume for the current pair of planes:
	1	Press <b>[REVIEW]</b> to display the <b>TEE</b> review screen for viewing the volume and then use the navigation buttons at the top of the screen to position the structure in the center of the three plane quadrants (MPR windows).
	2	Press <b>[VOL MEASURE]</b> to display the <b>TEE</b> volume measurement screen.
	3	On the upper left quadrant and the upper right quadrant, define a contour (trace):
		(a) Roll the trackball to position the crossmark at the starting point and then press a trackball <b>SELECT</b> key.
		(b) For each subsequent point, roll the trackball to position the crossmark and then press a trackball SELECT key.
		(c) To add points to the area spline, roll the trackball to position the crossmark on the line displayed between two points and then press a trackball <b>SELECT</b> key.
		(d) To indicate completion of the area measurement, roll the trackball to position the crossmark near the starting point.
		The system automatically closes the shape and displays the measurement value. The system depicts the completed contours in green.
	4	Select the <b>Calculate Volume</b> button on the right of the screen to calculate the traced volume.
		The system displays the values for the calculated surface and for the volume of the traced region on the lower right quadrant (3-D volume):
		• <b>Volume</b> indicates the volume of the whole measurement object.
		• <b>Color Volume</b> indicates the blood volume inside the measurement object. (Displayed for Color Doppler data only.)
	5	To rotate the 3-D volume or the lower left plane quadrant, press and hold a <b>SELECT</b> key and then roll the trackball in the required direction.

- To increase the correspondence between the defined contours and the anatomy of interest displayed in the lower left quadrant (after calculating a volume):
- 1 Select the **Double number of planes** button on the right of the **TEE** volume measurement screen to add plane pair(s).
- **2** Select the **Next plane pair** button on the right of the screen to display the next plane pair.
- **3** Calculate another volume.
- ◆ To add plane pair(s):
- Select the **Double number of planes** button on the right of the **TEE** volume measurement screen.
- To reduce plane pair(s):
- Select the **Halve number of planes** button on the right of the **TEE** volume measurement screen.
- To select a plane pair:
- Select the **Next plane pair** button or the **Previous plane pair** button on the right of the **TEE** volume measurement screen.

You can add annotations to planes displayed on the **TEE** review screen. Annotations include text and arrows.

- To add an annotation (text) to a plane:
- 1 Select the **Measurements** button on the upper right of the **TEE** review screen.
- 2 Select the **Annotation** button on the right of the screen.
- **3** Roll the trackball to position the cursor on the required plane and then press a trackball **SELECT** key.

The system displays a text box for entry of the annotation.

- **4** Use the alphanumeric keyboard to enter the annotation and then press the **RETURN** key on the alphanumeric keyboard.
- **5** To adjust the position of the annotation, roll the trackball to position the cursor on the annotation, press and hold a trackball **SELECT** key, roll the trackball, and then release the trackball **SELECT** key when the required position is attained.

Annotating Images

	•	<b>_</b>
	•	To add an arrow to a plane:
	1	Select the <b>Measurements</b> button on the upper right of the <b>TEE</b> review screen.
	2	Select the <b>Arrow</b> button on the right of the screen.
		The system changes the cursor to a crossmark shape.
	3	Roll the trackball to position the cursor at the point on the required plane on which to place the end of the arrow (ray or line) and then press a trackball <b>SELECT</b> key.
		The system displays the arrow with its end (opposite the arrowhead) located at the cursor position.
	4	Roll the trackball to position the cursor at the point on the required plane on which to place the head of the arrow and then press a trackball <b>SELECT</b> key.
		The system displays the arrow with its arrowhead located at the cursor position.
	5	To reposition the arrow, roll the trackball to position the cursor on the arrow, press and hold a trackball <b>SELECT</b> key, roll the trackball to reposition the arrow, and then release the trackball <b>SELECT</b> key.
Deleting Measurements, Annotations, or Arrows	You TE	u can delete measurements, annotations, or arrows displayed on the <b>E</b> review screen.
	•	To delete a measurement, annotation, or arrow:
	1	Select the <b>Measurements</b> button on the upper right of the <b>TEE</b> review screen.
	2	Roll the trackball to position the cursor on the required measurement or annotation and then press a trackball <b>SELECT</b> key.
	3	Select the <b>Delete selected annotation or measurement</b> button on the right of the screen.

- To delete all measurements, annotations, and arrows:
- **1** Select the **Measurements** button on the upper right of the **TEE** review screen.
- **2** Ensure that there are not any selected measurements, annotations, or arrows.
- **3** Select the **Delete selected annotation or measurement** button on the right of the screen.

Storing and Exporting	You vol	a can store and export clips and images. You can also export 3-D ume datasets.
	<b>NO</b> har	<b>TE:</b> The system automatically stores the 3-D volume dataset to its d disk during acquisition.
Storing Clips and Images	You me	a can store clips and images from the <b>TEE</b> review screen or <b>TEE</b> volume asurement screen to the ultrasound system's hard disk.
	•	To store a clip:
	•	Start playback of the phase loop and then press the <b>CLIP STORE</b> key on the keyboard.
	٠	To store an image:
	•	Change the display format, if required, and then press the <b>IMAGE STORE</b> key on the keyboard.
Exporting Datasets, Clips, and Images	Yoı exte	a can export datasets, clips, and images from the <b>TEE</b> review screen to ernal media. See "Exporting Data" on page 74.
	٠	To export the currently displayed 3-D volume dataset:
	1	Press <b>[REVIEW]</b> and then select the <b>Tools</b> button on the upper right of the <b>TEE</b> review screen to display the selections for exporting.
	2	Select the <b>Export Clip</b> button on the right of the screen.
	•	To export a clip:
	1	Press <b>[REVIEW]</b> and then select the <b>Tools</b> button on the upper right of the <b>TEE</b> review screen to display the selections for exporting.
	2	Start playback of the phase loop and then select the <b>Export</b> <b>Animation or Still Image</b> button on the right of the screen.
	٠	To export an image:
	1	Press <b>[REVIEW]</b> and then select the <b>Tools</b> button on the upper right of

- the TEE review screen to display the selections for exporting.Change the display format if required, stop playback, and then select
  - the **Export Animation or Still Image** button on the right of the screen.

### TRANSESOPHAGEAL TRANSDUCERS

Siemens provides the following transesophageal transducers optimized for use in cardiac scanning:

TRANSDUCER	IMAGING FORMAT	IMAGING PLANES
TE-V5M	Vector wide view array	Multiplane
TE-V7B	Vector wide view array	Biplane
TE-V7M	Vector wide view array	Multiplane

For the following important safety information concerning transesophageal transducers, see your *Safety Manual*:

- Transducer power safety considerations
- Clinical contraindications
- Transducer leakage current
- Transducer covers
- Transducer care
- Using ultrasound coupling gels
- Precleaning
- Disinfecting and sterilizing procedures
- Transducer decontamination methods
- Storing transducers

#### Monitoring the Sensor Temperature

The system constantly monitors the temperature of the transesophageal transducer and displays a series of messages on the screen to inform you of the temperature and status. Each transesophageal transducer has a thermal sensor that monitors the lens temperature during an exam and displays it in the upper right corner of the display.

The thermal software contains three temperature limits that prompt the system to display messages informing you of the temperature and recommending appropriate responses. The following table lists transducer temperature limits:

	TE-V5M	TE-V7B	TE-V7M
NEAR THERMAL LIMIT	40.0 °C	40.0 °C	40.0 °C
THERMAL LIMIT	41.0 °C	41.0 °C	41.0 °C
MAXIMUM THERMAL LIMIT	43.0 °C	43.0 °C	43.0 °C

You can turn off the temperature display during normal scanning. If you do so, the system displays the temperature only when it is at or above the near thermal limit.

- To turn off the temperature display when the temperature is less than 40.0 °C:
- **1** Press **THRML**.
- **2** Press **[TEMP ON/OFF]** to turn on or off the continuous display of the sensor temperature.

#### Selecting a User Setting for the V7M Transducer

When you scan with the V7M transducer, you must select the appropriate user setting based on the core temperature of the patient. If the core temperature of the patient is 37.0 °C, use the **NORMAL** (default) user setting. If the core temperature of the patient is above 37.0 °C, select the **HYPERTHERMIC** user setting.

A hyperthermic patient is a patient whose core temperature is above 37.0 °C and below 38.0 °C. If at any time during the exam you determine that the core temperature of the patient is above 37.0 °C, change the V7M transducer user setting from the default **NORMAL** user setting to the **HYPERTHERMIC** user setting.

- To select a user setting for the V7M transducer:
- **1** After initializing the V7M transducer, press **OPTIONS** to display the Transducer Options menu.
- **2** If the patient temperature is above 37.0 °C and does not exceed 38.0 °C, select **[HYPERTHERMIC]**.
- **3** If the patient temperature is 37.0 °C, select **[NORMAL]**.

