SONOS 7500/5500
System Basics

PHILIPS
Warranty
The information contained in this document is subject to change without notice.

Philips Ultrasound makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

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This product may contain re-manufactured parts equivalent to new in performance or have had incidental use.

WARNING
Electrical Shock Hazard
Do not remove system covers. To avoid electrical shock, use only supplied power cords and connect only to properly grounded wall (wall/mains) outlets.

Explosion Hazard
Do not operate the system in the presence of flammable anesthetics.

Safety Information
Before you use the Philips ultrasound system, be sure to read the Safety and Standards Guide.

Pay special attention to the “Warnings” and “Cautions.”

The warnings explain the dangers of electrical shock and explosion hazard, the safety of ultrasound, applications, guidelines for fetal use, and guidelines for setting controls that affect acoustic output and accuracy of clinical measurements.

The cautions explain potential dangers to equipment.

Warning symbol used in the Text:

---

Caution symbol used in the Text:

---

Warning Symbols used on the System or its Probes:

⚠️ Instruction manual symbol: The product is marked with this symbol when it is necessary for the user to refer to the user’s guide.

⚠️ Dangerous voltages symbol: Indicates potential for electrical shock.

Monitor Radiation
The monitor used in this system complies with the FDA regulations that were applicable at the date of manufacture (21 CFR Subcategory J).

Prescription Device
The United States Food and Drug Administration requires the following labeling statement:

Caution - Federal Law restricts this device to use by or on the order of a physician.

Important

Europe: The product is marked with the CE mark. The CE mark indicates compliance with the essential requirements of the Medical Device Directive (93/42/EEC). 

Authorized EU Representative:

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Preface

This guide describes the basic operation of the Philips SONOS 7500 and SONOS 5500 ultrasound imaging systems.

What’s New In This Guide For D.0

The following major additions, deletions, and changes were made to this guide for software revision D.0:

• This manual does not include information about Live 3D and BiPlane imaging modes. For more information about them, see the Using 3-Dimensional and BiPlane Imaging guide.

• Material about the SONOS 4500 system and about strip-chart recorders is removed, since these are not supported by software revision D.0.

• The book’s organization is changed, to make it easier for readers to use it in conjunction with the SONOS system’s Getting Started Audio CD.

• A new chapter is added, to summarize how to set up, perform, and record ultrasound exams. (See Chapter 6.)

• Brief introductions are added to all chapters, to provide better context and perspective, and to give readers handy pointers to each chapter’s contents.

• The last chapter (about ordering supplies and accessories) is removed, and replaced by ordering information at the end of Chapter 1.
The SONOS D.0 Documentation Set

Use this guide in conjunction with the following books:

- *Controls Reference*—Provides a detailed description of all system controls.
- *Safety and Standards Guide*—Provides information on safety issues.
- *Measurements and Calculations Reference*—Provides information on measurements and calculations that you can perform on your ultrasound system.
- *Transducer Reference*—Provides information on the operation, care, and cleaning of transducers.

Additionally, several specialty guides and multimedia products describe SONOS imaging applications and optional packages:

- *Using Integrated Digital Interface (IDI)*
- *Using Stress Echocardiography*
- *Using 3-Dimensional and BiPlane Imaging*
- *Using Contrast Imaging*
- *Using Acoustic Quantification*
- *Using Acoustic Densitometry*
- *SONOS Live 3D Cardiac Echo: Features and Fundamentals* (a CD guide to Live-3D cardiac imaging)
- *LVO and Contrast CK: A Practical Approach* (a video guide to SONOS contrast echocardiography detection techniques)
- *Stress Audio CD* (a spoken guide to performing SONOS stress echocardiography studies)

Conventions Used in This Guide

The following conventions are used in this guide:

- Touch-panel and rotary control names appear in bold text. For example, *Acquire Loop*.
- Function keys appear in a box. For example, [Enter].
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1 The System

Main Components

- Transducer holders
- Tilt and swivel monitor
- Optical disk drive
- Service floppy disk drive
- Optional VCR
- Touch panels
- Keyboard controls
- Transducer connections
- Circuit breaker (on back)
- Main power switch
- Optional peripheral
- Live-3D or IDI PC or other peripheral
- Wheel lock
Control Panel

Function keys, such as [Setup], [Position], and [Freeze], are active when their status lights are on. Pressing these keys turns them on or off.
The System

Touch Panels

Touch Panels

When you touch a control, the system highlights it to indicate the control is active. System controls, such as Presets, Tools, Physio, and Probes are located on the left touch panel. Imaging modalities, such as 2D, MMode, Color, PW, CW, and Angio appear on the primary right touch panel. Additional touch and rotary controls pertaining to the selected modality also appear on the primary right touch panel. In some cases, you will see Secondary Controls on the right touch panel. Touching this control displays another touch panel that contains controls that are not used as frequently.

Depending on the system you have and on your system’s options, you might not see some of the controls shown in this guide. Also, the illustrations in this book show only the pertinent controls required to access a function.

To turn off an active (highlighted) control, touch it.
The System

Touch Panels

Left Touch Panel
Contains system-specific controls.

Right Touch Panel
Contains mode-specific controls.

Secondary Touch Panel
Contains less frequently used controls.

Each rotary control adjusts the highlighted control above it. To change the value displayed, turn the rotary control to the right or left.
System Power

All systems have a separate circuit-breaker switch on the back panel, near the power-cord connection. This switch has on and off settings. If the SONOS system does not power up when the main power switch is turned on, this circuit-breaker may have tripped or may be set to off. If this happens, turn the circuit breaker completely off and then back on. Then turn system power on using the main power switch.

**Systems without PCs**

The main power switch immediately turns the system on and off.

**NOTE**
When the system is turned off, standby power remains on.

**Systems with PCs**

**NOTE**
Systems with PCs are equipped with circuitry to properly shut down the PC. Following the procedure described below helps to increase the reliability of the system.

- Turning the main power switch on turns on both the SONOS system and the PC.
- Turning the main power switch off and leaving it off for approximately three seconds starts the controlled PC-shutdown procedure:

1. An onscreen message displays: **Please wait while the system shuts down.**
2. The SONOS system then begins to shut down. It disables all controls and suspends scanning and other processing.
NOTE
Turning the main power switch back on before the shutdown message is displayed stops the shutdown procedure. The system and PC remain on.

NOTE
After the shutdown message has displayed, the system ignores further changes to the main power-switch setting, and shutdown completes. However, if you change the power-switch setting after the shutdown message is displayed, the new setting takes over after shutdown. For example, if you turn the main power switch back on during the final stages of shutdown, both the system and PC power up after shutdown completes.

3 After a short delay (typically less than 30 seconds), the PC shuts down.

4 A few seconds later, the SONOS system completes shutdown, but standby power remains on.

CAUTION
If you disconnect the power cord before system shutdown completes, the PC may not shut down properly.

If you turn system power off before the PC boots up completely, the PC may not shut down properly.

NOTE
If the PC does not power up when the SONOS system powers up, turn the main power switch off, wait for the system to power down completely, and then power the system back up. If the PC still does not power up, turn the PC power on by pressing the power button on the upper-left front corner of the PC.
Setting Up the System

1. Press Setup.

2. Touch System.

3. Perform Setup tasks described in the following sections.
The System
Setting Up the System

**Entering Your Institution Name**

1. Touch **Institute Name**.

2. Type the name of your institution. You can type up to 32 characters on two lines. If you make a mistake, use ← to erase the previous characters.

3. When you are done, press **Enter** twice quickly, or with the trackball, highlight **Okay** and press **Enter**.
Setting the Date

1. Turn the **Year** rotary control to the right to increase the year setting, or to the left to decrease it.

2. Turn the **Month** rotary control to the right to select a month later in the year, or to the left to select an earlier month.

3. Turn the **Day** rotary control to the right to increase the day of the month, or to the left to decrease it.
Setting Up the System

Setting the Time

1. Turn the **Hour** rotary control to the right to increase the hour setting, or to the left to decrease it. The system uses a 24-hour format.

2. Turn the **Minute** rotary control to the right to increase the minutes setting, or to the left to decrease it.
Adjusting the Control Panel and Touch Panel Lighting

1. To adjust the lighting of the touch controls, touch the Touch Light control and turn the Touch Light rotary control to the right to brighten the touch controls, or to the left to dim them.

2. To adjust the lighting of the hard controls, keyboard, and sliders, touch Backlight and turn the Backlight rotary control to the right to brighten it, or to the left to dim it.

Tip: Keep the Touch Light setting as low as possible for the ambient light.

NOTE To retain system settings, save them to a preset. See “Creating Presets” on page 3-6.
Adjusting the Monitor Position

You can move the monitor up and down to find the position that is most comfortable for you.

**CAUTION**

Do not push the release bar under the center front of the monitor unless you want to take the monitor off its base. See the *Safety and Standards Guide* for information on removing the monitor and moving the system.
Calibrating the Monitor

**CAUTION**

You must calibrate the monitor lighting correctly, or improper adjustment of system controls can occur. This can result in poor real-time image quality, VCR recording quality, or print quality.

There are two versions of SONOS monitor. You calibrate one using brightness/contrast dials. You calibrate the other using brightness/contrast push buttons.

**Calibrating monitors with brightness/contrast dials on the front**

1. On the monitor, turn the contrast dial up just until the top grayscale bar looks pure, bright white. Once it looks pure white, do not continue to turn the contrast dial.

Tip: Adjust monitor lighting when the ambient room lighting changes, such as for bedside studies.
The System

Setting Up the System

1. On the monitor, press and hold the right contrast button only until the top grayscale bar looks pure, bright white. Once it looks pure white, release the button.

Calibrating monitors with brightness/contrast push buttons on the front

2. On the monitor, turn the brightness dial down just until the bottom grayscale bar (the 16th bar) looks pure black and disappears into the screen background. When the monitor is properly calibrated, 15 grayscale bars are visible, running from white (top) to nearly black (bottom).

NOTE

While not a direct danger to patient or operator safety, ambient magnetic fields may affect the colors that are displayed on the imaging screen. To remove the effects of this interference, periodically degauss the monitor. Push up on the degaussing button located underneath the front-right corner of the monitor case.

Tip: Adjust monitor lighting when the ambient room lighting changes, such as for bedside studies.
2. On the monitor, press and hold the left brightness button only until the bottom grayscale bar (the 16th bar) looks pure black and disappears into the screen background. When the monitor is properly calibrated, 15 grayscale bars are visible, running from white (top) to nearly black (bottom).

**NOTE**  
While not a direct danger to patient or operator safety, ambient magnetic fields may affect the colors that are displayed on the imaging screen. To remove the effects of this interference, periodically degauss the monitor. Press the contrast - and + buttons simultaneously. The displayed image may briefly distort, but will quickly return to normal.
Using the Foot Switch

If you are using the foot switch, plug it into the back of the system into the connector labelled Foot Switch.

Use the foot switch as follows:

- Left pedal to freeze
- Middle pedal to print
- Right pedal to tape

See Using 3-Dimensional and BiPlane Imaging Guide for information about using the foot switch to acquire Full Volume images in Live-3D mode.

See Using Stress Echocardiography Guide for information on using the foot switch during a stress exam.

See Using Contrast Imaging for information on using the foot switch during contrast imaging.

**WARNING**

Do not use the foot switch in the operating room. IEC 601-1 specifies that foot-operated control devices used in the operating room must be of watertight construction. The foot switch supplied with the ultrasound system meets only drip-proof construction requirements.
Supplies and Accessories

To order supplies and accessories from within the U.S.A., visit:

http://shop.medical.philips.com

or call Medical Supplies at 1-800-225-0230.

From other countries, contact your local Philips representative or sales office.
The System

Supplies and Accessories
2 Transducers

Introduction

This chapter provides information about

- Connecting transducers (page 2-2)
- Activating transducers (page 2-4)
- Disconnecting and storing transducers (page 2-5)
- Troubleshooting transducers (page 2-6)

NOTE

Be sure that you use only Philips-approved transducers for your ultrasound system.

See the Transducer Reference, Safety and Standards Guide, and Using 3-Dimensional and BiPlane Imaging Guide for specific information about Philips ImagePoint and SONOS transducer specifications, cleaning, maintenance, and applications (including the x4 transducer used for Live-3D and BiPlane imaging).
Connecting Transducers

Imaging Transducers

1. With the latch in the vertical position, insert the transducer connector. Never force a transducer into place. If you feel any resistance, check the pin positions and try reinserting it.

2. Lock the connector by flipping the transducer lever to horizontal.
Nonimaging Doppler Pencil Transducers

1. Align the connector’s prongs with the receptacle.

2. Insert the connector.
Transducers
Activating Transducers

Activating Transducers

1. Touch **Probe**.

2. Touch the control indicating where the transducer is connected.
Disconnecting and Storing Transducers

1. Unlock and remove the transducer.

2. Store external imaging transducers in the holders. Place connectors in the individual side pockets to protect the pins. Store TEE transducers on a wall-mounted rack.

NOTE
See the Transducer Reference for information on caring for and cleaning your transducer.
Transducer Troubleshooting

Always make sure that the active preset is appropriate for the study being performed.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Probe or ??? Probe is displayed on the imaging screen.</td>
<td>Place the transducer connector lock in the horizontal position. Make sure the correct transducer slot is selected on the touch panel (Left, Center, Right, or Nonimage, under Probe).</td>
</tr>
<tr>
<td>No image.</td>
<td>Select the transducer on the touch panel (Left, Center, Right, or Nonimage, under Probe). Check to see if the transducer connector has any bent pins; if not, reconnect the transducer to ensure it is seated properly.</td>
</tr>
</tbody>
</table>
| Image is too soft, hazy, or gray. | Adjust the Postproc rotary control to increase grayscale contrast.  
  🗿 Compress to reduce low-level echoes.  
  🌿 Persist to sharpen the image.  
  Adjust monitor settings. |
| Image has too much contrast or is grainy. | Adjust the Postproc rotary control to obtain the desired image appearance.  
  🗿 Compress to increase low-level echoes.  
  Use a higher Frequency Fusion setting. Otherwise, change to a higher frequency transducer.  
  For slow-moving structures, 🌿 Persist to soften the image.  
  Adjust monitor settings. |

Tip: Postproc, Edge Enhance, and Persist are 2D/BMode controls. After adjusting controls, always check the transducer position.
## Transducers
### Transducer Troubleshooting

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need better penetration.</td>
<td>Use the lower <strong>Frequency Fusion</strong> setting. Otherwise, change to a lower frequency transducer. Use the <strong>LVO1</strong> or <strong>TCE1</strong> setting if you are in Contrast Harmonic imaging, and the <strong>Frequency Fusion 1</strong> setting if you are in Harmonic Fusion imaging.</td>
</tr>
<tr>
<td>Linear transducer loses part of image.</td>
<td>Make sure gel completely covers the face of the transducer.</td>
</tr>
</tbody>
</table>

**NOTE**

If the pins on the transducer connector are bent and if the troubleshooting suggestions do not help, contact your Philips Service Representative.
3 Presets

Introduction

A preset is a group of specific control settings that optimize the system for the exam you are about to perform. You use presets to establish initial settings such as compression and gain values, color maps and processes, screen formats, and acoustic power output levels. You can also use presets to determine patient information screens, measurements, calculations, and annotation labels for the selected study.

This chapter provides information about

- Philips-defined presets (page 3-2)
- Choosing presets (page 3-3)
- Modifying presets (page 3-4)
- Creating presets (page 3-6)
- Storing presets (page 3-8)
- Copying presets to a different SONOS system (page 3-9)
- Deleting presets (page 3-10)
Philips-Defined Presets

The system ships with Philips-defined presets for each exam type. Table 3-1 shows the number of Philips-defined presets by exam type and the number of presets you can create.

Table 3-1  Philips-Defined Presets

<table>
<thead>
<tr>
<th>Exam Type</th>
<th>Philips-defined Presets</th>
<th>Available Customized Presets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Vascular</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Abdominal</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>OB/GYN</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Peripheral Vascular</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Small Parts Exam</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

When you turn on or reset the system, it activates the last preset used. Before starting a study, check the preset shown on the screen and, if necessary, touch a more appropriate preset. Always select the Philips preset at the start of the study to return to the initial values.
Choosing Presets

1. Touch Preset.

2. Touch the exam type (if applicable).

3. Touch the preset you want to use for this study.
Modifying Presets

1. Touch the preset you want to alter. You can modify all Philips and custom presets.

2. Adjust controls to display the image as you want to see it.
Presets
Modifying Presets

3. To change Setup values, such as lighting and display options, press *Setup* and make the necessary adjustments. Press *Setup* again to exit Setup mode.

4. With *Preset* active, touch *Save Preset*.

5. Select *Modify Current* with the trackball and press *Enter*. To keep the current name, quickly press *Enter* twice or highlight *Okay* and press *Enter*. To rename the preset, type a new name and quickly press *Enter* twice, or highlight *Okay* and press *Enter*.