USER SETTING	DESCRIPTION
[HYPERTHERMIC]	Patients with core temperature above 37.0 °C and not exceeding 38.0 °C
[NORMAL]	Patients with core temperature of 37.0 °C

**NOTE:** NORMAL is the default V7M transducer user setting.

	You can change the user setting at any time. For example, if you are using the <b>NORMAL</b> user setting and the <b>NEAR THERMAL LIMIT</b> or <b>AT THERMAL</b> <b>LIMIT SYSTEM FROZEN</b> message displays, you can change the user setting to <b>HYPERTHERMIC</b> to prevent the system from exceeding the thermal limit prematurely. If the thermal sensor indicates that the lens temperature has exceeded the thermal limit, the system will automatically turn off the transducer transmitters to force the transducer to cool down. If you determine the core temperature of the patient has returned to 37.0 °C, re-select the <b>NORMAL</b> user setting. The V7M transducer is not intended for use in patients whose core temperature is below 37.0 °C. If the core temperature of the patient is below 37.0 °C, the V7M thermal sensor will not prevent the transducer from overheating in the event of a malfunction. If the core temperature of the patient is below 37.0 °C, unplug the transducer from the system until the core temperature of the patient returns to 37.0 °C.
WARNING!	The V7M transesophageal transducer can exceed 43 °C in the event of a system malfunction, which can harm the patient. Unplug the V7M transducer from the system during periods of poor perfusion or circulatory arrest, or during the hypothermic phase of open heart surgery. Using the V7M transducer in the event of a system malfunction under any of these conditions could harm the patient.
CAUTION!	When you are using the <b>HYPERTHERMIC</b> user setting on a hyperthermic patient, there is a risk of exceeding the maximum thermal limit <b>(MAXIMUM THERMAL LIMIT EXCEEDED)</b> , which results in continuous image freeze. As patient temperature exceeds 38.0 °C, the likelihood of exceeding the maximum thermal limit increases. If patient temperature is less than 2 °C above normal, you can minimize the possibility of exceeding the maximum thermal limit by reducing transmit power.

Thermal Limit Messages	The following table shows how to respond to the different thermal limit messages:		
MESSAGE	MEANING	ACTION	
NEAR THERMAL LIMIT	The temperature is between the near thermal limit and the thermal limit.	Turn <b>OUTPUT</b> counterclockwise to reduce the acoustic output to prevent the sensor temperature from reaching the thermal limit.	
		( <i>V7M Only</i> ) If you are using the <b>NORMAL</b> user setting, you can switch to the <b>HYPERTHERMIC</b> user setting.	
AT THERMAL LIMIT SYSTEM FROZEN	The system has reached the thermal limit and entered freeze mode.	Press <b>[OVERRIDE ON/OFF]</b> or select <b>OVERRIDE</b> from the pop-up menu button to override and permit the transducer temperature to increase up to the maximum thermal limit. The system exits freeze mode and returns to scanning.	
		( <i>V7M Only</i> ) If you are using the <b>NORMAL</b> user setting, you can select <b>OVERRIDE</b> and then switch to the <b>HYPERTHERMIC</b> user setting.	
		If you do not override, the system remains frozen until the temperature drops below the near thermal limit temperature.	
MAXIMUM THERMAL LIMIT EXCEEDED	The sensor temperature has increased to the maximum thermal limit; the system enters continuous freeze mode.	The system is inoperable until you change transducers or reinitialize the system. To reinitialize the system, disconnect the transducer connector and reconnect it.	
TRANSDUCER INOPERABLE	The system detects sensor failure or the thermal	<b>1</b> Disconnect the transducer connector from the system.	
	sensing software is not functioning.	<b>2</b> If you have another transducer, connect it to the system.	
		<b>3</b> Contact the Siemens Uptime Service Center for instructions.	
TRANSDUCER HAS COOLED. ACOUSTIC OUTPUT REDUCED. PRESS "PROCEED" TO CONTINUE.	The sensor temperature is low enough to allow scanning.	Press <b>PROCEED</b> to resume scanning with the transducer.	

If the sensor temperature increases to the maximum thermal limit, the system transmitter shuts down, the system enters a continuous freeze mode, and the maximum thermal limit exceeded message appears on the screen.

Inspecting the Transducer	ne transesophageal transducer should be carefully inspected before each cam. If you find any damage or signs of wear, DO NOT use the ansducer. Check that the following items are working properly: Transducer tip and articulation section	
	Intracavity and electrical cables	
	Steering knobs	
	Ratchet buttons that control the locking mechanism	
	Perform a leakage current test on the transducer at the end of each transducer high-level disinfection procedure. Retest prior to use if the transducer has not been used for an extended period of time or to check the leakage current of the transducer in the event that it was damaged by being dropped or struck against another object. See your <i>Safety Manual</i> for more information on performing leakage current tests.	
Covering the	The transducer flexible neck should be in the straight position.	
Transducer	• To cover the transducer:	
	1 Slide the cover over the narrow end of the applicator cone leaving about 5 cm of the cover's tip in excess at the narrow end and about 3 cm in excess at the wide end.	
	<b>2</b> Fold about 3 cm of the cover under the wide rim of the applicator.	
	<b>3</b> Place the plastic tubing on a disposable syringe and fill the syringe with ultrasound coupling gel.	
	<b>4</b> Push the plastic tubing into the applicator through the wide end.	
	<b>5</b> Inject a quantity of gel into the tip of the cover and gently squeeze the end of the cover to ensure that the gel is at the tip of the cover.	
	<b>6</b> Remove the syringe and plastic tubing.	
	7 Insert the applicator over the tip of the transducer until the tip of the cover contacts the tip of the transducer. Remove any air bubbles between the tip of the transducer and the cover. Air bubbles can impede sound wave transmission and should be removed.	

Preparing the	٠	To prepare the system:	
System		Connect and lock the transducer connector to the transducer port on the front of the system.	
	2	Place the system in a stand-by mode (freeze the display) while you prepare the patient.	
	3	Remove the patient's dentures and other removable appliances.	
	4	Ensure that the transducer's flexible neck can be adjusted smoothly.	
	5	Ensure the brakes are not applied (that is, make sure that the ratchet buttons are in the off position).	
Inserting the Transducer	<ul> <li>In an intraoperative procedure, insert the transducer after an endotracheal tube is in place. If an endotracheal tube will not be used, insert the transducer soon after induction of anesthesia. In pediatric patients with nasotracheal intubation, use direct laryngoscopic vision to guide the transducer.</li> <li>To aid in inserting the transducer you may want to use a sterile, watersoluble lubricating gel (K-Y jelly) on the tip of the transducer cover and along the intracavity cable. A viscous lubricant may also be applied to the transducer prior to insertion.</li> <li><b>To insert the transducer:</b></li> <li>If appropriate, apply an aerosol local anesthetic solution to the patient's throat. Do not apply an aerosol anesthetic to the intracavity cable.</li> </ul>		
	2	Position the patient as determined by the physician.	
		For an outpatient procedure, a commonly used position to reduce the possibility of aspiration and to optimize insertion is a horizontal and left lateral decubitus position. Flex the patient's right knee and place it in front of the left leg to limit the patient's mobility.	
	3	Place the smaller end of the bite guard into the patient's mouth. Orient the larger sides of the bite guard toward the patient's nose and chin.	
WARNING!	D el w m	amage that occurs from failure to use a bite guard may cause ectrical or mechanical hazard to the patient and is not covered under arranty or service contract. Use a bite guard to protect the patient and aintain your warranty and service contract.	

- **4** Orient the transducer with the active face toward the patient's chin, as shown in the following illustration.
- **5** With the patient's head flexed forward, insert the transducer through the bite guard. Advance it to the posterior aspect of the tongue. If the patient is conscious, instruct the patient to breathe gently through the nose.
- **6** Using gentle pressure with your fingers, advance the transducer to the esophageal orifice. If the patient is conscious, ask the patient to swallow to help direct the transducer into the upper part of the esophagus.

Mild resistance may be felt at 15 to 18 cm. Advance the transducer firmly but do not force it. If moderate resistance is encountered the transducer may be misdirected. Withdraw and redirect it if required. Continue to insert the transducer until approximately 25 cm of the transducer cable is inserted beyond the patient's incisors.

When inserted, the active face of the transducer faces anterior. The scanning plane is transverse when positioned with the active face anterior as shown in the following illustration. The initial image of the heart at approximately 25 cm from the incisors is the short-axis scan at the base of the heart.

- 7 Support the transducer handle and cable in your arm and hand or rest it next to the patient.
- **8** Adjust the position and orientation of the transducer as described in "Adjusting the Transducer Tip Position" on page 410.



#### Selecting an **Imaging Plane**

#### **Biplane Transducers**



Longitudinal plane

**Multiplane Transducers** 

Image Orientation in the V7M Transducer

During an exam you can change the position of the transducer tip to optimize tissue contact or to angulate the imaging plane to see the area of interest. The directions for adjusting the flexible neck refer to the patient's orientation.