Tip: Be sure the Annotation labels and Analysis measurements and calculations are appropriate for the new preset. For more information see Chapter 8, Chapter 9, and Chapter 10.
Creating Presets

You can define your own presets for each exam type and are only limited by the amount of available space on the touch panel. To create a new preset, use the following procedure:

1. Touch **Preset**.

2. Touch a preset of the same exam type as the one you want to create. This ensures that most system settings, including annotation labels and analysis measurements, are appropriate for the new preset.
3. Adjust the controls to display the image as you want to see it. To change Setup values, such as lighting and display options, press Setup and make the necessary adjustments. Press Setup again.

4. Touch Save Preset.

5. Highlight Create New with the trackball and press Enter. You are prompted to name the new preset. Give the preset a unique name and quickly press Enter twice or select Okay and press Enter.

6. Type the name of the new preset into the Create New Preset window and select Okay and press Enter.
Storing Presets

You can store modified or newly created presets, and are only limited by the amount of available space on the touch panel. To store a modified or new preset, use the following procedure:

1. After you have finished modifying or creating a preset to your satisfaction (as described on page 3-4 or page 3-6), with Preset active, touch **Save Preset**.

2. To save a modified preset, select **Modify Current** with the trackball and press **Enter**. To save a newly created preset, select **Create New** with the trackball and press **Enter**.

To keep the current name, quickly press **Enter** twice or highlight **Okay** and press **Enter**. To rename the preset, type a new name and quickly press **Enter** twice, or highlight **Okay** and press **Enter**.

Tip: Also save new or modified presets to a floppy diskette, so you can restore them in case of a system failure. See “Floppy Drive” on page 4-3 for more information.
Copying Presets to a Different SONOS System

To copy presets from one SONOS system to another, do the following:

1. On the system that is currently using the preset, store the preset on a floppy diskette using the **Backup Preset** control.

2. Insert the diskette in the SONOS system that you want to upgrade.

3. Touch **Add Preset** (which is below **Restore Preset** on the touch panel).

   This adds all presets from the disk to the system’s current presets. (Nonpreset files on the disk are ignored.)

4. If you did not want to add some of the presets on the disk, you can delete them from the system using **Delete Preset** (see “Deleting Presets” on page 3-10).
Deleting Presets

If the preset memory is full, you may have to delete a preset before creating new ones. You cannot delete Philips presets, but you can delete customized presets.

1. Touch the preset you want to delete.

2. Touch Delete Preset.

3. To confirm the deletion, highlight Okay with the trackball and press Enter. To retain it, highlight Cancel and press Enter.
4 Peripheral Devices

Introduction

WARNING This system has been investigated to the requirements of IEC 601-1, with peripherals that are powered by the built-in isolation transformer. Anyone who uses the system with peripherals that are powered from a separate wall receptacle is considered to be configuring a medical system, and is therefore responsible that the system complies with the requirements of the IEC 601-1-1. If you have additional questions, contact your Philips representative.

This chapter provides information about the SONOS

- System monitor (page 4-2)
- Floppy drive (page 4-3)
- Optical disk drive (page 4-5)
- PC (page 4-6)
- VCR (page 4-6)
- Printer (page 4-10)
- RS-232 interface (page 4-20)
- Remote service feature (page 4-22)

NOTE Optional peripherals shipped with your ultrasound system are configured at the factory to optimize ease of use and image quality. Operator’s manuals from other manufacturers may describe additional features on those devices. Note, however, that modifying factory settings can potentially affect how those peripherals operate with your system. To ensure that peripherals work as designed with your system, it is recommended that you do not change peripheral settings.
System Monitor

Adjusting the Monitor Position

For information about adjusting the system monitor for user comfort, see “Adjusting the Monitor Position” on page 1-12.

Calibrating the Monitor

There are two versions of the SONOS monitor. You calibrate one using brightness/contrast dials. You calibrate the other using brightness/contrast push buttons. For instructions, see “Calibrating the Monitor” on page 1-13.
Floppy Drive

The Service Floppy drive allows you to

- Save and restore customized presets
- Format and erase floppy diskettes
- Upgrade software
- Install software options

Controls

Add Preset  Reads a previously stored system configuration data set from disk.
Backup Preset  Saves system configurations, including presets and other settings, to a formatted floppy diskette. Screen instructions are provided.
Clear Diskette  Erases all disk files.
Format Diskette  Formats any manufacturer’s 3.5” floppy diskette to DOS compatibility. If you have the Integrated Digital Interface option, you must turn the system off then on again after formatting a diskette.
Install Options  Installs optional software provided by Philips. Only used by Philips service organization.
Read Diskette  Reads text files stored on a floppy diskette.
Restore Preset  Retrieves previously stored system preset from the floppy diskette. Screen instructions are provided.
Upgrade Software  Installs system upgrade software provided by Philips. Only used by Philips service organization.
Peripheral Devices

Floppy Drive

Accessing the Service Floppy Disk Drive

1. Press Setup.

2. Touch Service Floppy.

3. Select the option you want and follow the instructions. Press Setup to return to imaging.
Optical Disk Drive

5 1/4-inch

The following table describes the optical-disk media that can be used with the SONOS system using a 5 1/4-inch optical-disk drive:

<table>
<thead>
<tr>
<th>Drive</th>
<th>Revision</th>
<th>Media Compatibility and Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4X</td>
<td>SONOS 7500/5500</td>
<td>1X (read only) 600 MB</td>
</tr>
<tr>
<td></td>
<td>A.0 through B.0</td>
<td>2X (read/write) 1.2 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4X (read/write) 2.3 GB</td>
</tr>
<tr>
<td>8X</td>
<td>SONOS 7500/5500</td>
<td>1X (read only) 600 MB</td>
</tr>
<tr>
<td></td>
<td>B.1 through D.0</td>
<td>2X (read only) 1.2 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4X (read/write) 2.3 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8X (read/write) 4.8 GB</td>
</tr>
</tbody>
</table>

3 1/2-inch

The following table describes the optical-disk media that can be used with the SONOS system, using a 3 1/2-inch optical-disk drive:

<table>
<thead>
<tr>
<th>Revision</th>
<th>Media Compatibility and Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SONOS 5500</td>
<td>(read/write) 540 MB</td>
</tr>
<tr>
<td>B.1 and B.2</td>
<td></td>
</tr>
<tr>
<td>SONOS 7500/5500</td>
<td>(read/write) 540 MB</td>
</tr>
<tr>
<td>D.0</td>
<td>or</td>
</tr>
<tr>
<td></td>
<td>(read/write) 2.3 GB</td>
</tr>
</tbody>
</table>
Peripheral Devices

PC

PC

A PC is installed on systems that receive the optional Live-3D imaging software. This PC allows users to perform the following Live-3D operations:

- Save study images to the PC disk.
- Review, retrieve, and delete studies that are stored on the PC disk.
- Export studies from the PC disk to the CD-ROM media.

For more information about these operations and about the PC’s controls, see the *Using 3-Dimensional and BiPlane Imaging Guide*.

VCR

**NOTE** For information about using the VCR to videotape exams, see Chapter 6.

**Controls**

**Primary**

Color Adjusts playback color intensity.

EJECT Ejects the tape from the VCR.

FF Rapidly advances a VCR tape.

Frame Displays the next or previous tape frame. Available during playback, when PAUSE is on.

Mic Enables and disables the microphone, to record external sound onto a tape.
PAUSE  Pauses and resumes recording or playback, without disengaging the VCR heads.

PLAY  Activates VCR playback.

RECORD  Indicates that the system is recording the display onto a VCR tape.

REW  Rapidly rewinds a VCR tape.

SEARCH  Pauses the VCR playback picture and puts the system into search mode.

Speed  Adjusts the tape search speed. Available when SEARCH is on.

STOP  Stops any active VCR operation.

Tape  Starts and pauses VCR recording.

Tape Find  Displays the frame specified. The format you enter must match the format used during recording (either the time format using Tape Time or the number format using Tape Number).

Tape Number  Lets you enter a number on the imaging screen that matches the number recorded on the VCR tape. Tape Number must be enabled in Setup to see this control as part of the VCR control set.

Tape Time  Lets you enter a time (hours, minutes, and seconds) on the imaging screen that matches the time recorded on the VCR tape. Tape Time must be enabled in Setup to see this control as part of the VCR control set.

VCR Play  Displayed on the right touch panel, this indicates that a VCR image is on the imaging screen. Touching VCR Play stops VCR playback and displays the previous format.
Setup

Blink, Normal, and Inverse are available for both Tape Number and Tape Time. With VCR highlighted, press [Setup] and select either Tape Number or Tape Time. Turn the rotary control beneath the highlighted selection to select Blink, Normal, or Inverse. Press [Setup] again to return to imaging.

- **Blink**: Displays tape time or tape number in blinking numerics.
- **Inverse**: Displays tape time or tape number in numerics within a shaded box.
- **Normal**: Displays tape time or tape number in normal video display.
- **Tape Number**: Enables Tape Number, for entering a number on the screen that matches the number recorded on the VCR tape.
- **Tape Time**: Enables Tape Time, for entering a time (hours, minutes, and seconds) on the screen that matches the time recorded on the VCR tape.
### VCR Troubleshooting

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tape controls do not display.</td>
<td>Make sure there is a tape in the VCR.</td>
</tr>
<tr>
<td>Cannot hear sounds on the tape.</td>
<td>Turn up the <strong>Volume</strong> control.</td>
</tr>
<tr>
<td>Images are too light or dark on playback.</td>
<td>Make sure the monitor <strong>brightness</strong> and <strong>color</strong> controls are correctly set.  See “Calibrating the Monitor” on page 1-13 for details.  For tapes recorded with color, adjust <strong>Color</strong> during playback.</td>
</tr>
</tbody>
</table>
| Playback quality is inferior.    | To obtain and view Super VHS images, record on a  
- Super VHS VCR (if your VCR has an S-VHS switch, be sure it is on)  
- Super VHS tape |
| Cannot view taped images.        | Try viewing the tape on a Super VHS VCR. If a Super VHS tape was recorded in S-VHS, you can only view the images on a Super VHS VCR. |
| VCR images are printed on the wrong printer. | Press **Setup**, touch **Print**, and adjust **VCR [printer]** to display the printer to use for VCR images. |

**Tip:** Always use high quality tapes for best results.
Printers

The SONOS system allows you to send an image to your local printer or to a networked DICOM printer.

NOTE

The DICOM Print support option must be installed by your Philips Customer Engineer. The ultrasound system must include an Integrated Digital Interface (IDI) configured for DICOM networking. The system must also be configured for DICOM printers.

Printing an Image Locally

Use the following procedure to print using the SONOS printer.

1. Make sure the printer is on and has paper. Clean gel from your hands before loading paper.
Tip: If Quad Format is on in Setup, you must press [Print] four times to produce a four-image print.

2. Press [Print].
Peripheral Devices
Printers

**DICOM Printers**

DICOM print allows you to print ultrasound still frames to a networked DICOM black and white or color printer. Images are automatically sent to the printer when the study ends. When **Network Autosend** is enabled, a sheet of images is printed when the sheet is full. If both color and black and white DICOM printers are configured, the system can automatically send images to the appropriate printer.

**Setting Up DICOM Print**

A **DICOM** rotary control appears on the **Setup Print** touch panel if the DICOM printer is available, and has either two or four positions, depending on the number of DICOM printers configured.

<table>
<thead>
<tr>
<th>2D System</th>
<th>Color</th>
<th>Angio</th>
<th>AQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP-5600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjust</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Quad Format

<table>
<thead>
<tr>
<th>BW UP-890</th>
<th>Color UP-51MD</th>
<th>VCR UP-890</th>
<th>Report External</th>
<th>DICOM &lt;XXX&gt;</th>
</tr>
</thead>
</table>

If only one printer is configured, the **DICOM** rotary control choices are

- **Off**—Disables DICOM print.
- **BW** or **Color**—Sends acquired images to the DICOM printer.
If the system is configured for both a color and a black and white DICOM printer, the DICOM rotary control choices are

- **Off**—Disables DICOM print.
- **Auto**—The system sends acquired images to one of the DICOM printers, depending on the image type.
  - Monochrome images go to the DICOM black and white printer.
  - Doppler spectral images go to the DICOM black and white printer even if there is color in the reference section of the image.
  - Colorized images with color go to the DICOM black and white printer.
  - All other images with color go to the DICOM color printer.
- **BW**—All images print on the DICOM black and white printer.
- **Color**—All images print on the DICOM color printer.

**Tip:** The settings that you select must match the settings of the output device (external printer) that you want to use.
Peripheral Devices
Printers

Using DICOM Prints

Acquiring Images

When DICOM print is enabled, pressing [Acquire] or touching Acquire Frame when a still frame is displayed places the current image in the queue for DICOM print. A print exposure indicator window is displayed for four seconds, at the bottom right of the imaging screen.

If Network Autosend is on, SONOS sends a preselected number of images to the printer. The images begin printing as soon as the printer has received the specified number of images. If Network Autosend is off, the images do not start printing until you touch End Study.

Example:

3 B/W

The exposure window shows the type of printer that will print the image and the image count sent to that printer from the current study. In the example shown, the system sends the image to the black and white DICOM printer, and the image is the third one acquired in the study.

NOTE

Deleting an acquired image from system memory does not change the exposure count.
Retrieving Stored Images for DICOM Printing

Images stored on the system’s hard disk or optical disk can be queued for DICOM printing by using the Disk Retrieve control in Loop mode. After Disk Retrieve loads an image into system memory, it can be printed to the DICOM printer when the current study ends, provided the DICOM rotary control is enabled.

1. Touch Disk on the left touch panel.
2. Touch End Study on the left touch panel.
3. The system
   a. Saves all acquired still frames to disk.
   b. Sends all acquired still frames to the DICOM printers.
   c. Resets the print exposure counters to zero.

A network status window on the monitor shows the number of files being sent to DICOM storage, and the status of the printers and DICOM servers.

Example:

| Store: 3 |
| B/W: Done |
| Color: Unavail |

In the example, three files are loaded in the IDI waiting to be saved to a DICOM storage device, all acquired black and white images were printed, and the DICOM color printer is unavailable.

NOTE: Images are processed based on the DICOM rotary control settings in Setup Print, when the images are acquired. Changing the settings has no effect on images already stored in system memory.
Selecting a Different Printer

Use the following procedure to select the print device.

1. Press [Setup], and touch Print.

2. Adjust controls to change where black and white, color, VCR, Report, or Serial Port pages are printed.

3. Press [Setup] to exit Setup mode.

Tip: If External appears on the screen, you can connect an external printer to the system.
Printing an Analysis Report

After you complete configuring the RS232 interface, you can send analysis reports to an external printer or to a PC.

1. Touch Analysis.


3. Press Print.
**Printer Troubleshooting**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper jams during printing.</td>
<td>Fan the paper before loading it.</td>
</tr>
<tr>
<td></td>
<td>Store paper flat. If it is curled, try to flatten it before loading.</td>
</tr>
<tr>
<td></td>
<td>Make sure paper trays fit securely into the printer.</td>
</tr>
<tr>
<td>Prints have white lines.</td>
<td>Check the paper supply and remove any pieces with gel on them. Always clean gel off your hands before loading paper.</td>
</tr>
<tr>
<td>Four images print instead of one on a sheet.</td>
<td>Press [Setup], touch Print, and touch Quad Format to turn off printing of four images per sheet.</td>
</tr>
<tr>
<td>Prints are coming out of the wrong printer, or are not printing at all.</td>
<td>Press [Setup], touch Print, and adjust the appropriate control to change where the black and white, color, VCR, or Analysis report pages are printed.</td>
</tr>
<tr>
<td>Prints are blank.</td>
<td>Make sure the paper is inserted properly.</td>
</tr>
</tbody>
</table>

**Tip:** Always use high quality paper for best results.
The colors do not look right. Press Setup, touch Print, touch UP-5xx Adjust (control name depends on printer), and alter the settings, as necessary. The default values for the UP-5200 are

- Contrast – 6
- Brightness – 4
- Red, Green, Blue – 12

The default values for the UP-5600 are

- Contrast – 2
- Brightness – 14
- Red – 7
- Green – 8
- Blue – 7

Black and white contrast or brightness is not ideal. For black and white printers, consult the manufacturer’s manual.
Configuring the RS-232 Interface

You can configure the RS-232 interface for sending analysis reports to either an external printer or a PC. The RS-232 interface is a 25-pin connector port located on the back of the ultrasound system (J1). See “Connecting the Ultrasound System to a Modem” on page 4-23.

1. Press [Setup] and touch System.

2. Touch Serial Port.
Peripheral Devices

Configuring the RS-232 Interface

3. Use the trackball to highlight a setting, and make your selections by typing in the information. On the Serial Port Setup window, enter data such as baud rate, stop and data bits, and select parity and print range according to the external printer device that is connected.

   **Serial Port Setup**
   
   | Baud Rate: | 9600 bps |
   | Stop Bits:  | 1         |
   | Data Bits:  | 8         |
   | Timeout Duration: | 30 secs |
   | Parity:      | Even     |
   | Print Range: | None     |

4. Press **Setup** to finish and exit Setup mode. After you complete the setup and selection of the Serial Port for printing analysis reports, the system redirects the output of the analysis report to the serial port when you touch the Print controls.
Peripheral Devices

Using the Remote Service Feature

Using the Remote Service Feature

This option may or may not be available in your local area. For details, contact your Philips Service Representative.

The Remote Service feature gives your Philips Service Representative access to the system via a modem.

This section describes how to use the Remote Service feature.

WARNING

DO NOT use the Remote Service feature or the modem while imaging a patient.
Connecting the Ultrasound System to a Modem

1. Disconnect all transducers and other external peripherals.

2. Connect the modem to the RS-232C 25-pin connector port located on the back of the ultrasound system (J1).

3. Connect the modem to a fax line, or to a dedicated analog phone line.

4. Turn on the modem. The system is now ready for Remote Service mode.
Peripheral Devices
Using the Remote Service Feature

Selecting Remote Service Mode

1. To access the Test Menu, press Test.

2. Use the trackball to select Remote Service Mode and press Enter.

3. After a short delay, the system displays a message indicating it is ready to accept a call from the local Philips Service Center.
While the system is being worked on, the Status box is updated:

- **Idle**: Indicates the system is not logged on to remote service.
- **Remote User Connected**: Indicates the Service Center is connected to the system.
- **Working**: Indicates the system is logged on to remote service, and is being worked on.

### Exiting Remote Service Mode

After your lab is notified by the local Service Center that the ultrasound system is ready to be used for imaging, follow these steps to return to live imaging.

1. **Use the trackball to select Exit Remote Service Mode and press Enter.**

   ![Status box](image)

   **Status**
   - **Idle**
   - **Exit Remote Service Mode**

2. **After the system warning message appears, highlight Okay with the trackball and press Enter.**

   ![Warning message](image)

   **WARNING:** The modem and modem cable must be disconnected from system prior to performing any imaging.

3. **Disconnect the modem from the system.**

   **Okay**

Note that the information in the Status box is not an indicator that the Philips Representative is done working on the system.

Note that if the Status box reads either Remote user logged on, or Working, and you disconnect the modem, delays in servicing the system can occur.
Peripheral Devices
Using the Remote Service Feature

4 To exit from the Test Menu and return to Imaging mode, press \textbf{Test}.

\begin{center}
\begin{tabular}{|l|}
\hline
\textbf{Test Menu} \\
\hline
Run Basic Test \\
Run Extended Basic \\
Key PRocessor \\
Scan Converter \\
Scanner \\
Other Tests and Utilities \\
Test Setup \\
Run Time Error Log \\
System Information \\
Remote Service Mode \\
RST Error Log \\
\hline
\end{tabular}
\end{center}

To return to Imaging mode, press \textbf{Test}.

5 To return to live imaging, touch 2D or another imaging mode.

\begin{center}
\textbf{WARNING} Make sure the modem is disconnected from the system before imaging a patient.
\end{center}
5 Physios

Introduction

Using SONOS physios, you can connect ECG and other physical sensors to the patient and monitor their heart sounds, pulse, respiration, and ECG waveforms in real time.

This chapter provides information about

- Physio imaging screen and touch panels (page 5-2)
- Physio controls (page 5-3)
- Setting up physios (page 5-7)
- Setting up triggering modes (page 5-8)
- Connecting physios (page 5-10)
- Viewing physios (page 5-12)
- Physio troubleshooting (page 5-14)
Screen and Touch Panels

Heart sound waveform

Pulse waveform

Respiration waveform

ECG waveform

<table>
<thead>
<tr>
<th>Physio</th>
<th>Rwave</th>
<th>Beep</th>
<th>ECG</th>
<th>Resp</th>
<th>Pulse</th>
<th>Hrtsound</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Invert</th>
<th>Physio</th>
<th>Suppress</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trigger</th>
<th>Delay</th>
<th>Beats</th>
<th>ECG Gain 40%</th>
<th>ECG Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECG</td>
<td>15</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Primary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Beats</strong></td>
<td>When Trigger ECG is active, adjusts the number of beats between the triggered updates of a 2D, Color, Angio, or Spectral Doppler image.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AutoBeat Sequence</strong></td>
<td>Defines the sequencing of R-wave acquisition of images in Triggering mode.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Delay</strong></td>
<td>When Trigger ECG is active, updates the 2D, Color, Angio, or spectral Doppler image at a specified number of milliseconds after the R-wave.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ECG</strong></td>
<td>Enables gain and position adjustment of the ECG waveform. In 2D, Color, and Angio, the waveform appears below the image and cannot be repositioned.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gain</strong></td>
<td>[Gain ECG, Gain Pulse, Gain Resp, or Gain Hrtsound] Adjusts the amplitude of the active waveform signal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hrtsound</strong></td>
<td>Enables adjustment of Hrtsound Gain and Position. Activates the heart sound Filter control in Setup.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Interval</strong></td>
<td>When Trigger Timer is active, adjusts the 2D, Color, Angio, or Spectral Doppler image update interval, in milliseconds.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Invert</strong></td>
<td>Inverts the polarity of the ECG, Aux 1, Aux 2, and Resp waveforms.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Monitoring Mode</strong></td>
<td>Turns on or off the low MI grayscale image in real time on the right side of a side-by-side display during a trigger beat acquire. Helps maintain the imaging plane without disrupting the contrast agent. Values are On/Off. Only available in BW and Angio modes using the s3 transducer in TCE1 and TCE2. See Using Contrast Imaging for more information.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Physios Controls

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physio Suppress</strong></td>
<td>Turns <strong>Hrtsound</strong>, <strong>Pulse</strong>, and <strong>Resp</strong> physio waveforms on or off.</td>
</tr>
<tr>
<td><strong>Position</strong></td>
<td><strong>[Position ECG, Position Pulse, Position Resp or Position Hrtsound]</strong>&lt;br&gt;Adjusts the vertical position of the active waveform. Available in MMode, spectral CW and PW, and when Acoustic Quantification (AQ) waveforms are displayed.</td>
</tr>
<tr>
<td><strong>Pulse</strong></td>
<td>Enables gain and position of the pulse waveform. Available in Color mode and Spectral Doppler.</td>
</tr>
<tr>
<td><strong>Resp</strong></td>
<td>Enables adjustment of the respiration waveform, which displays movement of the chest during respiration. The respiration waveform is derived from the ECG leads.</td>
</tr>
<tr>
<td><strong>RWave Beep</strong></td>
<td>Controls whether or not the system beeps during each R-wave. Not available in Doppler modes.</td>
</tr>
<tr>
<td><strong>Test</strong></td>
<td>Puts a test signal through the currently active physio channel.</td>
</tr>
</tbody>
</table>

**Tip:** To suppress the ECG waveform, you must turn **ECG** off in Physio Setup.
**Trigger**

Selects the triggering mode: Off, ECG, Timer, Loop/ECG or Loop/Timr. Trigger activates either Beats and Delay or time Interval for triggering 2D, Color, Angio, or Doppler (with or without spectral) updates.

Loop/ECG and Loop/Timr are available in Contrast or AD only.

With **Contrast** active, Loop/ECG lets you acquire the same portion of the cardiac cycle while the 2D, Color, or Angio image is displayed in real time. With AD active, Loop/ECG lets you acquire images while the 2D image is displayed in real time. Updates the acquisition based on the selected beats and delay.

With **Contrast** active, Loop/Timr lets you acquire images at a slower interval while the 2D, Color, or Angio image is displayed in real time. With AD active, Loop/Timr lets you acquire images while the 2D image is displayed in real time. Updates acquisition in milliseconds, based on selected intervals.

When **PW** is active, turning Trigger off activates simultaneous Duplex Doppler mode.
Physios
Controls

Setup

ECG  Selects an input source for the ECG waveform, or turns the waveform off.

ECG Output  Lets you take the ECG signal from the ECG output on the back of the system and use the signal as input to another device.

Filter  Removes frequencies below the hertz level specified. Only available when Hrtsound Normal is activated.

Hrtsound  Selects an input source for the heart sound waveform, or turns the waveform off.

Pulse  Selects an input source for the pulse waveform, or turns the waveform off.

Resp  Selects an input source for the respiration waveform, or turns the waveform off.

Rwave Output  Lets you take the ECG R-wave signal from the ECG output on the back of the system, and use the R-wave signal as input to another device.

For complete details about Physio controls for contrast imaging, see Using Contrast Imaging.

WARNING  Do not use ECG patient cables with detachable lead wires that have exposed male pins. Electrocution could result if these pins are plugged into an AC power.
Setting Up Physios

1. Press [Setup], and touch **Physio**.

2. Turn the rotary controls to adjust the Physios setup for the waveforms you want to view, or turn the rotary control to Off for those that you do not need. Turn **Normal** to obtain the signal from a physio transducer connected to the system, or **AUX** for an auxiliary signal from another source.

3. Press [Setup] to exit Setup mode.
Setting Up Triggering Modes

1. Touch **Physio**.

2. Use the **Trigger** rotary control to select **ECG**, **Timer**, **Loop/ECG**, or **Loop/Timr** mode. (**Loop/ECG** and **Loop/Timr** only appear if **Contrast** or **AD** is on. For complete details, see *Using Contrast Imaging*).

3. Adjust **Delay** and **Beats** (or **Interval** if **Trigger Timer** is active) to set up triggering.

**NOTE**

In PW and CW, if no R-wave is present, the ECG trigger does not appear.
4. Turn the Trigger rotary control to Loop/ECG or Loop/Timr in Contrast or AD mode, to view a real-time image and acquire triggered images.

5. Turn the Trigger rotary control to Trigger ECG in Contrast mode. The Frames control appears and the system goes into Multiple Frame Triggering mode (MFT). See Using Contrast Imaging for more information about MFT.

Tip: Triggered images can only be acquired in Contrast and AD modes.
Connecting Physios

NOTE Your system may not have all of the physios shown.

1. Make sure that **ECG Normal** is displayed in Setup. Insert the ECG cable connector into the ECG receptacle under the keyboard.

2. Connect the pin connector to the ECG cable.
3. Attach the electrodes and ECG leads to the patient as shown. Proper ECG lead placement is critical for receiving a good ECG and respiration signal.

![ECG Lead Placement Diagram]

**NOTE** Lead placements in the drawing above are anatomically incorrect; however, this placement obtains optimal triggering for AQ, CK, AD, and 3D.

4. Connect and attach cables for other physios you want to use. Make sure Setup values match the connections.

![Physio Connections Diagram]
NOTE

The Pulse waveform is unavailable in 2D, Color, Angio, nonspectral Doppler modes, and AQ.

1. Touch Physio. Only waveforms that you have set up appear. Physio Suppress must be off to see all available waveforms.

2. Verify that the ECG complex size is correct for each mode by touching the mode (2D, MMode, PW, CW, or AQ) and ECG. To set the size of an active trace, adjust the Gain rotary control.
3. Check the trace positions by touching each mode and then each waveform you want to see in that mode. Only one waveform control can be active at a time. The Gain and the Position rotary controls pertain to the active waveform.

If an active Trace is not displayed, touch Test. If necessary, adjust Position.
Physio Troubleshooting

Always make sure that the active preset is appropriate for the study being performed.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physio does not display.</td>
<td>For physios other than ECG, make sure <strong>Physio Suppress</strong> is off.</td>
</tr>
<tr>
<td></td>
<td>Check to ensure the physio cable is secure in the correct connection and is correctly attached to the patient.</td>
</tr>
<tr>
<td></td>
<td>Touch <strong>Test</strong> to test physio signals.</td>
</tr>
<tr>
<td></td>
<td>For ECG and respiration signals, check the patient cable, the connection to the system, the electrodes, and the lead placement.</td>
</tr>
<tr>
<td></td>
<td>Adjust <strong>Gain</strong> and <strong>Position</strong> controls for the active waveform. If there is no touch control for the physio waveform you want to view, press <strong>Setup</strong>, and make sure this physio is set to <strong>Normal</strong> (for a physio transducer connected to the system) or <strong>Aux</strong> (for an external signal connected).</td>
</tr>
<tr>
<td>Too many physios display.</td>
<td>With <strong>Physio</strong> active, press <strong>Setup</strong>, and set the physios you do not want to see to <strong>Off</strong>.</td>
</tr>
<tr>
<td>Waveform is too big or too small.</td>
<td>Adjust the physio <strong>Gain</strong> and <strong>Position</strong> controls for the active waveform.</td>
</tr>
<tr>
<td>The ECG or respiratory waveform contains an artifact or wanders</td>
<td>Follow the electrode manufacturer’s suggestions for skin preparation.</td>
</tr>
<tr>
<td></td>
<td>Put a little gel on the electrodes. They might be dry.</td>
</tr>
<tr>
<td></td>
<td>Reconnect the lead to the electrode, and check the electrode placement on the patient.</td>
</tr>
</tbody>
</table>
## Physios

### Physio Troubleshooting

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
</table>
| 2D reference image does not update       | Make sure **2D Hold** or **BMode Hold** is off in CW and PW modes.  
Verify that **Freeze** is off. Verify that the ECG leads are connected properly.  
Adjust **Delay** or **Beats** rotary control if an R-wave is present, or **Interval** rotary control if there is no R-wave (all **Physio Trigger** controls).  
Adjust **ECG Gain** rotary control. |
| System does not stop beeping             | Touch **RWave Beep** to turn off the beep during each R-wave.  
| Waveform shape is wrong                  | Make sure each physio cable is secure in the correct connection on the system, and that touch controls match your selections.  
For example, for ECG and Pulse waveforms, Physio Setup should show **ECG** and **Pulse** set to **Normal** to obtain the signal from a physio transducer connected to the system, or to **AUX** for an auxiliary signal from another source. |
6 Doing Exams

Introduction

This chapter outlines the basic steps for performing an ultrasound imaging exam. The basic procedure is to:

- Select a preset (page 6-1)
- Set up the exam (page 6-2)
- Connect a transducer (page 6-10)
- Optimize the image (page 6-10)
- Videotape the exam (page 6-11)
- Store the image (page 6-15)
- Send the image over a network (if desired) (page 6-15)

The following sections walk you through this procedure.

Selecting a Preset

For information about selecting an exam preset, see Chapter 3.
Setting up the Exam

1. Make sure all peripherals are on and the recording medium is correctly inserted.

NOTE You can operate the VCR using the controls on the touch panel. See Chapter 4 for more information.

2. Select or reselect the preset to match the study you are about to perform. The active preset is shown on the screen, unless you touch Preset Name on the left touch panel to turn off the preset display.
3. Press [Patient ID] to display the **Patient Information** window. The window is preset-dependent. It contains information pertinent to the exam type.

**NOTE**

Patient information is automatically stored to the Analysis report, and can only be edited on the **Patient Information** window.
4. To enter new patient data:

   a. If a **PATIENT SELECTION** window is onscreen, highlight **Manual Entry** and press **Enter**.

   b. Highlight **New** and press **Enter**.

   c. Type in the new patient information. A red box outlines the active field. To move from field to field, use the trackball.

   **Note:** The MRN is the Medical Record Number.

   ![Patient Information Form](image)

   **NOTE** Select **Prior** to display the patient data that was previously on-screen. **Prior only** retrieves one previous information display. See the *Using Integrated Digital Interface (IDI) User’s Guide* for information on how to enter and retrieve patient information on systems with the IDI option.
5. To edit patient data, highlight **Edit** and press **Enter**. Type in your changes.

The current date shows the system setup date; see Chapter 1 for details. This date is used to calculate the patient age for EnConcert and Analysis reports. If the date is incorrect, the patient age will be incorrect.
Doing Exams

Setting up the Exam

6. To enter this patient information and return to live imaging, press **Enter** twice, or press **Patient ID**.
7. To specify the information that will appear on the screen, press **Setup**. Then touch **System** on the right touch panel and **ID Display**. Use the trackball to select the patient identification information that will be displayed on the screen.