**NOTE:** You cannot rotate the imaging plane when the display is frozen or when a Cine display is active.

When you begin an exam with a biplane transesophageal transducer, the transverse plane is active. You can switch planes at any time during real-time imaging. A symbol in the upper-left corner of the screen indicates the active imaging plane.

#### To switch imaging planes, press UP/DOWN.

The multiplane transesophageal transducer allows you to rotate the imaging plane by rotating the transducer crystal within the tip of the transducer. The starting position, when the transducer is initially plugged into the system, is 0 degrees, which is equivalent to the transverse plane in biplane transesophageal transducers. You can reorient the imaging plane any time during real-time imaging by using the rotation control switch on the forward (distal) portion of the transducer control housing.

#### To reorient the imaging plane:

- 1 Press the raised portion of the rotation control switch to change the rotation to a larger angle. (The harder you press, the faster the angle rotates.)
- 2 Press the other side of the switch to obtain a smaller angle.

A rotation angle of 90° is equivalent to the longitudinal imaging plane in biplane transesophageal transducers. A rotation angle of 180° results in a mirror image transverse imaging plane. You can select intermediate rotation angles to optimize imaging of the region of interest.

The default image orientation for the V7M transducer is reversed 180 degrees (a mirror image) as compared with that of the V5M transducer. (By default, the ACUSON " **G** " is to the upper *right* of the image for both transducers.) In order to obtain a similar image orientation for the V7M transducer (as compared to that on the V5M) you must either press the L/R key or reverse the angle setting by 180 degrees.

You can use the default image orientation or reverse it.

#### To reverse the image orientation for the V7M transducer:

While using the default orientation, press L/R, located above the DGC sliders.

The image presentation is reversed, and the ACUSON " **¬**" is displayed to the upper *left* of the image.

Use the standard angle settings described elsewhere in this section.

#### Adjusting the Transducer Tip Position

During an exam you can change the position of the transducer tip to optimize tissue contact or to angulate the imaging plane to see the region of interest. Hold the transducer in your right hand with the intracavity cable pointing away from your body.



**5** Check the electrical safety of the transducer as described in your *Safety Manual*.

# **VASCULAR FEATURES**

Vascular Features describes special features for vascular exams. These features are available on Sequoia C256 Echocardiography Systems, Sequoia C512 Echocardiography, Systems and on Sequoia 512 Ultrasound Systems. This part includes the following chapters:

### **TRANSCRANIAL IMAGING**

You can use the following approved transducer in 2-D, spectral Doppler, or Color Doppler (CD) mode to perform adult transcranial (TCI) and trans-orbital (TCI ORB) exams:

• 3V2

FDA power output guidelines specify that you must use power levels less than the ones shown in the following table for transcranial and transorbital exams. Siemens provides specialized Exam Presets that set up the system to use the appropriate levels.

	TRANSCRANIAL EXAMS	TRANS-ORBITAL EXAMS
Approved Power Levels	Mechanical Index < 1.9	Mechanical Index < 0.23

Siemens provides the following Exam Presets for easy, high-resolution transcranial imaging.

NAME	USE
TCI	General transcranial imaging
TCI ORB	Trans-orbital imaging

When you use one of these Exam Presets, FDA power level requirements may appear in on-screen messages.

### Initializing Transcranial Transducers

When you initialize a TCI-compatible transducer for use in TCI exams, the system optimizes the transducer for TCI exams and resets it for TCI power levels. The TCI format name appears on the screen in place of the transducer name. The following table lists the TCI transducer and its corresponding TCI format names.

TRANSDUCER NAME	NAME ON SCREEN WHEN INITIALIZED FOR TCI	NAME ON SCREEN WHEN INITIALIZED FOR TCI ORB
3V2	3V2 TCI	3V2 TCI ORB

#### • To initialize a TCI transducer:

- **1** Connect the transducer to the system.
- 2 Press **XDUCER** and then press **[3V2]** to activate the 3V2 transducer.
- **3** Press **OPTIONS** to display the Transducer Options menu, and choose from the following transducer formats.

FORMAT	USE FOR
CARDIOLOGY	Echocardiograms
TCI MI < 1.9	TCI exams
ORB MI <0.23	TCI ORB exams

**4** To insure compatibility with FDA power guideline levels, press **EXAM PRESETS** and select TCI or TCI ORB.

### **GENERAL IMAGING FEATURES**

General Imaging Features describes special features for radiology exams. These features are available on Sequoia 512 Ultrasound Systems. This part includes the following chapters:

Chapter 39	Using Needle Guides	417
Chapter 40	Endocavity Transducers	429

# **USING NEEDLE GUIDES**

Using Needle Guides	This chapter clarifies the procedures for using Needle Guides on Siemens ultrasound systems. Use it in place of the Needle Guide chapter in your <i>User's Manual</i> . (For information about using Endocavity Needle Guides, see the Endocavity Transducer chapter in your <i>User's Manual</i> .)
	This chapter covers the following topics:
	Using the Needle Guide Program
	Practicing the Needle Guide Procedure
	Needle Guide Kits
	Preparing a Transducer
	Using Specific Needle Guides
Using the Needle Guide Program	The Needle Guide program displays the projected needle path on the 2-D image. Use the following procedure to perform a biopsy using the Needle Guide program. Practice this procedure, as described in "Practicing the Needle Guide Procedure" on page 419, before using it during an exam
	<b>NOTE:</b> Transducers that are compatible to use with Needle Guides are labeled with the following symbol. The symbol is located under the transducer name.



#### • To perform a biopsy using the Needle Guide program:

1 Connect the transducer you intend to use for the biopsy and begin a 2-D scan of the appropriate anatomy.

For a list of transducers that support Needle Guides, see "Using Specific Needle Guides" on page 421.

- 2 Press **NEEDL GUIDE** to display the needle path.
- **3** If the Needle Guide you are using supports connecting needles at different angles, you see a soft key menu for selecting an angle. Press the soft key corresponding to the angle you intend to use.
- **4** Display a single caliper and position it along the needle path at the target site for the biopsy.

The system displays two measurements:

- The minimum needle length measurement (**MIN NEEDLE**) reports the minimum needle length required to perform the biopsy.
- The puncture-to-site measurement (**PUNCT LEN**) reports the distance from the puncture site to the caliper position.

**IMPORTANT:** The caliper MUST be placed along the needle path. If it is not, the displayed measurements may be incorrect.



- **5** Select a needle for the biopsy procedure that is at least as long as the minimum needle length measurement.
- **6** Prepare the transducer cover and Needle Guide following the specific instructions for the transducer you are using in "Using Specific Needle Guides" on page 421.
- 7 Return to scanning within the Needle Guide program at the biopsy site, insert the needle along the displayed needle path, and perform the biopsy.

The screen shows both the displayed path and the actual needle path. The displayed path is provided as an indicator only. The needle may bend or deflect slightly as it moves through the tissue. You must monitor the progress of the needle tip by watching the image on the screen. If the motion of the needle on the screen appears uncoordinated with the needle movement, you may want to increase the frame rate.

- **8** Remove the needle, and then disassemble and disinfect the Needle Guide according to the specific instructions for the transducer you are using in "Using Specific Needle Guides" on page 421.
- **9** To exit the Needle Guide Program, press **NEEDL GUIDE**.

Practicing the Needle Guide Procedure	Siemens recommends that you practice the Needle Guide procedure with each transducer. The practice procedure allows you to increase your skill with these options and to verify that the Needle Guide is operating properly.		
	Th	e materials required to perform this practice procedure include:	
	•	A beaker, pail, sink, or paper cup at least 15 cm (6 in) deep	
	•	A straight 18- or 20-gauge needle or cannula, 15 to 25 cm long	
	•	Needle Guide, Needle Guide kit, and compatible transducer	
	•	Sequoia system with Needle Guide software	
	•	To practice the Needle Guide procedure:	
	1	Fill the beaker, pail, sink, or paper cup with at least 12 cm of water.	
		Degassed water, obtained by filling the container with water six to eight hours prior to performing the procedure, improves visibility of the needle.	
	2	Cover the transducer as described in "Preparing a Transducer" on page 420.	
	3	Assemble the Needle Guide according to the specific Needle Guide instructions in "Using Specific Needle Guides" on page 421.	
	4	Enter the Needle Guide program to display the needle path.	
	5	If the Needle Guide you are using supports different angles, you see a soft key menu for selecting an angle. Press the soft key corresponding to the angle you intend to use.	
	6	Immerse the active face of the transducer no more than 2 cm.	
WARNING!	Do not immerse the transducer beyond 2 cm. Doing so may damage the transducer.		
	7	Insert the needle through the barrel to its maximum depth.	
		The needle should remain within the needle path displayed on the screen. If the needle falls outside the displayed path, contact the Siemens Uptime Service Center.	
Needle Guide Kits	Ea an fol	ch Needle Guide starter set contains reusable Needle Guide adaptors d sterile procedure kits. Each disposable procedure kit contains the lowing components:	
	•	Set of sized needle insert barrels	
	•	Transducer cover	
	•	Needle clip (for Slide-On Needle Guides only)	
	•	Sterile packet of coupling gel	
	Yo Civ	u can obtain additional sterile procedure kits from your Amedic or vco Sales Representative.	