**Note:** The **Misc** field matches the **Misc** field on the **Patient Information** window.

<table>
<thead>
<tr>
<th>SETUP: Modify controls. Press &lt;SETUP&gt; to return to imaging.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient ID Display</strong></td>
</tr>
<tr>
<td>Select the text that you want displayed on the images.</td>
</tr>
<tr>
<td>Up to four items may be checked.</td>
</tr>
<tr>
<td>☑️ Last Name</td>
</tr>
<tr>
<td>☑️ First Name</td>
</tr>
<tr>
<td>☑️ MRN</td>
</tr>
<tr>
<td>☐ Accession</td>
</tr>
<tr>
<td>☑️ Misc</td>
</tr>
<tr>
<td>☐ Location</td>
</tr>
<tr>
<td>☐ Performed by</td>
</tr>
<tr>
<td>☐ Indication</td>
</tr>
<tr>
<td><strong>Default</strong></td>
</tr>
<tr>
<td><strong>Clear All</strong></td>
</tr>
<tr>
<td><strong>Okay</strong></td>
</tr>
<tr>
<td><strong>Cancel</strong></td>
</tr>
</tbody>
</table>

To close this window, press **Setup**.
8. Touch the mode you want to use. (If a noncardiac preset is active, the BMode touch control appears instead of the 2D touch control.)
9. Touch any of the mode-specific controls that are displayed. See the section on the mode you are using for detailed information.

10. Adjust imaging controls applicable to this mode, as necessary. General imaging controls are described in Chapter 7.
Connecting a Transducer

For information about connecting transducers and physio sensors to the SONOS system, see Chapter 2 and Chapter 5.

Optimizing the Image

For information about optimizing images, see the specific imaging-modality sections in Chapter 7.
Videotaping the Exam

1. Make sure the VCR is on, and that a tape is in. To record time or frame numbers, touch Tape Time or Tape Number (only one appears, depending on what you select in Setup.)

2. To begin taping, press Tape.
Tip: The VCR is turned off automatically when you turn off the system.

3. When you are done recording, press Tape. If you are using the foot switch, press Record to pause taping.
Viewing Taped Images

1. With the VCR on and a tape inserted, touch PLAY. If necessary, use Color to adjust the intensity of color recorded on a tape.

2. Use SONOS controls, as necessary, to view specific segments. To make measurements on taped images, first follow the steps in “Calibrating Videotaped Images for Measurement” on page 9-22.

3. To return to the previous format, touch VCR Play.
### VCR Troubleshooting

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tape controls do not display.</td>
<td>Make sure there is a tape in the VCR.</td>
</tr>
<tr>
<td>Cannot hear sounds on the tape.</td>
<td>Turn up the <strong>Volume</strong> control.</td>
</tr>
<tr>
<td>Images are too light or dark on playback.</td>
<td>Make sure the monitor [vol] and [ch] controls are correctly set. See “Calibrating the Monitor” on page 1-13 for details. For tapes recorded with color, adjust <strong>Color</strong> during playback.</td>
</tr>
<tr>
<td>Playback quality is inferior.</td>
<td>To obtain and view Super VHS images, record on a</td>
</tr>
<tr>
<td></td>
<td>- Super VHS VCR (if your VCR has an S-VHS switch, be sure it is on)</td>
</tr>
<tr>
<td></td>
<td>- Super VHS tape</td>
</tr>
<tr>
<td>Cannot view taped images.</td>
<td>Try viewing the tape on a Super VHS VCR. If a Super VHS tape was recorded in S-VHS, you can only view the images on a Super VHS VCR.</td>
</tr>
</tbody>
</table>

| VCR images are printed on the wrong printer.  | Press **Setup** and touch **Print**, and adjust **VCR [printer]** to display the printer to use for VCR images. |
Storing the Image

For information about storing images, see Chapter 11 and Chapter 12.

Sending the Image Over a Network.

For information about sending images over a network, see Chapter 12.
Doing Exams

Sending the Image Over a Network.
7 Imaging Modalities

Introduction

This chapter provides information about how to use the SONOS system

- General Imaging Controls (page 7-2)
- Frequency Fusion Imaging (page 7-4)
- Harmonic Fusion Imaging (page 7-8)
- Zoom Mode (page 7-15)
- Dual Imaging Mode (page 7-19)
- 2D Imaging (page 7-23)
- 2D/BMode Imaging (page 7-30)
- MMode Imaging (page 7-48)
- Color Imaging (page 7-60)
- PW and CW Imaging (page 7-79)
- Angio Imaging (page 7-108)
- Doppler Imaging (page 7-121)

These sections provide detailed information about each mode’s screens, touch panels, controls, procedures, and image optimization.

This chapter does not discuss

- Live-3D and BiPlane Imaging (see the Using 3-Dimensional and BiPlane Imaging Guide)
- Contrast Imaging (see the Using Contrast Imaging Guide)
- Acoustic Quantification (AQ) (see the Using Acoustic Quantification Guide)
- Acoustic Densitometry (AD) (see the Using Acoustic Densitometry Guide)
General Imaging Controls

The controls described in this section pertain to all modes, unless otherwise specified.

**Compress**
Adjusts the dynamic range of returning echoes, thereby affecting the 2D/BMode or the MMode.

**Depth**
Adjusts the vertical acoustic field of view for the structure being imaged. Increasing the depth setting decreases the frame rate.

**Focus**
Repositions the acoustic depth of the 2D/BMode focal zones, indicated by carets.

**Freeze**
Freezes and unfreezes the display.

**Frequency Fusion**
Optimizes frequencies for penetration, texture, or resolution. Changes are reflected in the Frequency Fusion icon and on the process line displayed at the top left corner of the screen.

**Gain**
Adjusts the amplification of received acoustic signals. Received gain values range from 0 to 100. Used in 2D/BMode and MMode.

**LGCs**
(Lateral Gain Controls) Each of the eight sliders adjusts the amplification of returning signals within a specific lateral 2D/BMode or AQ image area. Available only with sector and curvilinear array transducers.

**Magnify**
Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes.

**Position**
In conjunction with the trackball, repositions the active 2D/BMode, Zoom, or color area.

**Size**
In conjunction with the trackball, resizes the active area.

**Spectral**
Reformats the screen display to turn a Doppler spectral trace on or off.
Imaging Modalities
General Imaging Controls

**TGCs**
(Time Gain Compensation controls) Each of the eight sliders adjusts the amplification of returning 2D/BMode and AQ signals at a specific image depth. Adjust the TGCs in a smooth curve to compensate for acoustic attenuation.

**Trackball**
In conjunction with **Size**, resizes the active 2D/BMode, Zoom, or color area. In conjunction with **Position**, repositions the active area. In conjunction with **Enter**, repositions the MMode line, the Doppler cursor, the PW sample volume, or the CW focal point (diamond).

**Zoom**
Turns zoom (magnification) mode on or off. To move the zoom preview area, use the trackball (**Position** is active when you first enter zoom preview). To resize the zoom preview area, press **Size** and use the trackball. Then touch **Zoom** again to enter full zoom mode.

*Tip:* When activated, **Zoom** is first outlined by a box. This indicates zoom preview. Touch **Zoom** a second time to go into full zoom.
Frequency Fusion Imaging

Introduction

Frequency Fusion settings control the transducer frequencies that are used to generate 2D images. The SONOS system offers up to five settings, which depend on the transducer and configure it for the optimum combination of

- Penetration (primarily using low transducer frequencies)
- Resolution (primarily using high transducer frequencies)
- Tissue texture (using blended low and high transducer frequencies)
Screen and Touch Panels

Frequency Fusion setting

Frequency Fusion icon

Probes

Secondary Controls

Zoom

Harmonic Fusion

Colorize

U/D Invert

Soft Echo Enhance

Focal Zones 2

Focus

Postproc B

Magnify 1.0
Icons

The Frequency Fusion icon represents 2D image quality changes between penetration (P), texture (T), and resolution (R).

- When the blue triangle is on the left side, penetration is optimized.
- When the blue triangle is on the right side, resolution is optimized.
- When the blue triangle is in the center, this denotes a blended balance resulting in optimal tissue texture (T).

The following list describes the values for these icons:

- P = Penetration (low frequency imaging)
- T = Texture (blended low and high frequency)
- R = Resolution (high frequency imaging)
- 3, 8 = Approximate range of frequencies that contribute to the image

Controls

Frequency Fusion (Rotary Control) Selects the Frequency Fusion setting. Changes are reflected in the Frequency Fusion icon and on the process line displayed at the top left corner of the screen. Not available when the image has been frozen using the Freeze key.
Using Frequency Fusion

To change the current transducer’s Frequency Fusion setting

1. If the Harmonic Fusion control is highlighted in the right touch panel, touch it to turn Harmonic Fusion off.

2. Turn the Frequency Fusion rotary control knob (below the right touch panel) to select a new setting.

3. Check the Frequency Fusion icon on the imaging display screen, to confirm that it shows the desired setting.

The following restrictions apply to Frequency Fusion:

- Frequency Fusion operates on any unfrozen, real-time, 2D image.
- Frequency Fusion icons do not appear in Doppler spectral trace modes.
- The number of rotary-control settings varies with the transducer.
Harmonic Fusion Imaging

Introduction

Harmonic Fusion for tissue provides improved visualization of the endocardial border, particularly with patients who are difficult to image. Harmonic Fusion imaging activates harmonics for a 2D image only—all Doppler modes remain at the fundamental frequency.

Following are some Harmonic Fusion guidelines:

- You are required to use a harmonics-ready transducer, such as the s3, s4, s8, 11-3L, c3540, OmniPlane III, or x4.
- When using Harmonic Fusion imaging, the **Power** control on the secondary touch panel affects transmit power.
- A maximum frame rate of 30 Hz (25 Hz for PAL systems) is used. There are exceptions, such as with the s3 transducer, which allows higher frame rates in Harmonic Fusion setting 5.
- Harmonic Fusion is available with cardiac exam presets, the transcranial preset, and the following abdominal presets: abdominal, vascular abdominal, small parts, and renal. Harmonic fusion is also available with vascular-carotid, PV, low-extremity, and upper-extremity exams and presets. The available exams and presets depend upon the transducer type.

In Harmonic Fusion imaging, the Harmonic Fusion icon replaces the Frequency Fusion icon. The selection is indicated by a circle around the setting. For more information, see “Icons” on page 7-10.

**NOTE**

For information about Harmonic Fusion in Live-3D and BiPlane imaging modes, see the *Using 3-Dimensional and BiPlane Imaging Guide*. 
Screen and Touch Panels

Acoustic output index
Transducer label
Transmit/Receive frequencies

Probes

Secondary Controls
Harmonics Plus
Zoom

Harmonic Fusion
Colorize
UID
Invert
Enhance

Harmonic Fusion 1
Focal Zones 1
Postproc
Focus
Magnify

1.0
Imaging Modalities

Harmonic Fusion Imaging

**Icons**

In Harmonic Fusion imaging using an s4 transducer, one of the following icons appears and replaces the Frequency Fusion icon:

- **Penetration (P):**
  - Transmit frequency: 1.8 MHz
  - Receive frequency: 3.6 MHz

- **Texture (T):**
  - Transmit frequency: 1.8 MHz
  - Receive frequency: 3.6 MHz

- **Resolution (R):**
  - Transmit frequency: 2.1 MHz
  - Receive frequency: 4.2 MHz

Transducer transmit frequency in megahertz (MHz)

Transducer receive frequency in megahertz

The Harmonic Fusion icon on the left shows penetration selected, as indicated by a circled P, and shows a transducer transmitting at 1.8 MHz and receiving at 3.6 MHz. The Harmonic Fusion icon in the center shows texture selected, as indicated by a circled T, and shows a transducer transmitting at 1.8 MHz and receiving at 3.6 MHz. The Harmonic Fusion icon on the right shows resolution selected, as indicated by a circled R, and shows a transducer transmitting at 2.1 MHz and receiving at 4.2 MHz.

In Harmonic Fusion imaging using an s3 probe, one of the following icons appears and replaces the Frequency Fusion icon:

- **Penetration (P):**
  - Transmit frequency: 1.3 MHz
  - Receive frequency: 2.6 MHz

- **Texture (T):**
  - Transmit frequency: 1.6 MHz
  - Receive frequency: 3.2 MHz

- **Resolution (R):**
  - Transmit frequency: 1.3 MHz
  - Receive frequency: 2.6 MHz

Transducer transmit frequency in megahertz (MHz)

Transducer receive frequency in MHz

1.8, 2.1 = Transducer transmit frequency in megahertz (MHz)

3.6, 4.2 = Transducer receive frequency in megahertz
The Harmonic Fusion icon on the far left shows penetration selected, as indicated by a circled P, and shows the transducer transmitting at 1.3 MHz and receiving at 2.6 MHz. The Harmonic Fusion icon on the far right shows resolution selected, as indicated by a circled R, and shows the transducer transmitting at 1.6 MHz and receiving at 3.2 MHz. The Harmonic Fusion setting in the center shows texture selected, as indicated by a circled T, and shows the transducer transmitting at 1.3 MHz and receiving at 2.6 MHz. The other two intermediate Harmonic Fusion settings show a mixture of penetration and texture, or texture and resolution. The icons show circled P and T, or T and R.

**NOTE**
The Harmonic Fusion rotary control is not displayed when in Tissue Doppler mode.

For a complete list of transducers that are used in harmonic imaging, see the *Transducer Reference.*
### Imaging Modalities

#### Harmonic Fusion Imaging

**Controls**

**Primary**

**Harmonic Fusion (Touch Control)**
Activates Harmonic Fusion for imaging tissue. Activates Harmonics for a 2D image only. Available only with a harmonics-ready transducer, such as the s3, s4, s8, 11-3L, c3540, OmniPlane III, or x4.

**Harmonic Fusion (Rotary Control)**
Selects the Harmonic Fusion setting and is available only when Harmonic Fusion is on. Changes are reflected in the Harmonic Fusion icon and on the process line displayed at the top left corner of the screen. Not available when the image has been frozen using the **Freeze** key.

**Harmonics Plus**
Provides enhanced Harmonics when the s3 transducer is in Harmonic Fusion settings 1, 3, and 4. May reduce the display frame rate.

**Secondary**

**L/R Invert**
Switches the left/right orientation of the image. Appears on the right primary touch panel in noncardiac presets. Also appears on the left touch panel under the Image controls.

**Persist**
Adjusts the amount of frame averaging, which can give a smoother appearance.

**Power**
Adjusts transmit power in decibels (dB) where 0.0dB = maximum power and -30.0dB = minimum power.

**Secondary Controls**
Switches between the primary and secondary touch panels. When the control is highlighted, the secondary controls are active.
Using Harmonic Fusion

1. Touch **Probe**.

2. Touch the control indicating where the harmonics-ready transducer is connected.

3. Touch **Preset** and select an exam type.
4. Touch **Harmonic Fusion** to activate Harmonic Fusion imaging.

5. Turn the **Harmonic Fusion** rotary control to optimize the image.
Zoom Mode

Introduction

Zoom mode allows you to magnify the image without resizing it. Zoom mode has the following features:

- **Zoom** is also available from a frozen nonzoomed image and during loop replay.
- A magnification rotary control allows you to quickly magnify the image without resizing. The 1.0 selection on the *Magnify* rotary control sets the image to its normal, unzoomed size.
- A zoomed image is live during repositioning.
- A *Pan* touch control in Color mode allows you to pan a color image. When the *Pan* control is on, *Position* and *Size* affect the zoom area rather than the color area.
- **Zoom** is available in Doppler and Dual image modes.

**NOTE** For information about Live-3D and BiPlane Zoom mode, see the *Using 3-Dimensional and BiPlane Imaging Guide*. 
**Screen and Touch Panels**

The following illustration shows how the Zoom preview box changes on the imaging screen as the **Magnify** rotary-control setting is increased.

![Illustration of Zoom preview box changes](image)

**NOTE**

When **Magnify** = 1, the preview box covers the entire image and there is no magnification.

**Controls**

The following illustration shows the Zoom mode controls:

![Zoom mode controls illustration](image)
Using Zoom Mode

1. When zoom is first activated, the default Zoom area is outlined by a Zoom preview box, at a **Magnify** setting of 2.0.

2. To increase or decrease the Zoom magnification, turn the **Magnify** rotary control.

   The size of the Zoom preview box changes accordingly. For example, the size of the box decreases when **Magnify** is set to a higher number.

3. To move the zoom preview box, use the trackball (**Position** is active when you first enter zoom preview).

4. To further change the size and shape of the Zoom preview box, press **Size** and use the trackball.

5. Touch **Zoom** again to enter full zoom mode.

   Pressing the **Enter**, **Size**, or **Position** key when Zoom is in preview mode also displays the zoomed image.

6. Touch **Zoom** again to return to the original unzoomed display.
Zoom mode has the following limitations:

- You cannot zoom in on the following frozen images: triggered trapezoid, triggered color compare, interval-triggered 2D hold, dual, and multi-frame trigger.
- The Size and Position key controls are unavailable during side-by-side MMode. You need to touch Zoom to select a new zoom size or position.
- The Pan touch control is unavailable in linear PW spectral Doppler mode.
- On steered linear dual displays, when the left and right control settings differ, each image is restricted to its own half of the screen.