User Manual

Preparing a Transducer	Always use a protective transducer cover over the transducer when you	
	use a Needle Guide. Some Needle Guides require that you apply the	
cover before you assemble the Needle Guide onto the transd		
Ν	Needle Guides require that you apply the cover after you assemble the	
	Needle Guide onto the transducer. Follow the instructions for your	
	specific Needle Guide in "Using Specific Needle Guides" on page 421.	

Use the following sterile procedure to apply the cover.

**IMPORTANT:** Use proper sterile technique at all times when removing the transducer cover and other accessories from the sterile kit. Two people are required to perform this procedure.

#### • To cover the transducer:

**1** For transducers that require Needle Guide assembly *before* covering transducer:

Attach Needle Guide onto uncovered transducer following the instructions in "Using Specific Needle Guides" on page 421.

If assembly is required *after* covering transducer, skip to step 2.

- **2** Non-sterile person: Apply a moderate amount of coupling gel to the active face of the transducer.
- **3 Sterile person**: Remove the transducer cover from the sterile kit and gather it at the tip.
- **4 Non-sterile person**: Hold the transducer by the cable and place it into the transducer cover.
- **5 Sterile person**: Pull the cover over the transducer, smoothing the cover to remove the air bubbles. Air bubbles can impede sound wave transmission. DO NOT use a transducer cover that is cut, torn, or otherwise not completely intact. Be careful not to over-stretch the transducer cover. Covers that are too tight can tear later, when you attach the Needle Guide to the transducer.
- **6 Sterile person**: Secure the transducer cover in place using the tie straps at the end.
- **7** For transducers that require Needle Guide assembly *after* covering transducer:
- 8 Sterile person: Attach Needle Guide onto covered transducer following the instructions in "Using Specific Needle Guides" on page 421.
- **9** If the Needle Guide is already assembled under the transducer cover, skip to step 8.
- **10 Sterile person**: Remove and open the tube of sterile gel from the kit and apply gel to the active face of the transducer.

Using Specific Needle Guides	The remainder of this document contains instructions for assembling, disassembling, and disinfecting specific Needle Guides.	
IMPORTANT:	Be sure to follow the instructions for the transducer and Needle Guide that you are using. There are different procedures for different Needle Guides.	
WARNING!	Siemens Needle Guides are designed and manufactured to attach firmly to designated transducers and should not require excessive force to assemble or disassemble. If it appears that excessive force or manipulation is required to assemble or disassemble Needle Guide components, please contact the Siemens Uptime Service Center before using it.	
	The following tabl section, to find inf	e lists available Needle Guides and tells where, in this ormation on each.
	TRANSDUCER:	FOR INSTRUCTIONS, SEE:
	4C1	"Civco Needle Guides" on page 421
	4V1	"Civco Needle Guides" on page 421
	4V2	"Original Quik-Clip Needle Guides" on page 425
	5C2	"Original Quik-Clip Needle Guides" on page 425
	6C2	"Civco Needle Guides" on page 421
	6L3	"Original Quik-Clip Needle Guides" on page 425
	8C4	"8C4 Quik-Clip Needle Guides" on page 422
	8L5	"Original Quik-Clip Needle Guides" on page 425
Civco Needle Guides	Siemens has contracted with Civco Medical Instruments to design and produce Needle Guides for some Siemens transducers. These Needle Guides (which you purchase from Siemens) are shipped with a manual that describes how to use the Needle Guides with the Siemens transducers. Follow the instructions in the Civco manual to learn how to attach, detach, and disinfect the Needle Guide.	
	Be sure to check the Needle Guide over and sterilizing instruction requirements from	ne Civco booklet to learn whether to assemble the r or under the transducer cover. Also check disinfecting tructions; Civco Needle Guides have different n Siemens Needle Guides.
	If you need to reor brackets for the Ne Representative.	rder one of these Needle Guides or order additional eedle Guide, contact your Siemens Sales
	If you need to reor Instruments.	der sterile biopsy kits, contact Civco Medical
Supported Transducers	• 4C1	
	• 6C2	
	• 4V1	

Guides

**Multiple Angle Paths** The 4V1 Needle Guide supports attaching needles at different angles. When using the Needle Guide program, you must press the soft key corresponding to the angle that you are using to display the correct needle path.

8C4 Quik-Clip Needle Siemens Quik-Clip Needle Guides are available for use with several transducers. The 8C4 transducer uses a unique, plastic Needle Guide. For information about other Quik-Clip Needle Guides, see "Original Quik-Clip Needle Guides" on page 425.

> The Quik-Clip Needle Guides have two parts. The adapter assembles onto the transducer. The barrel assembles onto the adapter and holds the needle. Choose the barrel corresponding to the gauge of the needle you want to use.

IMPORTANT: The 8C4 Quik-Clip Needle Guide uses a unique type of barrel. Do not try to use barrels from other Quik-Clip Needle Guides with this Needle Guide.



Supported Transducers Supported Needle Types

- 8C4
- Needles from 14 to 22 gauge
- 8 French catheters

Transducers that support the 8C4 Quik-Clip Needle Guide have indentations, called detents, on either side for holding the guide in place.



Use the following procedure to attach the Needle Guide adapter in the detents and connect the barrel to the adapter.

Assembling the Needle Guide

- To assemble the 8C4 Quik-Clip Needle Guide:
- 1 Cover the transducer as described in "Preparing a Transducer" on page 420.
- 2 Place the locator ball on the inside of the adapter into the circular detent on the transducer.

**3** Slide the Quik-Clip Needle Guide down into the H-shaped detents of the transducer (on the orientation groove side).



**4** Insert the appropriate size barrel into the barrel holder.



**5** Twist the barrel to lock it into position.



**6** Insert the needle through the funnel opening in the top of the barrel.



Releasing the Needle from the Needle Guide

- To detach the needle from a 8C4 Quik-Clip Needle Guide:
- **1** Turn the tab on the barrel clockwise to expose the opening of the barrel.
- **2** Slide the transducer with the Needle Guide away from the needle. The needle is still inserted in tissue.
- To disassemble the 8C4 Quik-Clip Needle Guide:
- 1 Turn the tab on the barrel counter clockwise to unlock the barrel.
- **2** Press the lever on the Needle Guide towards the transducer to release the Needle Guide.
- **3** Dispose of the barrel and transducer cover.
- **4** Clean, sterilize, and store the Quik-Clip Needle Guide. Clean, disinfect, and store the transducer.

Disassembling the Needle Guide
Disinfecting the Needle	Always disinfect a Quik-Clin Needle Guide after each use	
Guide	<ul> <li>To disinfect an 8C4 Quik-Clip Needle Guide after use:</li> </ul>	
	<ul> <li>To distinct an 6C4 Quik-Crip Needle Guide after use:</li> <li>Clean the Needle Guide with a brush or cloth that has been dampened with soap and water or with a specialized soap and precleaner. You can use any of the precleaning solutions listed in you system manuals.</li> </ul>	
	<b>2</b> Sterilize the Needle Guide using one of the following techniques:	
	Steam sterilization (autoclaving)	
	Ethylene oxide (ETO) sterilization	
	Dry heat sterilization	
	Liquid sterilization	
	You can use any of the high-level disinfecting/sterilizing liquids listed in your system manuals. A high-level sterilant is one that has glutaraldehyde as an active ingredient. Follow the sterilizing agent manufacturer's instructions for use.	
Original Quik-Clip Needle Guides	Siemens Quik-Clip Needle Guides are available for use with several transducers. Although these Needle Guides operate in the same way, be sure only to use the Needle Guide designed for the specific transducer that you are using.	
	The Quik-Clip Needle Guides have two parts. The adapter assembles onto the transducer. The barrel assembles onto the adapter and holds the needle. Choose the barrel corresponding to the gauge of the needle you want to use.	
IMPORTANT:	Do not try to use barrels from the 8C4 Needle Guide with original Quik- Clip Needle Guides.	
Supported Transducers	• 4V2, 5C2, 6L3, 8L5	
Supported Needle Types	Needles from 14 to 22 gauge	
	• 8 French catheters	
Assembling the Needle Guide	Transducers that support the original Quik-Clip Needle Guide have indentations, called detents, on either side for holding the guide in place.	
Vertical de	Petent Vertical bar Horizontal detent	
	Needle Guide body	

Use the following procedure to attach the Needle Guide adapter in the detents and connect the barrel to the adapter.

Roller bar

- To assemble the original Quik-Clip Needle Guide:
- 1 Cover the transducer as described in "Preparing a Transducer" on page 420.
- 2 Place the vertical bar on the guide in the vertical detent on the transducer.

Hold the Needle Guide body in place with your thumb.

**3** Smooth the transducer cover as you roll the Needle Guide roller bar into the horizontal detent.





4 Verify that the Needle Guide is correctly attached into the detents.



**5** Insert the appropriate size barrel into the barrel holder.



**6** Twist the tab to lock the barrel into position.



7 Insert the needle through the funnel opening in the top of the barrel.



Releasing the Needle from the Needle Guide

- To detach the needle from an original Quik-Clip Needle Guide:
- **1** Turn the tab on the barrel clockwise to expose the opening of the barrel.
- **2** Slide the transducer with the Needle Guide away from the needle still inserted in tissue.

Disassembling the Needle	•	To disassemble the original Quik-Clip Needle Guide:
Guide	1	Twist the barrel to unlock it, and then remove it from the guide.
	2	Remove the guide by pressing up on the roller bar.
	3	Dispose of the barrel and transducer cover.
	4	Clean, sterilize, and store the Quik-Clip Needle Guide. Clean, disinfect, and store the transducer. Dispose of all procedure kit supplies.
Disinfecting the Needle Guide	Al	ways disinfect a Quik-Clip Needle Guide after each use.
	•	To disinfect a Quik-Clip Needle Guide after use:
	1	Clean the Needle Guide with a brush or cloth that has been dampened with soap and water or with a specialized soap and precleaner. You can use any of the precleaning solutions listed in the <i>Transducer Specifications Manual</i> .
	2	Sterilize the Needle Guide using one of the following techniques:
		Steam sterilization (autoclaving)
		Ethylene oxide (ETO) sterilization
		Dry heat sterilization
		Liquid sterilization
	Yo	u can use any of the high-level disinfecting/sterilizing liquids listed in

You can use any of the high-level disinfecting/sterilizing liquids listed in the *Transducer Specifications Manual*. A high-level sterilant is one that has glutaraldehyde as an active ingredient. Follow the sterilizing agent manufacturer's instructions for use.

Endocavity Transducers are only available on Sequoia 512 systems.

Siemens endocavity transducers have imaging capabilities similar to other Siemens transducers including the ability to operate in the following modes: 2-D imaging mode, M-mode, pulsed Doppler mode, and Color Doppler (Color Doppler Velocity and Color Doppler Energy) mode.

Siemens provides the following endocavity transducers and Needle Guides.

TRANSDUCER	ТҮРЕ	NEEDLE GUIDE TYPE	NEEDLE GAUGE	NEEDLE LENGTH
EV-8C4	Endovaginal	Reusable	16 gauge and higher	25 cm or more
EC-10C5	Endorectal	Disposable	16 gauge and higher	20 cm or more

For the following important safety information concerning endocavity transducers, see your *Safety Manual*:

- Transducer power safety considerations
- Clinical contraindications
- Transducer covers
- Transducer care
- Using ultrasound coupling gels
- Precleaning
- Disinfecting and sterilizing procedures
- Transducer decontamination methods
- FDA warnings for latex products
- Storing transducers

Endocavity Safety and Supplies	Be sure to read your <i>Safety Manual</i> before performing endocavity exams. This section presents additional information about endocavity safety and supplies.
Using Transducer Kits	Endocavity transducer kits include the following material:
	Endocavity transducer
	Plastic card with transducer cleaning instructions
	Plastic carrying and storage case
	Latex transducer covers and elastic bands
Using and Obtaining Additional Items	To use the endocavity transducers, you need the following additional items:
	Protective transducer covers
	Endorectal disposable biopsy kits
	Disinfection/sterilization solution and decontamination containers
	Ultrasound coupling gel
	Protect an endocavity transducer with a cover during patient exams. You can use specially designed latex transducer covers, over-the-counter condoms (without reservoir ends), or sterile transducer covers. (See your <i>Safety Manual</i> for important warnings about using latex products.)
Products for High Level Disinfection/Sterilization	Use only the disinfecting and sterilizing solutions listed in your <i>Transducer Specifications Manual</i> as compatible with endocavity transducers. Use of any other solutions or procedures will void your transducer warranty.
	Only products with specific commercial names listed in your <i>Transducer Specifications Manual</i> are compatible with the material used in certain Siemens transducers. Products with variations of these names, or products that manufacturers insist are equivalent, must be reviewed by Siemens. Any product that is not on the list is not known to be compatible with Siemens transducers. For information, please contact Siemens Customer Information Center (CIC) at 1 (800) 228-4128. Also, contact the manufacturer of the solution for information regarding the solution's FDA and EPA regulatory status for the purpose of cleaning, disinfecting, and sterilizing.
	Refer to your <i>Transducer Specifications Manual</i> for a list of manufacturers. Contact listed manufacturers for information about obtaining these

solutions.

Ultrasound Coupling Gel	Use an ultrasound coup recommend you check v FDA regulatory status a about coupling gels, see	ling gel to prepare the transducer for an exam. We with the product's manufacturer to determine nd appropriate use. For additional information your <i>Transducer Specifications Manual</i> .
WARNING!	For vaginal imaging, b ultrasound coupling ge to human reproductive	e especially careful when choosing an el. Certain ultrasound coupling gels may be toxic e cells.
Biopsy Instruments	The endorectal Needle C instruments. Biopsy kits the following sources:	Guides are compatible with most biopsy and automated biopsy guns are available from
	INSTRUMENT	MANUFACTURER
	Endorectal disposable biopsy kits	CIVCO Medical Instruments, Inc. 102 First Street South Kalona, IA 52247 800 445-6741 (319) 656-4447 Fax: (319) 656-4451
	Automated biopsy guns	Bard Urological Division CR Bard, Inc. Covington, GA 30209 800-526-4455
		Boston Scientific Division of Meditech 480 Pleasant Street Watertown, MA 02172 (617) 923-1720 800-225-3238

#### Using Transducer Covers

Use protective transducer covers to cover the transducer during patient exams. After each exam, regard the transducer cover and any other wastes as potentially infectious and dispose of them accordingly.

Cleaning, Sterilizing, and High Level Disinfecting	For transducer cleaning, sterilizing, and high level disinfecting procedures, see your <i>Safety Manual</i> . For approved cleaning, sterilizing, and disinfecting solutions, see your <i>Transducer Specifications Manual</i> .
Needle Guide Safety	Always follow these basic precautions:
	• INSPECT the Needle Guide prior to use to ensure that it is not bent or misshaped. DO NOT use the Needle Guide if it is deformed in any way. Contact the Siemens Uptime Service Center to inspect it.
	• Follow all the basic precautions for endocavity transducer safety and maintenance described in "Using Endovaginal Transducers" on page 433.
	• STERILIZE reusable endovaginal Needle Guides before each use. These Needle Guides can be used multiple times and are, therefore, NOT shipped sterile.
	• DO NOT use any disposable Needle Guides after the sterility expiration date.
Sterilizing Reusable Needle Guides	If the Needle Guide is contaminated with blood, body fluids, or other materials, always perform a high-level disinfection before cleaning.
	The Needle Guide must be sterilized using one of the following procedures prior to use and between exams:
	Steam sterilization
	Gas sterilization
	• Soak in a sterilizing solution—only use solutions that are cleared by FDA and approved by EPA, such as Cidex; follow the disinfecting agent manufacturer's instructions for use.
Storing the Needle Guide	After you clean and sterilize a Needle Guide, store it in the original shipping packing or with the endovaginal transducer in its storage case.

### Using Endovaginal Transducers

You can use the EV-8C4 or the EC-10C5 transducer for endovaginal exams. Prepare the transducer as shown in the following illustration.



**3** Gather any slack in the transducer cover to the underside of the transducer. Hold the Needle Guide directly over the transducer and assemble as shown in the following illustration.



You can perform endorectal exams with the EC-10C5 transducer.

## Performing Endorectal Exams and Biopsies

Preparing the Transducer High level disinfect the transducer prior to use and between each exam. Disconnect the transducer from the system before preparing it for use.

Prepare the transducer as shown in the following illustration.

1. Disconnect the transducer from the system.

2. Place a small amount of ultrasound coupling gel on the inside surface of the tip of the latex transducer cover.



3. Place the transducer cover on the transducer so it covers the insertable portion of the transducer.

## Beginning an Endorectal Exam

Before inserting the transducer, many clinicians and urologists recommend that you perform a digital rectal exam to palpate the prostate and check for contraindications to insertion of the endorectal transducer. Also, this digital exam will prepare the patient to more easily accept the endorectal transducer insertion. Be sure to wear gloves while performing this procedure.

- 1 Connect the transducer to the Sequoia system and lock it in place.
- **2** Place enough ultrasound coupling gel or lubricating jelly on the end of the covered transducer to facilitate insertion.
- **3** Position the patient as determined by the staff supervising urologist or radiologist. The most commonly used position is the left-lateral decubitus position with the patient's knees bent up toward the chest.
- **4** Have the system actively scanning, so that you can visualize that the transducer is correctly inserted and positioned. DO NOT freeze the image. While the system is actively scanning, the screen shows an image that indicates the transducer position and depth of insertion.
- **5** For coronal images, the orientation groove should be in the up position (toward the patient's right hip). For longitudinal images, the orientation groove should be directed posteriorly. (The orientation may be changed for biopsy procedures.)
- **6** Insert the transducer into the patient's rectum while viewing the depth of insertion on the screen.