**NOTE** After a black-and-white or color image has been frozen, it can be zoomed.
Dual Imaging Mode

Introduction

Dual Imaging mode allows you to display and manipulate two independent scans on the SONOS imaging screen. This mode has the following features:

- Each image has its own color bar and Fusion icon.
- You can independently set the color scale.
- You can individually set and display the depth of each image at the top right of the screen. For example, 12/16 cm means that the left image is 12 cm and the right image is 16 cm.
- You can display zoomed images.
- You can select Dual Imaging mode even when an image is frozen. Turning on Dual Imaging mode after Freeze mode displays the frozen image in dual format, along with a live image. This is not available with trapezoidal images.
- You can independently select and display body markers for both images.
Screen and Touch Panels

The following illustration shows the Dual Imaging mode screen:
Controls

The Left and the Right touch controls allow you to select the active image. Only one image can be active at a time. The active image is identified by a clear orientation dot - ●; the inactive image is identified by a filled dot - ○. Settings for gain and compression are abbreviated to G and C. (For example, G 50 C 45 means that the current Gain setting is 50 and the Compress is 45.) To scroll the active image, press Freeze and scroll with the trackball.

Using Dual Imaging Mode

1. Touch Image on the left touch panel.

<table>
<thead>
<tr>
<th>Image</th>
<th>Dual Image</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Touch Dual Image.

3. Touch Left or Right to choose the image you want to be live. A highlighted Left or Right control and a clear orientation dot on the screen indicate a live image.

4. Adjust imaging controls for the live image. The effects are seen on the live image, leaving the frozen image unchanged.

5. Press Freeze to freeze both images simultaneously. Pressing Freeze again returns the system to live imaging mode.

6. Touch Dual Image to exit Dual Imaging mode.
Dual Imaging mode restrictions

Dual Imaging mode is not available in MMode, AQ, or Doppler modes. You cannot change the preset while in Dual Imaging mode. You cannot display an Angio image next to a color image. You cannot adjust the

- Color baseline
- Angio threshold
- Color tag
2D Imaging

Introduction

When any transducer other than a Doppler-only transducer is being used in a cardiac preset, the default imaging modality is 2D mode. In this mode, the imaging screen displays a two-dimensional black-and-white scan.
Screen and Touch Panels

- Lateral Gain Control
- Acoustic output index
- Transducer label
- Persistence, Postproc, and Frequency Fusion setting
- Depth selection
- Frame rate
- Black/white grayscale bar
- Frequency Fusion icon

### Probe

<table>
<thead>
<tr>
<th>Left</th>
<th>Center</th>
<th>Right</th>
<th>Nonimage</th>
</tr>
</thead>
<tbody>
<tr>
<td>S4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Secondary Controls

- Zoom
- Frequency Fusion
- Colorize
- U/D Invert
- Soft Echo Enhance
- Focal Zones
- Postproc B

### Magnify

- 1.0
Controls

Primary

Colorize  Optimizes contrast resolution by activating the current colorization map, and overlaying the grayscale image. To change the active map, turn the color rotary control just under the Colorize touch control.

Focal Zones  Selects transmit focal zones for sector transducers. The preset and the transducer determine the available number of focal zones. A caret appears on the screen for each selected focal zone. With two focal zones active, the frame rate decreases.

Focus  Repositions the acoustic depth of the 2D focal zone, indicated by carets.

Frequency Fusion  Optimizes frequencies for penetration, texture, or resolution. Changes are reflected in the Frequency Fusion icon and on the process line displayed at the top left corner of the screen in Cardiac presets.

Frame Lock  Locks or unlocks the Integrated Backscatter (IBS) imaging frame rate to the video frame rate. The values are on and off. It is on by default. Applies to IBS, 2D, and AD.

IPower  Sets the transmit power for Contrast TCE-3 Impulse Imaging.

Harmonic Fusion (Touch Control)  Activates Harmonic Fusion for imaging tissue. Activates Harmonics for the 2D image only. Available only with a harmonics-ready transducer, such as the s3, s4, s8, 11-3L, c3540, OmniPlane III, or x4. Not available when the image has been frozen using the Freeze key.
### Imaging Modalities

#### 2D Imaging

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Harmonic Fusion (Rotary Control)</strong></td>
<td>Selects the Harmonic Fusion setting when Harmonic Fusion is on. Changes are reflected in the Harmonic Fusion icon and on the process line displayed at the top left corner of the screen in Cardiac presets. Not available when the image has been frozen using the [freeze] key.</td>
</tr>
<tr>
<td><strong>Harmonics Plus</strong></td>
<td>Boosts BMode image sensitivity and provides enhanced Harmonics when the s3 transducer is in Harmonic Fusion settings 1, 3, and 4. May reduce the display frame rate.</td>
</tr>
<tr>
<td><strong>Magnify</strong></td>
<td>Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes.</td>
</tr>
<tr>
<td><strong>LGCs (Lateral Gain Controls)</strong></td>
<td>Each of the eight sliders adjusts the amplification of returning signals within a specific lateral 2D/BMode image area. Available only with sector and curvilinear array transducers.</td>
</tr>
<tr>
<td><strong>Postproc</strong></td>
<td>Affects the softness and brightness of grayscale images stored in memory, according to visual preference. The curve you select affects both real-time and frozen images, but does not affect video playback images.</td>
</tr>
<tr>
<td><strong>Secondary Controls</strong></td>
<td>Switches between the primary and secondary touch panels. When the control is highlighted, the secondary touch controls are active.</td>
</tr>
<tr>
<td><strong>Soft Echo Enhance (Touch Control)</strong></td>
<td>Activates soft echo enhancement imaging, which may enhance visualization of low-level ultrasound signals from normal anatomy and pathology. The Soft Echo Enhance icon reflects the soft echo enhancement setting and the transducer frequency range. Frequency Fusion and Harmonic Fusion are unavailable when Soft Echo Enhance is on.</td>
</tr>
<tr>
<td><strong>Soft Echo Enhance (Rotary Control)</strong></td>
<td>Select the soft echo enhancement setting when Soft Echo Enhance is on. Settings A to C automatically adjust transmit power, persistence, dynamic range, and post-processing to provide increased sensitivity.</td>
</tr>
</tbody>
</table>
**TGC Curve**

Turns the TGC Curve display on or off. Press **Setup** and touch **TGC Curve**. Then press **Setup** again to return to the live display. TGC sliders affect the screen display only in 2D and Tissue Doppler modes.

**Trapezoid**

Activates trapezoidal imaging, which widens the linear image to a trapezoidal shape. Available only with transducers that offer this feature.

**U/D Invert**

Inverts the apex of the sector from its current orientation. Appears on the right primary touch panel in cardiac presets and on the secondary touch panel in noncardiac presets. Also appears on the left touch panel under the **Image** controls. Available only with sector and curvilinear array transducers.

**Zoom**

Turns zoom (magnification) on or off. To move the zoom preview area, use the trackball (**Position** is active when you first enter zoom preview). To resize the zoom preview area, press **Size** and use the trackball. Then touch **Zoom** again to enter full zoom mode.

Tip: When activated, **Zoom** is first outlined by a box. This indicates zoom preview. Touch **Zoom** a second time to go into full zoom.
Imaging Modalities

2D Imaging

Secondary

**Adaptive Power**
Activates 2D imaging with Adaptive Power.
Automatically adjusts the transmit power as focus is adjusted. When Adaptive Power is on, moving the focal carat to the near field reduces clutter. When multiple focal zones are active, the power adapts to the deepest focal carat. Available in Fusion imaging, but not in Harmonic, Contrast, or Soft Echo Enhancement imaging. This control is unavailable with curvilinear transducers.

**IBS**
Toggles between an Integrated Backscatter (IBS) image and a standard 2D image. Mainly used for Tissue Characterization studies using Acoustic Densitometry (AD). Values are on and off. By default, it is off.

**LGC**
Turns the Lateral Gain Controls on and off.

**L/R Invert**
Switches the left/right orientation of the image.
Appears on the secondary touch panel in cardiac presets and on the right primary touch panel in noncardiac presets. Also appears on the left primary touch panel under the Image controls.

**Sweep**
Changes the sweep speed of the ECG waveform.
Available speeds are 25, 50, 100, and 150 mm/sec.

**Persist**
Adjusts the amount of frame averaging, which can give a smoother appearance.

**Power**
Adjusts transmit power in decibels (dB) where 0.0dB = maximum power and -30.0dB = minimum power. This control is displayed as part of the primary 2D control set when Contrast is on.

**Secondary Controls**
Switches between the primary and secondary touch panels. When the control is highlighted, the secondary controls are active.
## Setup

**Acquire Max:**120/300Hz  
Works in conjunction with the **Maximize Transfer/Frames** touch control in Disk Setup. **Acquire Max:**120 Hz limits frame rate to 120 Hz. **Acquire Max:**300 Hz allows frame rates up to 300 Hz.

**Depth Marks**  
Displays fixed depth marks along the right side of the image. The MMode/Doppler line is displayed only if **MMode or Doppler** is on while depth marks are displayed.

**Time Gain Compensation (TGC) sliders**  
Adjusts amplification of returning 2D signals at a specific image depth. Moving the slider to the right increases amplification; moving the slider to the left decreases amplification. Screen display of slider settings is toggled on and off using the **TGC Curve 2D Setup control**.
2D/BMode Imaging

Introduction

When any transducer other than a Doppler-only transducer is being used in a noncardiac preset, the default imaging modality is 2D/BMode. In this mode, the imaging screen displays a two-dimensional black-and-white scan.

NOTE
2D/BMode is available in noncardiac presets.
Screen and Touch Panels

Acoustic output index
Transducer label
Preproc (MMode), Persistence, Postproc
Depth selection
Grayscale bar
Frequency Fusion icon

Probe

BMode
Secondary Controls
Spectral
Zoom
Harmonic Fusion
Focal Strength
Colorize
L/R Invert
Soft Echo Enhance
Frequency Fusion 3
Focal Zones 3
Postproc
H
Steering
Magnify
7.0
Controls

Primary

BMode is used for all presets except cardiac.

Colorize Optimizes contrast resolution by activating the current colorization map and overlaying the grayscale image. To change the active map, turn the color rotary control just under the Colorize touch control.

Focal Strength When on, the focus is increased at the selected focal zone or zones, producing better resolution in the area of interest. If more that one focal zone is selected, the focal carets are automatically positioned closer together on the screen, indicating the increased focal intensity. (Focal Strength is only available on linear and CLA transducers.)

Focal Zones Selects up to four possible transmit focal zones. The actual number of zones available is dependent on transducer and depth. A caret appears on the screen for each selected focal zone. As focal zones are increased, the frame rate decreases.

Focus Repositions the acoustic depth of the 2D/BMode focal zone, indicated by carets.

Frequency Fusion Optimizes frequencies for penetration, texture, or resolution. Changes are reflected in the Frequency Fusion icon.

Harmonic Fusion (Touch Control) Activates Harmonic Fusion for imaging tissue. Activates Harmonics for a 2D image only. Available only with a harmonics-ready transducer, such as the s3, s4, s8, 11-3L, c3540, OmniPlane III, or x4.

Harmonic Fusion (Rotary Control) Selects the Harmonic Fusion setting when Harmonic Fusion is on. Changes are reflected in the Harmonic Fusion icon.
<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LGCs</strong> (Lateral Gain Controls)</td>
<td>Each of the eight sliders adjusts the amplification of returning signals within a specific lateral 2D/BMode or AQ image area. Available only with sector and curvilinear array transducers.</td>
</tr>
<tr>
<td><strong>Magnify</strong></td>
<td>Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes.</td>
</tr>
<tr>
<td><strong>Postproc</strong></td>
<td>Affects the contrast and brightness of grayscale images stored in memory, according to visual preference. The curve you select affects both real-time and frozen images, but does not affect video playback images.</td>
</tr>
<tr>
<td><strong>Secondary Controls</strong></td>
<td>Switches between the primary and secondary touch panels. When the control is highlighted, the secondary controls are active.</td>
</tr>
<tr>
<td><strong>Soft Echo Enhance (Touch Control)</strong></td>
<td>Activates soft echo enhancement imaging, which may enhance visualization of low-level ultrasound signals from normal anatomy and pathology. The Soft Echo Enhance icon replaces the Frequency Fusion icon and reflects the setting and the transducer frequency range. Frequency Fusion and Harmonic Fusion are unavailable when Soft Echo Enhance is on.</td>
</tr>
<tr>
<td><strong>Soft Echo Enhance (Rotary Control)</strong></td>
<td>Select the soft echo enhancement setting when Soft Echo Enhance is on. Settings A to C automatically adjust transmit power, persistence, dynamic range, and post-processing to provide increased sensitivity.</td>
</tr>
<tr>
<td><strong>Spectral</strong></td>
<td>Reformats the screen display to turn a Doppler spectral trace on or off.</td>
</tr>
<tr>
<td><strong>Steering</strong></td>
<td>Enables continuous steering of linear grayscale images to the right or left, to achieve an optimum imaging angle.</td>
</tr>
<tr>
<td><strong>Zoom</strong></td>
<td>Turns zoom (magnification) on or off. To move the zoom preview area, use the trackball (Position is active when you first enter zoom preview). To resize the zoom preview area, press Size and use the trackball. Then touch Zoom again to enter full zoom mode.</td>
</tr>
</tbody>
</table>

Tip: When activated, Zoom is first outlined by a box. This indicates zoom preview. Touch Zoom a second time to go into full zoom.
Secondary

**Adaptive Power**  
Activates 2D imaging with Adaptive Power. 
Automatically adjusts transmit power as focus is adjusted. 
When Adaptive Power is on, moving the focal carat to the near field reduces clutter. When multiple focal zones are active, the power adapts to the deepest focal carat. This control is unavailable with Curvilinear transducers.

**Depth Marks**  
Displays fixed depth marks along the right side of the image. The MMode/Doppler line is displayed only if MMode or Doppler is on while depth marks are displayed.

**Edge Enhance**  
Provides increased edge definition in the PW image and the MMode trace by using the touch controls.

**LGC**  
Turns the Lateral Gain Controls on and off.

**Persist**  
Adjusts the amount of frame averaging, which can give a smoother appearance.

**Power**  
Adjusts transmit power in decibels (dB) where 0.0dB = maximum power and -30.0dB = minimum power. Is displayed as part of the primary 2D control set when contrast is on.

**Trapezoid**  
Activates trapezoidal imaging, which widens the linear image to a trapezoidal shape. Available with linear array transducers.

**U/D Invert**  
Inverts the apex of the sector from its current orientation. Appears on the right primary touch panel in cardiac presets and on the secondary touch panel in noncardiac presets. Also appears on the left touch panel under the Image controls. Available only with a sector and curvilinear array transducers.
Imaging Modalities

2D/BMode Imaging

Setup

**Acquire Max: 120/300Hz**

Works in conjunction with the **Maximize Transfer/Frames** touch control in **Disk Setup**. **Acquire Max: 120 Hz** limits frame rate to 120 Hz. **Acquire Max: 300 Hz** allows frame rate to 300 Hz.
Using 2D/BMode

1. Ensure the active preset is correct for the study. To change a preset, touch Preset and choose the exam type (if applicable) and the preset.

<table>
<thead>
<tr>
<th>Preset</th>
<th>Vascular Exam</th>
<th>Carotid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Touch BMode.
3. Adjust the imaging controls sliders, as necessary. You may also need to increase the **Power** settings to increase the acoustic power and adjust the TGC and Gain settings.

4. Optimize the image using the touch controls. To adjust the image location or width, press **Size** or **Position** and use the trackball.

5. To see lateral walls more clearly, adjust the LGC sliders.
Displaying a time gain compensation (TGC) curve

To display a TGC curve:

1. In 2D or BMode, press Setup.

2. Touch TGC Curve on the right touch panel.

3. Press Setup to exit.
Biopsy Support

Introduction

Your system supports the use of biopsy needle guides on these probes:

- E6509
- c3540
- C5040

Biopsy support is available when

- A probe (for which biopsy needle guides are available) is connected to the system and selected
- A noncardiac preset is selected
- Zoom mode is off
Biopsy screens

The following illustration shows the biopsy gun graphic. It indicates the ideal biopsy needle path as a dotted line at an angle to the image. When the needle can be mounted in more than one position, the **Crossover Depth** rotary control selects the angle. The spacing along the needle path is 1 cm for deep depths and 0.5 cm for shallow depths.

A crosshair cursor on the dotted line indicates the target. The trackball controls the cursor location. In the upper right corner of the screen display, **NEEDLE LENGTH** indicates the minimum length of needle required to reach the target. This is the distance from the top of the needle guide to the target.
The following illustration shows the biopsy needle graphic. The diverging dotted lines show the area in which the needle can be expected to travel. These display guidelines should be used as an indicator only. Needle deflection or bending may occur as it passes through tissue. Use the imaging screen to monitor the progress of the needle. The spacing is 1 cm along the needle path for deep depths and 0.5 cm for shallow depths.