Determine and review with your staff urologist or radiologist the techniques and precautions for inserting the endocavity transducers into the rectum.

It is sometimes useful to invert the 2-D image when performing ultrasound exams or biopsies of the prostate. For instructions, see Chapter 9.

Endorectal Needle Guides	Consider practicing positioning and assembling the Needle Guide and endorectal transducer before performing a sterile procedure.
	Use the correct preparation and examination procedures described in this manual for assembling and disassembling Needle Guides.
WARNING!	Siemens Needle Guides are designed and manufactured to attach firmly to designated transducers and should not require excessive force to position or disassemble. If it appears that excessive force or manipulation is required to position or disassemble Needle Guide components, please contact the Siemens Uptime Service Center before using it.
	Before attaching a Needle Guide, prepare the transducer with a cover as described in "Preparing the Transducer" on page 435.
Attaching Needle Guides	• To attach a Needle Guide, follow the procedure for your specific transducer in the following section.
EC-10C5 Needle Guide	To attach a Needle Guide:
	<b>1</b> Obtain a sterile biopsy kit.
	<b>2</b> Prepare the EC-10C5 transducer with the appropriate transducer cover. Refer to "Preparing the Transducer" on page 435.
	<b>3</b> Hold the Needle Guide directly over the transducer as shown in the following illustration. Press the Needle Guide straight down to align the <b>locating pins</b> on the Needle Guide with the <b>locating holes</b> on the transducer
IMPORTANT:	Check for secure attachment of the Needle Guide onto the transducer. The Needle Guide should not turn or shift on the transducer.
	1 ON: down only 2
	Transducer Cover Gel

Transducer Cover

Λl

Gel

	4	Apply a small amount of sterile coupling gel on the transducer cover at the active face.
	5	Cover the transducer and Needle Guide with the translucent, loose- fitting transducer cover.
	6	The gel in front of the active face of the transducer couples the two transducer covers.
Using the Needle Guide Tracking Path	You disj	cannot use the calculation packages when the Needle Guide path is played.
Activating the	٠	To display the Needle Guide path, press NEEDL GUIDE.
Tracking Path		Once the transducer is inserted, adjust the image by angling or rotating the transducer handle until the target for biopsy falls along the needle path.
WARNING!	O tra ne m pi se	nce the biopsy needle is inserted into the Needle Guide, the ansducer should not be repositioned without withdrawal of the eedle well away from the opening of the Needle Guide tube at rectal ucosa. Moving the transducer while the needle is in the tissue can roduce tissue lacerations. The needle can be in the tissue, yet not be en within the imaging field of view.
Taking Needle Guide Measurements	Use PUI tran NEI plu Gui dep nee in t	e a single-caliper marker to take Needle Guide measurements. The <b>NCT.LEN</b> (puncture length) measurement shows the distance from the nsducer face to the caliper along the projected needle path. The <b>MIN EDLE</b> (needle length) measurement is the <b>PUNCT.LEN</b> measurement, s the distance from the Needle Guide insertion point to the Needle ide exit point, plus an additional margin of 20 mm. This depth- bendent measurement reports the minimum required length for the dle to be used and should not be used to determine needle placement he body.
WARNING!	Th an ne	e caliper MUST be placed on the needle path for correct <b>PUNCT.LEN</b> d <b>MIN NEEDLE</b> measurements. If the caliper is not located on the edle path, the measurements displayed will be incorrect.
	If y as c	ou display the second caliper marker in a set, the two calipers operate lescribed in your User Manual.
Exiting the Needle Guide	٠	To exit the Needle Guide program, press [EXIT] or NEEDL GUIDE.
Program	The to t pro	e projected needle path disappears from the screen. The system returns he operating mode it was in before you entered the Needle Guide gram.
		ering a mode or a function that is not supported by the Needle Guide ion will cause the Needle Guide program to exit. To re-enter the edle Guide program, press <b>NEEDL GUIDE</b> .

Disassembling the Needle Guide	Aft pot	ter each exam, regard the transducer covers and any other wastes as tentially infectious, and dispose of them accordingly.
IMPORTANT:	Be th	e sure to wear gloves while performing this procedure. Be sure to use e correct disassembly procedure described in this manual.
WARNING!	N de m re U	eedle Guides are designed and manufactured to attach firmly to esignated transducers and should not require excessive force or anipulation to disassemble. If you believe that excessive force is quired to disassemble Needle Guides, please contact the Siemens ptime Service Center before using it.
Disassembling the	٠	To disassemble the EC-10C5 Needle Guide:
EC-10C5 Needle Guide	1	Pull the outer transducer cover up over the transducer end.
	2	Grasp the Needle Guide with the thumb and two fingers, and pull the Needle Guide off of the transducer shaft.
	3	An alternative method is to grasp the handle of the transducer in the manner that you use for scanning. Insert your thumb into the funnel of the Needle Guide and push the funnel end of the Needle Guide off the transducer. Pull the entire Needle Guide away from the transducer shaft.
	4	Remove the inner transducer cover.
	5	Regard all transducer covers and the EC-10C5 Needle Guide as potentially hazardous infectious waste, and dispose of them accordingly.
	6	Clean and disinfect the transducer as described in "Cleaning, Sterilizing, and High Level Disinfecting" on page 432.
	NC pro fur	<b>TE:</b> Siemens recommends that you practice the Needle Guide ocedure with each transducer to increase your skill and verify actionality.
		OFF: straight up only

Chapter 40 - Endocavity Transducers

# SYSTEM SETUP

System Setup describes how to customize your system. It includes the	
following chapter:	

Chapter 41 System Setup 44	Chapter 41	System Setup		43
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### Setup Menu

You use the Setup function to modify various setup parameters and customize your system. For detailed system setup instructions, see the *Administrator Manual*.

**1** To display the Setup menu, press **SETUP**.



The Setup menu contains - a list of the functions that you can customize.

- **2** Select a function you want to customize from the pop-up menu.
- **3** Use the following keys with the Setup screens:

[SOFT KEY]	FUNCTION
[HIDE MENU]	Temporarily remove a dialog box.
[SHOW MENU]	Redisplay the dialog box.
[PRIOR]	Return to the prior menu, either a dialog box or the Setup menu.
[EXIT]	Leave the Setup function.

# **Setup Options**

SETUP OPTION	FUNCTION
2-D	Customizes controls for the 2-D image such as scale and DGC display, <b>DEPTH</b> control, <b>FOCUS</b> control, and image size.
AEGIS	Customizes components of the AEGIS digital image and data management system, including playback mode and speed, and protocol type. See "AEGIS Software Setup" on page 446.
AUTO DOPPLER	Customizes Auto Doppler measurement configurations.
ANNOTATION	Customizes the six annotation keys, including whether they are cycling or menu annotation keys.
BEGIN/STUDY TYPE	Customizes Study Types including data fields for the Begin/End patient demographic page and default Exam Preset.
BODY MARKERS	Specifies which body markers are available during an exam, and allows you to adjust the size of the marker and the indicator. (Body markers are available for Sequoia 512 systems only.)
CALIPERS/TRACE	Customizes the caliper and trace measurement tools, and selects either GI/Vascular or Cardiac measurements for spectral Doppler.
	Enables the display of the hip angle calculation.
	Enables the display of a slope line for use with generic calipers in M-mode and for $\Delta$ <b>DCAL</b> measurements in Spectral Doppler.
CARDIAC CALC	Customizes measurements, calculations, and the report pages for the cardiac calculation package.
COLOR DOPPLER IMAGING	Controls the method of sizing the Color Doppler Imaging box.
FOOTSWITCH	Programs the two buttons on the footswitch to perform frequently used functions.
GYN CALC	Customizes measurements, calculations, and the report pages for the gynecology calculation package.
MONITOR	Customizes the monitor brightness and contrast levels.
OB CALC	Customizes measurements, calculations and the report pages for the OB calculation package.
OUTPUT	Customizes different acoustic power display options. See Chapter 1 for more information.
PRESETS	Customizes the Exam Presets and Image Presets.

SETUP OPTION	FUNCTION
PRINTING/PC	Links local printers to the <b>PRINT</b> , <b>ALT PRINT</b> , and <b>IMAGE STORE</b> keys. You also select the types of images you want to print with each of the three keys.
	Use this setup option to select the type of printing to printers or to a personal computer (PC).
SCREEN OPTIONS	Customizes screen display elements. You can enter your institution name or choose which system data fields to display on the screen.
	Allows you to select the spacing of dots in the cursor line for depths less than 80 mm and depths greater than 80 mm in the Cursor Line Dot Spacing section.
	Allows you to adjust relative brightness of Background, Text, Graphics, and Color Bands by selecting the <b>Adjust Brightness Levels</b> control.
	Allows you to select a large font size for annotations; data display box; and patient name and ID, and date.
SERVICE UI	Service User Interface. See "Service User Interface (SUI)" on page 450 for more information.
STRIP MODES	Customizes spectral Doppler and M-mode strip size and inversion behavior, and specifies the default cursor.
	Customizes TEQ for Doppler.
SYSTEM	Allows you to reset the system clock and modify system memory allocation.
SYSTEM LIGHTING	Customizes the settings for the system lighting options (down-light intensity, keyboard illumination) and output display contrast.
VASCULAR CALC	Customizes measurements, calculations, and the report pages for the vascular calculation package.
VCR/EXT-VIDEO	Modifies the SVHS signal output level.

### Code Key Setup Functions

You can also use **CODE +** certain keys on the keyboard to quickly access the setup screen for some system parameters. The following table shows the quick-access Setup functions available.

PRESS:	TO DISPLAY:
CODE + SIZE	The Strip Display Sizing setup screen if a strip mode is active, or the Image Size setup screen for 2-D images.
CODE + D COLOR	Color Doppler Imaging setup screen.
CODE + RES	2-D RES box.
CODE + TEQ	Customizes setup screen for tissue equalization technology, either TEQ or Native TEQ. When the footswitch is set up to control TEQ, press <b>CODE</b> + footswitch to open the setup screen. See "Tissue Equalization Technology Options" on page 89.

# AEGIS Software Setup

Use the following information to configure AEGIS parameters:

	PARAMETER	DESCRIPTION
	PLAYBACK MODE	Selects playback mode for stored clips: Free-running, Same start, or Loop-aligned.
_	PLAYBACK SPEED	Select a percentage of real-time speed.
		If the <b>Loop-aligned</b> playback mode is selected, then the system also lists "sh" playback speed settings, such as <b>50% sh</b> . When you select a "sh" playback speed setting, the system plays back the shortest (in duration of time) clips at the specified speed but plays the longest clips at a much faster speed.
		With the Sequoia 8.1 release, playback speed in Pharm Stress QSI is preset at 50% sh. If you use the preset of 50% sh for the Pharm Stress QSI exam preset, then the system plays back the shortest duration clips in stages Baseline, Low Dose, Peak, and Recovery at 50 percent of the real-time speed. The system plays back the longest duration clips in stages Baseline Ac. Capt, Low Dose Ac. Capt, Peak Ac. Capt, and Recovery Ac. Capt at a much faster speed to compensate for the high number of frames in each stage (clip).

PARAMETER	PARAMETER DESCRIPTION	
SAVE ON SELECT	Works with the <b>Save on Capture</b> setting for a protocol to determine when clips are saved.	
	If <b>Save on Select</b> is turned off and <b>Save on</b> <b>Capture</b> is turned off, clips are not saved when you end a study.	
	If <b>Save on Select</b> is turned on and <b>Save on Capture</b> is turned off, clips are saved only if you mark them as selected during review.	
	If <b>Save on Select</b> is turned off and <b>Save on</b> <b>Capture</b> is turned on, clips are saved automatically.	
	If <b>Save on Select</b> is turned on and <b>Save on Capture</b> is turned on, all captured clips are saved.	
PROTOCOL TYPE	Choose Free-form or Staged.	
DEFINE	Click to customize a protocol.	
PROTOCOL VIEW NAMES	Enter up to 10 names for protocol views. Use the scroll bar to view the whole list.	
Use the following in	formation to customize a free-form protocol:	
PARAMETER	DESCRIPTION	
CAPTURE TYPE	Enter the name of the capture type that you want to create, edit, or remove.	
CAPTURE TYPE	Enter the name of the capture type that you want to create, edit, or remove. Creates a new capture type with the settings shown. The new capture type appears at the end of the capture type list.	
CAPTURE TYPE ADD INSERT	Enter the name of the capture type that you want to create, edit, or remove. Creates a new capture type with the settings shown. The new capture type appears at the end of the capture type list. Creates a new capture type with the settings shown. The new capture type is inserted into the list of capture types immediately before the current capture type displayed.	
CAPTURE TYPE ADD INSERT REMOVE	Enter the name of the capture type that you want to create, edit, or remove. Creates a new capture type with the settings shown. The new capture type appears at the end of the capture type list. Creates a new capture type with the settings shown. The new capture type is inserted into the list of capture types immediately before the current capture type displayed. Removes the current capture type.	
CAPTURE TYPE ADD INSERT REMOVE PRIOR	Enter the name of the capture type that you want to create, edit, or remove. Creates a new capture type with the settings shown. The new capture type appears at the end of the capture type list. Creates a new capture type with the settings shown. The new capture type is inserted into the list of capture types immediately before the current capture type displayed. Removes the current capture type. Displays the name and settings for the previous capture type.	
CAPTURE TYPE ADD INSERT REMOVE PRIOR NEXT	<ul> <li>Enter the name of the capture type that you want to create, edit, or remove.</li> <li>Creates a new capture type with the settings shown. The new capture type appears at the end of the capture type list.</li> <li>Creates a new capture type with the settings shown. The new capture type is inserted into the list of capture types immediately before the current capture type displayed.</li> <li>Removes the current capture type.</li> <li>Displays the name and settings for the previous capture type.</li> <li>Displays the name and settings for the next capture type.</li> </ul>	
ADD ADD INSERT REMOVE PRIOR NEXT MAXIMUM CAPTURE FRAME RATE	Enter the name of the capture type that you want to create, edit, or remove. Creates a new capture type with the settings shown. The new capture type appears at the end of the capture type list. Creates a new capture type with the settings shown. The new capture type is inserted into the list of capture types immediately before the current capture type displayed. Removes the current capture type. Displays the name and settings for the previous capture type. Displays the name and settings for the next capture type. Selects the capture frame rate.	
CAPTURE TYPE ADD INSERT REMOVE PRIOR NEXT MAXIMUM CAPTURE FRAME RATE CLIP SIZE	Enter the name of the capture type that you want to create, edit, or remove. Creates a new capture type with the settings shown. The new capture type appears at the end of the capture type list. Creates a new capture type with the settings shown. The new capture type is inserted into the list of capture types immediately before the current capture type displayed. Removes the current capture type. Displays the name and settings for the previous capture type. Displays the name and settings for the next capture type. Selects the capture frame rate. Selects <b>Full, Condensed</b> , or <b>ROI</b> .	
CAPTURE TYPE         ADD         INSERT         INSERT         REMOVE         PRIOR         NEXT         MAXIMUM         CAPTURE         FRAME RATE         CLIP SIZE         JPEG         COMPRESSION	Enter the name of the capture type that you want to create, edit, or remove. Creates a new capture type with the settings shown. The new capture type appears at the end of the capture type list. Creates a new capture type with the settings shown. The new capture type is inserted into the list of capture types immediately before the current capture type displayed. Removes the current capture type. Displays the name and settings for the previous capture type. Displays the name and settings for the next capture type. Selects the capture frame rate. Selects <b>Full, Condensed</b> , or <b>ROI</b> . Selects a compression level for the stored clip.	

**Free-Form Protocols** 

	PARAMETER	DESCRIPTION
	CLIP SETTINGS	See "Clip Settings" on page 449.
	TRIG CLIP SETTINGS	Click to define clip settings for clips stored while the trigger function is active. See "Triggered Clip Settings" on page 449. (For more information about the trigger function, see "Triggered Images" on page 95.)
	[PRIOR]	Returns to the AEGIS dialog box.
Staged Protocols	Use the following inf	formation to customize a staged protocol:
	PARAMETER	DESCRIPTION
	STAGE	Enter the name of the stage that you want to create, edit, or remove.
	ADD	Creates a new stage with the settings shown. The new stage appears at the end of the stage list.
	INSERT	Creates a new stage with the settings shown. The new stage is inserted into the list of stages immediately before the current stage displayed.
	REMOVE	Removes the current stage.
	PRIOR	Displays the name and settings for the previous stage.
	NEXT	Displays the name and settings for the next stage.
	MAXIMUM CAPTURE FRAME RATE	Selects the capture frame rate.
	CLIP SIZE	Selects Full, Condensed, or ROI.
	JPEG COMPRESSION	Selects a compression level for the stored clip.
	DISPLAY STAGE TIMER	When turned on, the stage timer appears.
	SAVE ON CAPTURE	When turned on, automatically saves all clips that you capture.
	AUTO-REVIEW	When turned on, the system automatically enters Review mode after completing a capture.
	AUTO-DELETE UNSAVED CAPTURES	When turned on, any unsaved clips are automatically deleted, upon exiting the stage.
	CLIP SETTINGS	See "Clip Settings" on page 449.
	TRIG CLIP SETTINGS	Click to define clip settings for clips stored while the trigger function is active. See "Triggered Clip Settings" on page 449. (For more information about the trigger function, see "Triggered Images" on page 95.)
	[PRIOR]	Returns to AEGIS dialog box.