The dotted lines are set at an angle to the image. When the needle can be mounted in more than one position, the Crossover Depth rotary control selects the display appropriate for the needle position. The display changes to show the angle corresponding to the selected position. A crosshair cursor between the dotted lines indicates the target. The trackball controls the cursor location on the ideal needle path. In the upper right corner of the screen, NEEDLE LENGTH indicates the minimum length of needle required to reach the target. This is the distance from the top of the needle guide to the target.

**CAUTION**

The onscreen guidelines are intended as guides only and should never be used as absolute references.
The following illustration shows an example of the crossover depth. Biopsy needles mount on probes at an angle to the probe center line. Some biopsy guides, for example the C5040, can support more than one needle position. Each needle position on the guide is marked with its crossover depth. Crossover depth is the distance from the face of the probe to the point where the needle path intersects the probe center line.

NOTE

The crossover depth is an estimate and does not replace more direct measurements. Use the crossover depth only to identify the needle position on the guide and to select the correct crossover depth control setting.
Controls

The SONOS biopsy controls and displays help direct the operation of the biopsy needle.

**CAUTION**

During biopsy operations, it is important that you activate onscreen biopsy guidelines and carefully watch the image during needle insertion, to verify the needle path.

To use the biopsy controls, you need a biopsy-enabled transducer. The biopsy support controls are located on the right touch panel by touching **BMode** and **Secondary Controls**:

A touch control with three options lets you select the following:

- **Biopsy Off**—Disables the biopsy controls.
- **Biopsy Gun**—Displays a single dotted line representing the ideal needle path. (See page 7-40.)
- **Biopsy Needle**—Displays diverging dotted lines representing the expected path of the needle during insertion. (See page 7-41.)
Following are some guidelines for using SONOS biopsy controls:

- If the selected probe supports multiple needle mounting positions, you can use a rotary control to select crossover depth. (See page 7-42.)

- Biopsy graphics are erased from the screen in cardiac presets, and in PW, CW, MMode, and zoom modes.

- Changing the probe selection turns off biopsy support; it can be reactivated only when a probe that accepts biopsy guides is selected.

- When a biopsy screen display is on, the trackball controls a marker indicating the position on the image that is the target of the biopsy procedure along the needle path. The minimum needle length required to reach the target marker is displayed in the upper right corner of the screen.

**Probes supporting biopsy**

The following probes accept biopsy needle guides.

<table>
<thead>
<tr>
<th>Probe</th>
<th>Model</th>
<th>CIVCO Biopsy Kit</th>
<th>Crossover Depths</th>
</tr>
</thead>
<tbody>
<tr>
<td>E6509</td>
<td>21336A</td>
<td>610-588</td>
<td>187 mm</td>
</tr>
<tr>
<td>c3540</td>
<td>21321A</td>
<td>645-057</td>
<td>90 mm</td>
</tr>
<tr>
<td>C5040</td>
<td>21373A</td>
<td>645-032</td>
<td>20 mm 50 mm</td>
</tr>
</tbody>
</table>

To order biopsy kits contact
CIVCO Medical Instruments Co.
102 First Street
Kalona, IA 52247-9589 U.S.A.

E-mail: info@civcomedical.com
www.civco.com
Phone inside US: (800) 445-6741
Phone outside US: 1-319-656-4447
Fax orders to: 1-319-656-4451

For information about ordering other Philips Medical Systems supplies and accessories, see “Supplies and Accessories” on page 1-17.

**NOTE**

See the *Transducer Reference* for safety and maintenance information about the use of biopsy needles and guides.
2D/BMode Troubleshooting

Always make sure the transducer and active preset are appropriate for the study being performed. If necessary, adjust the \( \text{Exposure} \) and \( \text{Monitor} \) controls for ambient light. After adjusting any control, always check the transducer position.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image is difficult to see.</td>
<td>Adjust the screen’s background using the <strong>Backgrnd</strong> control (a System Setup touch control)\n</td>
</tr>
<tr>
<td></td>
<td>😊 <strong>Gain.</strong>\n</td>
</tr>
<tr>
<td></td>
<td>😊 <strong>Compress.</strong>\n</td>
</tr>
<tr>
<td></td>
<td>😊 <strong>Power.</strong>\n</td>
</tr>
<tr>
<td>Image is too soft, hazy, or gray.</td>
<td>Adjust the <strong>Postproc</strong> rotary control to obtain the desired image appearance.</td>
</tr>
<tr>
<td></td>
<td>😊 <strong>Compress</strong> to reduce low-level echoes.</td>
</tr>
<tr>
<td></td>
<td>😊 <strong>Persist</strong> to sharpen the image.</td>
</tr>
<tr>
<td></td>
<td>Adjust monitor settings.</td>
</tr>
<tr>
<td></td>
<td>Turn off <strong>Soft Echo Enhance.</strong></td>
</tr>
<tr>
<td></td>
<td>Use Harmonic Fusion to reduce clutter and delineate tissue borders.</td>
</tr>
</tbody>
</table>
2D/BMode Imaging

Image has too much contrast or is grainy.

- **Postproc** to decrease grayscale contrast.
- **Compress** to increase low-level echoes.

- **Frequency Fusion.** Increase transmit power by moving the transmit carat downward, if **Adaptive Power** is on or if using the control on the secondary touch panel. Otherwise, change to a higher frequency transducer.

For slow-moving blood or structures, touch **Secondary Controls** and **Persist** to soften the image.

Adjust monitor settings.

Use soft echo enhancement to emphasize certain pathologic or physiologic conditions.

Not enough penetration.

- **Gain.**

- **Frequency Fusion.** Increase transmit power by moving the transmit carat downward (if on) on or using the control on the secondary touch panel. Otherwise, change to a lower frequency transducer.

- **Power.**

Grayscale images are printed on the wrong printer.

Press [Setup], touch **Print**, and adjust B/W [printer] to display the printer to use for grayscale images.
<table>
<thead>
<tr>
<th>Issue</th>
<th>Resolution</th>
</tr>
</thead>
</table>
| Cannot see cardiac image.                 | Check the transducer position, and adjust if necessary.  
  - [Gain](#).  
  - [Frequency Fusion](#). Otherwise, change to a lower frequency transducer.  
  Touch [Harmonic Fusion](#) and choose setting 1.  
  Increase the frame rate by decreasing the width with [Size](#) and the trackball. If necessary, use [Zoom](#).  
  - [Postproc](#) to select a higher contrast curve.  
  Touch [Colorize](#) to improve contrast resolution.  
  - [Power](#).  
  Use Harmonic Fusion to reduce clutter and delineate tissue borders. |
| Cannot see lateral walls with sector transducers. | Adjust the LGC sliders that affect the wall area. Then adjust the sliders that affect either side of the wall area, to keep the LGC profile smooth instead of peaked.  
  Use Harmonic Fusion to reduce clutter and delineate tissue borders. |
| Vessel walls are unclear.                 | With a linear transducer, adjust [Steering](#) to make the beam perpendicular to the walls.  
  Reposition the transducer.  
  Adjust TGCs, [Gain](#) and [Compress](#).  
  Use soft echo enhancement to emphasize certain pathologic or physiologic conditions. |
| In soft echo enhancement mode, external radio frequency interference (RFI) affects the image. | Select [Soft Echo Enhance A](#) or [Soft Echo Enhance B](#), instead of [Soft Echo Enhance C](#). |
IMAGING MODALITIES
MMode Imaging

MMode Imaging

Introduction

2D/MMode is useful for timing the movement of cardiac structures. Any movement along the line of sight through the heart is translated into onscreen traces that accompany the scan image.

NOTE

MMode is not available in Color mode using a linear transducer or in Angio mode.
Screen and Touch Panels

Cardiac

NOTE: The screen can display an image and trace using four different formats. For more information, see “Displaying spectral and MMode traces” on page 7-57.
Noncardiac
Controls

Cardiac

If Color is active when you enter MMode, a subset of the Color controls appear instead of the MMode controls shown here.

**Colorize**
- Optimizes contrast resolution by activating the current colorization map, and overlaying the grayscale image. To change the active map, turn the color rotary control just under the Colorize touch control.

**Full Screen**
- If an MMode trace is present, toggles between full size trace and the last used mode format defined by Image Size.

**Magnify**
- Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes. In MMode, this only affects the reference image.

**Pan**
- When Zoom is on, enables the trackball to move the zoom/color box area over the image. Position must be highlighted.

**Postproc**
- Affects the softness and brightness of MMode images stored in memory, according to visual preference. The curve you select affects both real-time and frozen images, but does not affect video playback or 2D images. May be adjusted after freezing the image.

**Preproc**
- Adjusts the amount of contrast before MMode images are stored in memory.

**Print**
- Produces a hard copy of the screen display. If the onscreen image is live, it briefly freezes during printing and then returns to live imaging. You also can use the foot switch pedal to print information.

**Sweep**
- Changes the sweep speed for MMode images and any active physios. The display recording is at the speed selected. Available speeds are 25, 50, 100, and 150 mm/sec.
Imaging Modalities

MMode Imaging

Zoom

Turns zoom (magnification) on or off. To move the zoom preview area, use the trackball (Position is active when you first enter zoom preview). To resize the zoom preview area, press Size and use the trackball. Then touch Zoom again to enter full zoom mode.

Noncardiac

If Color mode is active when you enter MMode, Color controls appear instead of the MMode controls shown here.

NOTE

You cannot use Color MMode with linear transducers.

Colorize

Optimizes contrast resolution by activating the current colorization map, and overlaying the grayscale image. To change the active map, turn the color rotary control just under the Colorize touch control.

Full Screen

If an MMode trace is present, toggles between full size trace and the last used mode format define by Image Size or by a preset.

Magnify

Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes.

Postproc

Affects the softness and brightness of MMode images stored in memory, according to visual preference. The curve you select affects both real-time and frozen images, but does not affect video playback images.

Preproc

Adjusts the amount of contrast.

Print

Produces a hard copy of the screen display. If the onscreen image is live, it briefly freezes during printing and then returns to live imaging. You also can use the foot switch pedal to print information.
Imaging Modalities

MMode Imaging

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scroll</strong></td>
<td>Toggles between scrolling the trace display and the reference image. To use the Scroll Image, first press [Freeze].</td>
</tr>
<tr>
<td><strong>Spectral</strong></td>
<td>Reformats the screen display to turn a Doppler spectral trace on or off.</td>
</tr>
<tr>
<td><strong>Sweep</strong></td>
<td>Changes the sweep speed for MMode images. Available speeds are 25, 50, 100, and 150 mm/sec.</td>
</tr>
<tr>
<td><strong>Zoom</strong></td>
<td>Turns zoom (magnification) on or off. To move the zoom preview area, use the trackball ([Position] is active when you first enter zoom preview). To resize the zoom preview area, press [Size] and use the trackball. Then touch zoom again to enter full zoom mode.</td>
</tr>
</tbody>
</table>

Tip: When activated, Zoom is first outlined by a box. This indicates zoom preview. Touch Zoom a second time to go into full zoom.
Using MMode

1. Optimize the 2D or BMode image. To use Color MMode, touch **Color** and optimize the image using the keyboard imaging controls. Press **Enter** to return trackball control to the cursor line.

2. Position the cursor line with the trackball.
3. Touch **MMode**.

4. Optimize the display using the **MMode** touch controls.

**Tip:** If **Color** is on, but you do not want to see it, touch **Color Suppress**.
5. Adjust the keyboard imaging controls, as necessary. To scroll an MMode display, press Freeze and use the trackball. To return to live imaging, press Freeze again.
Displaying spectral and MMode traces

There are four displays for Spectral and MMode traces:

- Small image on top with large trace on bottom
- Large image on top with small trace on bottom
- Side-by-side image and trace
- Full-screen trace

The following illustration shows the side-by-side display:

NOTE

Full-screen and side-by-side MMode are unavailable when the depth is less than 3 cm (6 cm in Color and Angio). For European (PAL), the limits are 4 cm and 7 cm.
The following figure shows the full-screen display:

![Full-screen display diagram]

**Displaying side-by-side MMode or Doppler**

To display the side-by-side format in MMode or Doppler:

1. Touch **Image** on the left touch panel.

2. Touch **Image Size** repeatedly to cycle through the available formats until the side-by-side format appears. At shallow depths, this format is unavailable.

**Changing the display to full screen**

To display a full-screen MMode or Doppler trace:

1. Touch **Full Screen** on the right touch panel.

2. Touch **Full Screen** again to switch back to the previous display.

For more information on MMode and Doppler, see “Using MMode” on page 7-54 and “PW and CW Imaging” on page 7-79.
**MMode Troubleshooting**

Always make sure the active preset is appropriate for the study being performed. If necessary, adjust the \( \mathbb{M} \) and \( \mathbb{D} \) monitor controls for ambient light.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trackball moves too fast or too slowly.</td>
<td>Move the large dot on the cursor line toward the bottom of the image, using the trackball.</td>
</tr>
<tr>
<td>Poor MMode image.</td>
<td>Try <strong>Preproc 1</strong> for a softer image, or <strong>Preproc 2</strong> for a crisper image. Optimize the image by adjusting <strong>Gain</strong>, <strong>Compress</strong>, and TGCs. <strong>Postproc</strong> in MMode to increase the contrast of grayscale images.</td>
</tr>
<tr>
<td>MMode image is too faint on the display.</td>
<td><strong>Gain</strong>.</td>
</tr>
<tr>
<td>Trackball moves backward.</td>
<td>In <strong>Setup</strong> under the <strong>Loop</strong> controls, touch <strong>Scroll</strong> and move right or left.</td>
</tr>
</tbody>
</table>
Color Imaging

Introduction

Color mode uses color to represent the mean ‘velocity and direction of either blood (Color Flow) or tissue (Tissue Doppler). Different shades of colors in a defined color spectrum represent different velocities and directions of blood or tissue movement within the selected color area.

Color Flow is usually used to examine blood flow through valves or pathological orifices in the heart, or through vessels of the body. Tissue Doppler is usually used to examine tissue movement. Usually the color red represents flow or movement towards the transducer and blue represents flow or movement away from the transducer.

NOTE

Color mode is not available in MMode imaging when using a linear transducer.
Screen and Touch Panels

Cardiac
Imaging Modalities

Color Imaging

Noncardiac

- Color bar and baseline indicator
- Color flow frequency
- Highest mean velocity toward transducer: TIS: 0.2
  11-3L
- Preproc, Color Persist, Postproc, packet size/ filter, color map
  20/F/L2/A
- Carotid
- Highest mean velocity away from transducer: GAIN 60
  COMP 90
- Color area - adjust with trackball, and Position and Size keys: 4 CM
  12 Hz
- 2D/BMode Frequency Fusion icon
  - Carotid

Color

<table>
<thead>
<tr>
<th>Secondary Controls</th>
<th>Spectral</th>
<th>Zoom</th>
<th>Pan</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/W Suppress</td>
<td>Color Suppress</td>
<td>Color Compare</td>
<td>Map Invert</td>
</tr>
<tr>
<td>Gain 50%</td>
<td>Baseline</td>
<td>Density</td>
<td>Filter</td>
</tr>
<tr>
<td>Frequency</td>
<td>Focus</td>
<td>Scale</td>
<td>Magnify</td>
</tr>
<tr>
<td>Fusion 3</td>
<td></td>
<td></td>
<td>1.0</td>
</tr>
</tbody>
</table>
Controls

Cardiac primary

With Color active, touch PW, CW, or MMode to go into PW Color, CW Color, or MMode Color (combination) mode. The second mode control (PW, CW, or MMode) is highlighted, and the Color touch control is outlined by a box, indicating that Color mode is still active. To exit the combination mode, touch Color. Now the Color touch control is highlighted, indicating that only Color mode is active.

Baseline
Unwraps aliased signals. Shows higher velocities flowing in one direction by lowering color assignments for velocities flowing in the other direction.

B/W Suppress
Suppresses the black-and-white image that appears outside of the color image, thereby increasing the frame rate. Available with sector and curvilinear array transducers.

Color Compare
Displays grayscale and color versions of an image side by side.

Color Suppress
Removes color from an image while remaining in Color mode. Frame rate is unaffected.

Density
Trades off resolution versus frame rate by varying line density. Not available in Tissue Doppler mode.

Filter
Removes low-level signals and reduces noise in the image.

Focus
Repositions the acoustic depth of the color focal zone. When adaptive flow is on, the focus chooses the optimal color frequency.