Clip SettingsUse the following information to customize free-form and staged<br/>protocols for clips stored while the system's trigger function is inactive.<br/>(If you are customizing Trig Clip Settings, see "Triggered Clip Settings"<br/>on page 449, then click Clip Settings to display these options.)

PARAMETER	DESCRIPTION
CLIPS PER CAPTURE	Selects the number of clips stored: <b>1</b> , <b>2</b> , <b>4</b> , <b>8</b> , or <b>Indefinite</b> .
SEGMENTS PER CLIP	Selects the number of segments per clip from 0 to 99.
SEGMENT LENGTH	Specifies a segment length from 0 to 9999. Also select a unit type from the pop-up menu.
ALTERNATE SEGMENT LENGTH	Specifies an alternate segment length from 0 to 9999. Also select a unit type from the pop-up menu.
CINE R-R CAPTURE	Specifies the number of R-waves (heart cycles) per clip to capture when using Acoustic Frame Capture.
ENABLE R-WAVE GATED CAPTURE	Turn on this option to trigger captures from the ECG R-wave.
R-WAVE DELAY	Specifies an interval in msec after the R-Wave at which to begin the capture.

Triggered Clip Settings

When the system's trigger function is active, clips captured are composed of frames taken at each trigger point. Click **Trig Clip Settings**, and then use the following information to customize free-form and staged protocols for clips stored while the system's trigger function is active.

PARAMETER	DESCRIPTION
SEGMENT LENGTH	Specifies a segment length from 0 to 9999. Also select a unit type from the pop-up menu.
ALTERNATE SEGMENT LENGTH	Specifies an alternate segment length from 0 to 9999. Also select a unit type from the pop-up menu.
TIME DECIMATED CAPTURE	Use time decimated capture in non-cardiac applications to show changes over a long period of time without collecting a large number of images within the clip.
R-WAVE DECIMATED CAPTURE	Use R-wave decimated capture to capture one frame per heartbeat at a specified cardiac phase (when an ECG trace is available). R-wave decimated capture significantly reduces the number of frames required in a clip to show "wash-in" of contrast agent (when Burst is enabled in the multi-trigger setting for PrecisionBurst).

## Service User Interface (SUI)

The Service User Interface (SUI) provides you and your Siemens Customer Service Engineer access to system capabilities that aid in the maintenance of your Sequoia system. This manual describes how to use the Customer Diagnostic Suite feature; some features are reserved for authorized Siemens Service personnel.

- To enter SUI:
- **1** Press **SETUP** to display the system Set-up menu.
- **2** Choose Service UI from the Set-up menu to display the SUI menu.
- **3** Use the pointer and the trackball **SELECT KEYS** to select the icon for the function you want to perform.

**NOTE:** Some SUI functions require that you restart your system for changes to take effect.

ICON	FUNCTION
DATA BACKUP	Backs up system data to MO disk. On the Data Backup screen, click <b>Format MO</b> , and then select <b>[OK]</b> to format an unformatted MO disk. Click <b>ACUSON FAS Backups</b> to select the type of data to back up. Enter an optional backup name. Click <b>[START]</b> , and then <b>[OK]</b> to begin the backup.
DATA RESTORE	Restores system data from a backup MO disk inserted in the MO drive. Select the file you want to restore, click <b>[RESTORE]</b> , and then <b>[OK]</b> to restore the file.
CUSTOMER INFORMATION	Displays current identification information for the system.
NETWORK SETUP	Specifies the Sequoia system's network configuration. The network configuration includes the Sequoia system's network address and the addresses of other devices (such as print and file servers) that it communicates with on the network. You can set up multiple network configurations to connect to different networks or to the same network with different parameters. For example, when a system is shared by two departments in a hospital, there might be one configuration for each department. Your local network administrator or Siemens Customer Engineer should set up network configurations. (For more information, see the <i>Administrator Manual</i> .)
DICOM DEVICE	Configures a DICOM printer or server. This function should be performed by your Local Network Administrator or Siemens Customer Engineer.
HARDWARE DIAGNOSTICS	Use Hardware Diagnostics to detect hardware failures. This feature is accessible without a password. In-progress tests can be aborted at any time. Hardware Diagnostic displays the estimated time for test completion and upon test completion, displays the results as pass, fail, or cancel. For detailed information see the <i>Administrator Manual</i> , "Using the Service User Interface".

Remote Service	The Remote Service capability allows the Siemens Uptime Center to access special diagnostic service and maintenance tools within the Sequoia system.
	Included with the Sequoia system is a communications device that enables Siemens personnel to access your system to perform Siemens duties under the Warranty or qualifying Customer Protection Plan. You are responsible for providing a dedicated analog telephone line suitable for connection to the communications device. You are also responsible for replacing communications devices that are lost or damaged. For additional details, please refer to your Warranty Policy or Customer Protection Plan Terms and Conditions.
	The Siemens Uptime Center will coordinate the remote service procedure. The connection to the remote service will be made using a network modem or Ethernet cable. They will be available to answer any questions you might have during the process.
Requirements	To use remote service, you must provide:
	• A dedicated, analog telephone line. This phone line must be connected directly to the telephone utility's lines without passing through manual or automatic switchboards, PBX, or any other nonstandard telephone switching device.
	• Adequate space for the communications device. The approximate size of the device is 31 x 26 x 15 centimeters (12 x 18 x 6 inches).
	• Adequate space between the communications device and the patient. The communications device must be located at least 2 meters (6 feet) from the Sequoia system and from the patient. There may be other local regulatory requirements regarding the installation of the communication device.
Remote Service Safety Precautions	Electrical isolation between the communications device and the Sequoia system is provided by the isolator and cabling connections. For the isolation to be effective, it is imperative that the following requirements are followed.
WARNING!	Do not plug the communications device into the accessory outlets of the Sequoia system. Electrical isolation is provided by the isolator. No additional electrical path should be allowed between the communications device and the ultrasound system. The communications device must be connected to a grounded (protectively earthed) wall outlet.
	<b>Do not set the communications device on the Sequoia system.</b> The communications device equipment must be located at least 2 meters (6 feet) from the system and the patient.

**Remote Service** Depending on your system's configuration, you connect one of the Communications following communications devices to initiate remote service: Devices Network modem which connects using an Ethernet cable to the system's Ethernet port. For connection instructions, see "Remote Service Procedure - Network Modem" next. Serial modem which connects using a special Siemens serial cable to • the system's Serial port. For connection instructions, see "Remote Service Procedure - Serial Modem" on page 453. **Remote Service** To begin the remote service procedure using the Procedure network modem: Network Modem 1 Turn off the Sequoia system. 2 Move the system to a location near the network modem and the telephone line (if not already connected).

> Your Siemens Customer Engineer sets up the network modem for you and connects it to the telephone line. It is connected to the Sequoia system's Ethernet port (located on the back of the system) using a nonstandard cross-over cable. It may be disconnected from the Sequoia system for portable exams.

**3** If you need to connect the Ethernet cable, orient the connector with the small latch upwards and gently press the connector into the Ethernet port until it latches into place. Repeat this process to connect the other end of the cable to the network modem.



**4** Turn on the Sequoia system.

**5** Connect the telephone line to the network modem's Line port.

Make a note of the telephone number for this telephone line. You will need to provide it to the Siemens Help Desk.

**6** Turn on the network modem.

The Siemens Help Desk will initiate the remote service procedure.

7 When the remote service procedure is complete, turn off the system, wait for several seconds, and then turn it on again to reset it for imaging.

If you need to move your system for portable exams, you must first disconnect it from the modem.

To disconnect the network modem, depress the small latch on the Ethernet connection cable and gently pull the connector out of the Ethernet port on the Sequoia system.

Leave the cable connected to the network modem.

- To begin the remote service procedure using the serial modem:
- **1** Turn off the Sequoia system.
- **2** Move the system to a location near the network modem and the telephone line (if not already connected).
- **3** Check that the modem adapter is installed on the connector labeled **SERIAL/0 RS232** on the back of the Sequoia system as shown in the illustration on this page.

Remote Service Procedure -Serial Modem **4** Connect the modem cable to the modem adapter as shown in the illustration on this page.

If the cable does not easily snap in place, try turning it over.



**5** Make sure that the telephone line is connected between the telephone jack and the **LINE** connector on the modem, as shown in the following illustration:



Make a note of the telephone number for this telephone line. You will need to provide it to the Siemens Help Desk.

- **6** Verify that the modem power cable is connected to a grounded (protectively earthed) wall outlet.
- **7** Turn on the modem.
- **8** Turn on your Sequoia system.
- **9** The Siemens Customer Support Engineer can now access your system to run diagnostics from the Help Desk.
- **10** When the remote service procedure is complete, turn off the system, wait for several seconds, and then turn it on again to reset it for imaging.

If you need to move your system for portable exams, you must first disconnect it from the modem.

To disconnect the serial modem, disconnect the serial cable from the adapter on the back of the Sequoia system.

Leave the adapter connected to the Sequoia system and the cable connected to the modem.

Chapter 41 - System Setup

# ACUSON Sequoia User Manual

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