Frame Rate
Trades off resolution for frame rate. Values are 1–5. Higher values indicate higher frame rates. Only available in Tissue Doppler mode.
## Imaging Modalities
### Color Imaging

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency Fusion</strong></td>
<td>Optimizes frequencies for penetration, texture or resolution. Changes are reflected in the Frequency Fusion icon.</td>
</tr>
<tr>
<td><strong>Gain</strong></td>
<td>Adjusts system sensitivity to received color flow signals. Increasing the color gain percentage increases the amount of color displayed.</td>
</tr>
<tr>
<td><strong>Magnify</strong></td>
<td>Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes.</td>
</tr>
<tr>
<td><strong>Pan</strong></td>
<td>When <strong>Zoom</strong> is on (fully highlighted), enables the trackball to move the zoom/color box area over the image.</td>
</tr>
<tr>
<td><strong>Scale</strong></td>
<td>Changes the range of color flow velocities. Lower the scale to see slow flow, and increase it to see higher velocities.</td>
</tr>
<tr>
<td><strong>Secondary Controls</strong></td>
<td>Switches between the primary and secondary touch panels. When the control is highlighted, the secondary controls are active.</td>
</tr>
<tr>
<td><strong>Spectral</strong></td>
<td>Reformats the screen display to turn a Doppler spectral trace on or off.</td>
</tr>
<tr>
<td><strong>Sweep</strong></td>
<td>Changes the sweep speed of the ECG waveform. Available speeds are 25, 50, 100, and 150 mm/sec.</td>
</tr>
<tr>
<td><strong>Tissue Doppler</strong></td>
<td>Turns Tissue Doppler imaging mode on or off. Not available when the image has been frozen using the <strong>Freeze</strong> key.</td>
</tr>
</tbody>
</table>

**Zoom**       | Turns zoom (magnification) on or off. To move the zoom preview area, use the trackball (**Position** is active when you first enter zoom preview). To resize the zoom preview area, press **Size** and use the trackball. Then touch **Zoom** again to enter full zoom mode. |

---

**Tip:** When activated, **Zoom** is first outlined by a box. This indicates zoom preview. Touch **Zoom** a second time to go into full zoom.
Cardiac secondary

Adaptive Flow
Selects an optimal color flow frequency and focal depth and adjusts the PRF based on the size and location of the color flow window. (See “Using Color Imaging” on page 7-70.)

Colorize
Optimizes contrast resolution by activating the current colorization map, and overlaying the grayscale image. To change the active map, turn the color rotary control just under the Colorize touch control.

LGC
Touch control that turns the Lateral Gain Controls on and off.

Map
Changes the color flow map used for real-time and looping images. Maps represent conventions and flow characteristics assigned to the selected BART (Blue Away, Red Toward) or RABT (Red Away, Blue Toward) map.

Map Invert
Switches between the BART (Blue Away, Red Toward) and the RABT (Red Away, Blue Toward) color map conventions.

Packet
Selects the color flow packet size S (small), M (medium), or L (large). This determines how the system samples and processes color flow information. Not available in Tissue Doppler mode.

Persist
Adjusts the amount of color frame averaging, which can give a smoother appearance.
Imaging Modalities
Color Imaging

**Power**
Adjusts transmit power in decibels (dB) where 0.0dB = maximum power and -30.0dB = minimum power. Is displayed as a primary right-touch-panel control set when **Contrast** is on.

**Secondary Controls**
Switches between the primary and secondary touch panels. When the control is highlighted, the secondary controls are active.

**Smoothing**
Adjusts the amount of color scan line averaging, affecting the smoothness and sensitivity of the color display.

**Noncardiac primary**
With Color active, touch PW, CW, or MMode to go into PW Color, CW Color, or MMode Color (combination) mode. The second mode control (PW, CW, or MMode) is highlighted, and the Color touch control is outlined by a box, indicating that Color mode is still active. To exit the combination mode, touch Color. Now the Color touch control is highlighted, indicating that only Color mode is active.

**Baseline**
Unwraps aliased signals. Shows higher velocities flowing in one direction by lowering color assignments for velocities flowing in the other direction.

**B/W Suppress**
Suppresses the black-and-white image that appears outside of the color image, thereby increasing the frame rate. Available with sector and curvilinear array transducers.

**Color Compare**
Displays grayscale and color versions of an image side by side.

**Color Suppress**
Removes color from an image while remaining in Color mode. Frame rate is unaffected.

**Density**
Trades off resolution versus frame rate by varying line density.
Filter  Removes low-level signals and reduces noise in the image. It is recommended that you use Filter T with turbulence maps only.

Focus  Repositions the acoustic depth of the color focal zone.

Frequency Fusion  Optimizes frequencies for penetration, texture, or resolution. Changes are reflected in the Frequency Fusion icon and on the process line displayed at the top left corner of the screen.

Gain  Adjusts system sensitivity to received color flow signals. Increasing the color gain percentage increases the amount of color displayed.

L/R Invert  Switches the left/right orientation of the image. Appears on the secondary touch panel in cardiac presets and on the right primary touch panel in noncardiac presets. Also appears on the left touch panel under the Image controls.

Magnify  Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes.

Map Invert  Switches between the BART (Blue Away, Red Toward) and RABT (Red Away, Blue Toward) color map conventions.

Pan  When Zoom is on (fully highlighted), enables the trackball to move the zoom/color box area over the image.

Scale  Changes the range of color flow velocities. Lower the scale to see slow flow, and increase it to see higher velocities.

Secondary Controls  Switches between the primary and secondary touch panels. When the control is highlighted, the secondary controls are active.

Spectral  Reformats the screen display to turn a Doppler spectral trace on or off.
**Imaging Modalities**

**Color Imaging**

**Steering**
Steers linear color images to the right or left, to achieve optimal color flow angles. The baseline also returns automatically to the selected position.

**Zoom**
Turns zoom (magnification) on or off. To move the zoom preview area, use the trackball ([Position](#) is active when you first enter zoom preview). To resize the zoom preview area, press [Size] and use the trackball. Then touch **Zoom** again to enter full zoom mode.

**Noncardiac secondary**

**Adaptive Flow**
Selects an optimal color flow frequency and focal depth and adjusts the PRF based on the size and location of the color flow window. (See “Using Color Imaging” on page 7-70.)

**Colorize**
Optimizes contrast resolution by activating the current colorization map, and overlaying the grayscale image. To change the active map, turn the color rotary control just under the **Colorize** touch control.

**Color Priority**
Displays all received color data by giving higher priority to Color, overriding BMode information.

**Color Tag [1, 2]**
Shows all flow above a selected mean velocity in bright green. Also turns off **Color Tag**.

**LGC**
Turns the Lateral Gain Controls on and off. Not available with linear probes.

**Map**
Changes the color flow map used for real-time and looping images. Maps represent conventions and flow characteristics assigned to the selected BART (Blue Away, Red Toward) or RABT (Red Away, Blue Toward) map.

**Packet**
Selects the color flow packet size **S** (small), **M** (medium), or **L** (large). This determines how the system samples and processes color flow information.
### Imaging Modalities

#### Color Imaging

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peak Hold</strong></td>
<td>Displays, in color, the accumulated maximum flow velocities detected during a period of time (which must be defined using Setup).</td>
</tr>
<tr>
<td><strong>Persist</strong></td>
<td>Adjusts the amount of color frame averaging, which can give a smoother appearance.</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>Adjusts transmit power in decibels (dB) where 0.0dB = maximum power and -30.0dB = minimum power. Appears as part of the primary control set on the right touch panel when <strong>Contrast</strong> is on.</td>
</tr>
<tr>
<td><strong>Secondary Controls</strong></td>
<td>Switches between the primary and secondary touch panels. When the control is highlighted, the secondary controls are active.</td>
</tr>
<tr>
<td><strong>Smoothing</strong></td>
<td>Adjusts the amount of color scan line averaging, affecting the smoothness and sensitivity of the color display.</td>
</tr>
<tr>
<td><strong>Tag Position</strong></td>
<td>Adjusts the mean velocity for either <strong>Color Tag 1</strong> or <strong>Color Tag 2</strong>, whichever is currently on. Activated when you touch <strong>Color Tag</strong>.</td>
</tr>
<tr>
<td><strong>Trapezoid</strong></td>
<td>Activates trapezoidal imaging, which widens the linear image to a trapezoid shape. Available only with transducers that offer this feature.</td>
</tr>
</tbody>
</table>

**Setup**

**Peak Hold**

Selects the number of seconds of color flow display when **Peak Hold** and [Freeze] are active.
Using Color Imaging

1. Optimize the 2D/BMode image using the keyboard imaging controls.

2. Touch Color.
3. Adjust the location of the color area with the trackball. The Position key is active when you first enter Color. To change the size of the color area, press Size and use the trackball.

4. Adjust Color Gain, as necessary. Increasing the percentage increases the amount of color displayed.

5. Optimize the image using the Color touch controls.
Adaptive Flow

Adaptive Flow provides the best color sensitivity at every depth, while keeping the velocity scale constant. The following illustration shows Adaptive Flow side-by-side images with the color box set to different depths:

View 1 - Color box at shallow depth
View 2 - Color box at deeper depth

Tip: The system automatically provides the optimal color frequency, focus and adjusts the PRF.

Following are some Adaptive Flow guidelines:

- As the color box moves to the top of the sector (shallow depth), the system uses a higher color flow frequency (View 1).
- When the color box moves to the bottom of the sector, the system uses a lower color flow frequency (View 2).
- The user may override the selected frequency by
  - Moving the Focus rotary control to a new depth in the color box
  - Disabling Adaptive Flow
Color Compare

Color Compare mode allows you to quickly compare color and grayscale versions of the same image. The color image is displayed on the right, and the grayscale on the left. Color Compare is not available with spectral Doppler.

1. While displaying a live color image, touch **Color Compare**. The live color image appears next to a live grayscale image.

2. To freeze both images, press **Freeze**.

3. To display both images side by side with color suppressed, touch **Color Suppress**.

4. To turn off compare mode, touch **Color Compare** again.
The following illustration shows the Color Compare screen:

![Illustration of Color Compare screen](image-url)
**Color Troubleshooting**

Always make sure the active preset is appropriate for the study being performed. If necessary, adjust the [Multiplier] and [Volume] monitor controls for the ambient light.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not sensitive.</td>
<td>Adjust <strong>Color Gain</strong>. It could be either too high or too low.</td>
</tr>
<tr>
<td></td>
<td>☑ <strong>Scale</strong>.</td>
</tr>
<tr>
<td></td>
<td>☑ <strong>Power</strong>, if not at 100%.</td>
</tr>
<tr>
<td></td>
<td>Adjust <strong>Focus</strong> to point at the area of interest.</td>
</tr>
<tr>
<td></td>
<td>Adjust <strong>Smoothing</strong>.</td>
</tr>
<tr>
<td></td>
<td>Turn <strong>Color Priority</strong> on for small vessels.</td>
</tr>
<tr>
<td></td>
<td>Use a lower frequency transducer.</td>
</tr>
<tr>
<td></td>
<td>Reposition the transducer, or try another imaging window.</td>
</tr>
<tr>
<td></td>
<td>☑ <strong>Filter</strong> setting for optimal sensitivity.</td>
</tr>
<tr>
<td></td>
<td>Choose a larger packet size, such as <strong>L</strong> (large).</td>
</tr>
<tr>
<td></td>
<td>☑ <strong>Density</strong>.</td>
</tr>
<tr>
<td></td>
<td>Turn off <strong>Adaptive Color</strong>.</td>
</tr>
<tr>
<td>Need a higher frame rate.</td>
<td>For sector or curvilinear array transducers, remove the grayscale image outside the color area by turning on <strong>B/W Suppress</strong>.</td>
</tr>
<tr>
<td></td>
<td>Decrease the width of the color area by pressing [Size] and using the trackball.</td>
</tr>
<tr>
<td></td>
<td>☑ <strong>Density</strong>.</td>
</tr>
<tr>
<td></td>
<td>Use a smaller packet size.</td>
</tr>
<tr>
<td></td>
<td>☑ <strong>Scale</strong>.</td>
</tr>
<tr>
<td></td>
<td>☑ <strong>Depth</strong>.</td>
</tr>
</tbody>
</table>
### Imaging Modalities

#### Color Imaging

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Color is too speckled.</strong></td>
<td>☐ <strong>Smoothing</strong> to smooth the image.</td>
</tr>
<tr>
<td></td>
<td>☐ <strong>Gain.</strong></td>
</tr>
<tr>
<td>For slow-moving blood or structures,</td>
<td>☐ <strong>Persist.</strong></td>
</tr>
<tr>
<td><strong>Excessive turbulence seen using turbulence maps.</strong></td>
<td>When using turbulence maps, always use <strong>Filter T</strong> (for vascular presets only).</td>
</tr>
<tr>
<td><strong>Color display is aliasing.</strong></td>
<td>☐ <strong>Scale</strong> to see more high-velocity blood flow information, and remove more low-velocity information.</td>
</tr>
<tr>
<td></td>
<td>Adjust <strong>Baseline</strong> to unwrap aliased signals.</td>
</tr>
<tr>
<td></td>
<td>Change to a lower frequency transducer.</td>
</tr>
<tr>
<td><strong>Need better color resolution.</strong></td>
<td><strong>Vascular:</strong> Make sure that <strong>Adaptive Flow</strong> is on.</td>
</tr>
<tr>
<td></td>
<td>With linear transducers, use <strong>Steering</strong> to achieve optimal color flow angles by steering the image to the right or left.</td>
</tr>
<tr>
<td></td>
<td>For small vessels:</td>
</tr>
<tr>
<td></td>
<td>☐ <strong>Smoothing.</strong></td>
</tr>
<tr>
<td></td>
<td>☐ <strong>Density.</strong></td>
</tr>
<tr>
<td></td>
<td>☐ <strong>Packet size.</strong></td>
</tr>
<tr>
<td></td>
<td>Turn on <strong>Color Priority</strong> to view small vessels.</td>
</tr>
</tbody>
</table>
### Symptoms

| Need better color filling. |

| Suggestions |

- Adjust **Steering**.
- **Color Gain**.
- **Scale**.
- **Smoothing**.
- **Color Filter**.

  Adjust **Focus**.

  If a decrease in frame rate is acceptable **Packet** size. **Filter**.

  Disable **Adaptive Flow**.

  For slow-moving blood or structures, **Persist**.

  Use **Peak Hold** to accumulate color velocities.

- **Scale** to display higher velocities.

  Increase the frame rate by decreasing the width of the color area (press **Size** and use the trackball). Also be sure **B/W Suppress** is active for sector transducers.

  **Persist** to decrease frame averaging.

| Cannot see fast-moving velocities. |

| Suggestions |

- **Scale** to see more low-velocity blood flow information.
- **Filter**.

  For small vessels, **Smoothing**.

  **Power**.

  Turn **Color Priority** on to display more color (noncardiac presets only).

  Enable **Adaptive Flow**. **Scale**.
### Symptoms

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color image is noisy, flashing, or has artifacts.</td>
<td>🛠️ <strong>Smoothing</strong> to smooth the image.</td>
</tr>
<tr>
<td></td>
<td>🛠️ <strong>Filter</strong>.</td>
</tr>
<tr>
<td></td>
<td>🛠️ <strong>Scale</strong>.</td>
</tr>
<tr>
<td></td>
<td>🛠️ <strong>Color Gain</strong>.</td>
</tr>
<tr>
<td>For slow-moving blood or structures, 🛠️ <strong>Persist</strong> to increase frame averaging.</td>
<td>Narrows the color box to remove the source of artifacts.</td>
</tr>
<tr>
<td>Difficult to determine the amount of turbulence.</td>
<td>Select <strong>Map B, C, or I</strong> and use <strong>Filter T</strong> (if available with the selected preset.).</td>
</tr>
<tr>
<td>Color images are printed on the wrong printer.</td>
<td>Press [Setup], touch Print, and adjust <strong>Color [printer]</strong> to display the printer to use for color images.</td>
</tr>
</tbody>
</table>
PW and CW Imaging

Introduction

Pulsed Wave Doppler (PW) mode provides a “spectral” representation of the velocity of blood flow or tissue movement. Velocities are represented on graphs that use a cm/sec scale to enable velocities to be measured and tracked over time. The “Pulsed” in PW means that the transducer is sending the ultrasound pulse and receiving its echo through a single crystal. This permits you to sample velocities at specific depths.

Continuous Wave Doppler (CW) provides the same spectral display as PW, but the transducer uses separate crystals to transmit ultrasound pulses and receive their echoes. This permits you to sample higher velocities than in PW mode. But CW samples along the entire line of sight, and can exhibit more interference from movement.

This section describes

- PW and CW screens and touch panels (page 7-80)
- Controls (page 7-82)
- Using PW imaging (page 7-93)
- Using CW imaging (page 7-101)
- Troubleshooting PW and CW images (page 7-105)
Screen and Touch Panels

Cardiac

- Triggered 2D reference
- Sample volume
- Diamond-shaped high PRF gate
- Maximum positive velocity limit
- Time markers (1 sec-)
- High PRF indicator
- Doppler frequency
- Maximum positive frequency (KHz), if set up
- Velocity markers
- Baseline
- Gate depth, length, and cursor angle
- Difference between velocity markers
- Velocity scale

- Physio
- ECG

- Trigger Timer
- Interval 3000

- PW
- Secondary Tissue Doppler Spectral Zoo Non-image Xducer
- 2D Live 2D Hold Colorize Full Screen
- Gain 60% Baseline Focus Scale Compress 4
- Reject

- 1.8 MHz
- GATE: 8.0CM LEN: 0.12CM
- HPRF 200 C M / S 100
- Interval 3600 MS
PW Spectral (Noncardiac)

BMode image
Color box
Sample volume

Doppler frequency
Time markers
Velocity markers
Gate depth, length, and cursor angle
Baseline
Difference between velocity markers

Velocity scale

<table>
<thead>
<tr>
<th>PW</th>
<th>Secondary Triplex Controls</th>
<th>BMode</th>
<th>BMode</th>
<th>Live</th>
<th>Hold</th>
<th>Baseline</th>
<th>Angle</th>
<th>Gain</th>
<th>40%</th>
<th>Baseline</th>
<th>Spectral</th>
<th>Spectral</th>
<th>Zoom</th>
<th>Line Adjust</th>
<th>Sweep</th>
<th>Filter</th>
<th>50 Hz</th>
<th>Reject</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spectral Zoom</td>
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<tr>
<td></td>
<td>Spectral Invert</td>
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<td></td>
<td>Time markers</td>
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<td></td>
<td>Gate: 2.1CM LEN: 0.06CM θ 60</td>
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<td>Δ = 20</td>
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</tr>
</tbody>
</table>
Controls

Cardiac primary

NOTE The screen can display an image and trace using four different formats. For more information, see “Displaying spectral and MMode traces” on page 7-57.

Unless otherwise specified, controls pertain to both PW and CW Doppler. Angio mode can be combined with both PW and CW imaging.

2D Hold Freeze the 2D reference image and provides an uninterrupted Doppler spectrum. Is displayed only when Spectral is on.

2D Live Freeze the Doppler spectrum and returns the 2D reference image to real-time. Is displayed only when Spectral is on, and an imaging transducer is active.

Baseline Unwraps aliased signals by adjusting the zero baseline on the Doppler spectrum. Is displayed only when Spectral is on.

Colorize Optimizes contrast resolution by activating the current colorization map and overlaying the grayscale image. To change the active map, turn the color rotary control just under the Colorize touch control.

Compress In conjunction with the Reject rotary control, adjusts the grayscale of the Doppler spectrum.

Filter Removes audible signals of frequencies below the hertz level specified. For lower filter settings, both audio and spectral information are removed.

Focus Repositions the acoustic depth of the color focal zone.

Full Screen If an MMode Trace or Spectrum is present, toggles between full size trace and the last used mode format defined by Image Size.
Imaging Modalities

PW and CW Imaging

Gain
Adjusts the amplitude of received Doppler signals and noise.

Nonimage Xducer
Activates nonimage CW transducer. Appears only when a nonimaging transducer is plugged in.

Print
Produces a hard copy of the screen display. If the onscreen image is live, it briefly freezes during printing and then returns to live imaging. You also can use the foot switch pedal to print information.

Reject
In conjunction with Compress, adjusts the grayscale of the Doppler spectrum. Removes low-level Doppler signals.

Scale
Adjusts the range of Doppler velocities displayed. When the Scale setting is increased beyond standard PW levels, high PRF is activated. The HPRF label is displayed above the waveform, and diamond-shaped gates are displayed on the image. The high PRF feature displays higher velocity flow.

Spectral
Displays the Doppler spectrum on the screen. Turns off Spectral in PW mode, which makes PW Doppler audio available.

Sweep
Changes the sweep speed for the Doppler spectrum, and any active physios. Is displayed only when Spectral is on. Available speeds are 25, 50, 100, and 150 mm/sec.

Tissue Doppler
Turns Tissue Doppler mode on and off. Not available in CW.

Zoom
Turns 2D/BMode zoom (magnification) on or off. To move the zoom preview area, use the trackball (Position is active when you first enter zoom preview). To resize the zoom preview area, press Size and use the trackball. Then touch Zoom again to enter full zoom mode.

Tip: When activated, Zoom is first outlined by a box. This indicates zoom preview. Touch Zoom a second time to go into full zoom.
Imaging Modalities
PW and CW Imaging

Cardiac secondary

**ADP**  
Turns adaptive Doppler on and off. Adaptive Doppler enhances the signal in a spectral display relative to the background noise.

**Cursor Angle**  
Adjusts the angle-correction cursor to an estimated angle of flow direction (from 0 to 80 degrees).

**Gate Length**  
Adjusts the size of the PW gate.

**Magnify**  
Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes.

**Power**  
Adjusts transmit power in decibels (dB) where 0.0dB = maximum power and -30.0dB = minimum power.

**Secondary Controls**  
Switches between the primary and secondary touch panels. When the control is highlighted, the secondary controls are active.

**Spectral Invert**  
Affects whether velocities moving toward the transducer are displayed above or below the zero baseline. When using noncardiac presets, **Spectral Invert** also changes the sign (+/-) on the Doppler scale. Is displayed only when **Spectral** is on.
Cardiac setup

With CW or PW active, press [Setup] to adjust these controls. Press [Setup] again to return to live imaging.

**Baseline Suppress**  Removes spectral representations of frequencies below the filter setting.

**Frequency Scales**  Turns the display of frequency scales and frequency measurements on or off.

**Optimum Angle**  Adjusts the optimum angle-to-flow for linear transducers (PW only). Most vascular labs use 50 to 60 degrees.

**Temporal Smooth**  Adjusts the amount of horizontal spectral smoothing, to show envelope outlines according to visual preference.

**Units**  Sets the display of the Doppler velocity scale to cm/s or m/s (centimeters per second or meters per second). Changing the display units from cm/s to m/s does not change the units used for analysis. Analysis information is always displayed in cm/s.

**Velocity Smooth**  Adjusts the amount of vertical spectral smoothing, to show the most commonly occurring velocities according to visual preference.
Noncardiac primary

Unless otherwise specified, controls pertain to both PW and CW Doppler. Angio and Color modes can be combined with both PW and CW imaging.

**Audio**
Turns PW Doppler audio on or off. Available when PW is on and Spectral and Color are off.

**Baseline**
Unwraps aliased signals by adjusting the zero baseline on the Doppler spectrum. Is displayed only when Spectral is on.

**BMode Hold**
Freezes the BMode reference image and provides an uninterrupted Doppler spectrum. Is displayed only when Spectral is on and an imaging transducer is active.

**BMode Live**
Freezes the Doppler spectrum and returns the BMode reference image to real-time. Is displayed only when Spectral is on, and an imaging transducer is active.

**Color Gain**
Adjusts system sensitivity to received color flow signals. Increasing the color gain increases the amount of color displayed. Is displayed as part of the Color and BMode Live control set.

**Color Scale**
Changes the range of color flow velocities. Is displayed as part of the Color and BMode Live control set.

**Color Steering**
Steers linear color images to either the right or left, to achieve optimal color flow angles. When using a linear transducer in a vascular preset, the color map automatically inverts if you steer the transducer from left to right. The baseline also returns to its original position automatically. Is displayed as part of the Color and BMode Live control set.

**Compress**
In conjunction with the Reject rotary control, adjusts the grayscale of the Doppler spectrum. Is displayed only when Spectral is on.

**Cursor Angle**
Adjusts the angle-correction cursor to an estimated angle of flow direction (from 0 to 80 degrees).
**Duplex**
Activates simultaneous Duplex Doppler mode for PW Doppler vascular, abdominal, or OB/GYN exams. Not available when **Color** is on.

**Filter**
Removes audible signals of frequencies below the hertz level specified. For lower filter settings, both audio and spectral information are removed. Is displayed only when **Spectral** is on.

**Focus**
Repositions the acoustic depth of the color focal zone.

**Gain**
Adjusts the amplitude of received Doppler signals and noise. Is displayed only when **Spectral** is on.

**Gain (Angio)**
Adjusts system sensitivity to received angio signals. Increasing the angio gain percentage increases the amount of color displayed. Is displayed as part of the **Angio** and **BMode Live** control set.

**Gate Length**
Adjusts the size of the PW gate.

**Line Adjust**
Provides access to **Line Angle**. When off, the system positions the PW Doppler interrogation line (Intelligent Doppler feature) based on the **Optimum Angle** setting. Available only with linear transducers.

**Line Angle**
Lets you manually position the PW Doppler interrogation line. Only available when a linear transducer is active and **Line Adjust** is on.

**Nonimage Xducer**
Activates the connected nonimaging transducer.

**Reject**
In conjunction with **Compress**, adjusts the grayscale of the Doppler spectrum. Removes low-level Doppler signals. Is displayed only when **Spectral** is on.
Scale Adjusts the range of Doppler velocities displayed. When the Scale setting is increased beyond standard PW levels, high PRF is activated. The HPRF label is displayed above the waveform, and diamond-shaped gates are displayed on the image. The high PRF feature displays higher velocity flow. Is displayed only when Spectral is on.

Scale (Angio) Changes the range of angio flow velocities whose amplitude can be displayed. This affects the PRF. Lower the scale to see slow flow, and increase it to see higher velocities. Is displayed as part of the Angio and BMode Live control set.

Scroll/Trace Image Causes image to toggle between scrolling the trace display and the reference image. To use Scroll, you must first press Freeze.

Spectral Displays the Doppler spectrum on the screen.

Spectral Invert Affects whether velocities moving toward the transducer are displayed above or below the zero baseline. Spectral Invert also changes the sign (+/-) on the Doppler scale. Is displayed only when Spectral is on.

Steering (Angio) Steers linear angio images to the right or left, to achieve optimal angio flow angles. The baseline also returns automatically to the selected position. Is displayed as part of the Angio and BMode Live control set.
Sweep  Changes the sweep speed for the Doppler spectrum. Is displayed only when Spectral is on. Available speeds are 25, 50, 100, and 150 mm/sec.

Threshold  Determines the type of signals used in calculating the trace waveform. A higher setting indicates lower level pixels are used to calculate the trace waveform. To use, first press Freeze.

Trace  [Trace Auto, Trace Top, Trace Bottom]  Works in conjunction with autotrace’s blue line. Press the Freeze key and then touch Trace Auto. You can then toggle through the trace selections. Trace Auto includes PW information which is seen above and below the baseline. Trace Top displays the signal above the baseline, and Trace Bottom displays the signal below the baseline.

Triplex  Activates simultaneous triplex Doppler mode, in which both the image and Doppler spectral trace are live with Color/Angio on. Available in vascular presets.

Waveform  Suppress  Suppresses waveform line used for autotrace after

Zoom  Turns BMode zoom (magnification) on or off. To move the zoom preview area, use the trackball (Position is active when you first enter zoom preview). To resize the zoom preview area, press Size and use the trackball. Then touch Zoom again to enter full zoom mode.

Tip: When activated, Zoom is first outlined by a box. This indicates zoom preview. Touch Zoom a second time to go into full zoom.
Noncardiac secondary

The Meas Bar controls are available only when you are doing an automatic Doppler trace. To activate the Meas Bar controls, press Freeze and then Trace. To do an automatic Doppler trace, be sure that the Doppler Trace control is enabled in Setup. To do a manual Doppler trace, press Caliper and then Trace.

ADP

Turns adaptive Doppler on and off. Adaptive Doppler enhances the signal in a spectral display relative to the background noise.

Colorize

Optimizes contrast resolution by activating the current colorization map, and overlaying the grayscale image. To change the active map, turn the color rotary control just under the Colorize touch control.

Full Screen

If an MMode trace is present, toggles between a full size trace and the last used format defined by Image Size.

Magnify

Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes.

Meas Bar

Adjusts the position of the Measure Bar D time markers on a Doppler Trace. The Measure Bar D markers indicate the end-diastolic velocity and time points (D) that have been automatically chosen by the system. To use, first press Freeze.

Meas Bar

Adjusts the position of the Measure Bar D velocity markers on a Doppler Trace. The Measure Bar D markers indicate the end-diastolic velocity and time points (D) that have been automatically chosen by the system. To use, first press Freeze.

Meas Bar

Adjusts the position of the Measure Bar S time markers on a Doppler Trace. The Measure Bar S markers indicate the systolic velocity and time points (S) that have been automatically chosen by the system. To use, first press Freeze.
### Imaging Modalities

#### PW and CW Imaging

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meas Bar S (vel)</strong></td>
<td>Adjusts the position of the Measure Bar S velocity markers on a Doppler Trace. The Measure Bar S markers indicate the systolic velocity and time points (S) that have been automatically chosen by the system. To use, first press <strong>Freeze</strong>.</td>
</tr>
<tr>
<td><strong>Meas Bar S1 (time)</strong></td>
<td>Adjusts the position of Measure Bar S1 time markers on an automatically selected and traced spectral segment. The Measure Bar S1 markers indicate the systolic point of the next complex in the automatically traced spectral segment. To use, first press <strong>Freeze</strong>.</td>
</tr>
<tr>
<td><strong>Meas Bar S1 (vel)</strong></td>
<td>Adjusts the position of Measure Bar S1 velocity markers on an automatically selected and traced spectral segment. The Measure Bar S1 markers indicate the systolic point of the next complex in the automatically traced spectral segment. To use, first press <strong>Freeze</strong>.</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>Adjusts transmit power in decibels (dB) where 0.0dB = maximum power and -30.0dB = minimum power.</td>
</tr>
<tr>
<td><strong>Trapezoid</strong></td>
<td>Activates trapezoidal imaging, which widens the linear image to a trapezoid shape. Available only with transducers that offer this feature.</td>
</tr>
</tbody>
</table>
Noncardiac setup

With PW active, press Setup to adjust these controls. Press Setup again to return to live imaging.

**Baseline Suppress**
Removes spectral representations of frequencies below the Filter setting.

**Frequency Scales**
Turns the display of frequency scales and frequency measurements on or off.

**Interval**
Adjusts the update rate of the BMode reference image, when Duplex is off.

**Optimum Angle**
Adjusts the optimum angle-to-flow for linear transducers (PW only). Most vascular labs use 50 to 60 degrees.

**Temporal Smooth**
Adjusts the amount of horizontal spectral smoothing, to show envelope outlines according to visual preference.

**Units**
Sets the display of the Doppler velocity scale to cm/s or m/s (centimeters per second or meters per second). Changing the display units from cm/s to m/s does not change the units used for analysis. Analysis information is always displayed in cm/s.

**Velocity Smooth**
Adjusts the amount of vertical spectral smoothing, to show the most commonly occurring velocities according to visual preference.
Using PW Imaging

NOTE Angio and Color modes can be combined with PW imaging.

1. Optimize the 2D/BMode image using the keyboard imaging controls.

2. Position the cursor line with the trackball. Place the larger dot on the cursor line where you want the PW sample volume to be.
3. Touch PW, and adjust the sample volume position, as necessary. Touch Image Size to change the 2D/BMode image size. Use the Volume slider to adjust the audio.

4. Adjust the gate size with Gate Length and the estimated angle of flow with Cursor Angle.

5. Adjust the Baseline, Gain, Filter, Compress, Reject, and Scale rotary controls, as necessary. Optimize the spectral display using any PW touch controls.

Tip: Spectral turns the spectral display on or off. Activating 2D Live or BMode Live lets you more accurately place the sample volume.
Auto Trace in PW (noncardiac)

Use Trace to obtain a quick, comprehensive vascular measurement.

1. Optimize the PW image.

2. With Preset, Vascular Exam, and Carotid active, touch PW and Spectral.

Tip: You can also press Enter to enter Spectral Trace from PW preview mode.
3. Press Freeze.

Tip: When adjusting Threshold settings, a higher setting indicates lower level pixels are used in calculating the trace waveform.

4. Adjust the Threshold if necessary. Touch Trace Auto and touch the desired Trace setting (Auto, Top, or Bottom).
Nonimaging PW

1. Activate the nonimaging transducer by touching **Probe** and **Nonimage** on the left touch panel. If CW is the default for this transducer, touch **PW**. Use the Volume slider to adjust the audio.

2. Place the sample volume at the correct depth with the trackball, and then optimize the location. The audio and spectral display helps you to locate the best placement.
3. Optimize the spectral display.

4. To return to imaging, touch 2D or BMode.
Using Triplex Doppler in PW imaging

The **Triplex** control activates triplex Doppler mode. Triplex Doppler mode is the simultaneous display of a live BMode image, with a live Color or Angio image, and a live Spectral trace. Triplex is available only with the 11-3L transducer in a vascular preset.

Note the following Triplex Doppler guidelines:

- Touching **PW** or **CW** turns on **Spectral**, unless depth marks are used.
- In **PW** nonspectral mode, pressing the **Enter** key automatically turns on **Spectral**.
- **Spectral** is available in **2D/BMode**, **Color**, and **Angio** when depth marks are used.
- In **Spectral**, pressing **Enter** turns on **BMode Live** (**2D-Live** if in Cardiac).
- When **PW** is turned on, the gate automatically moves away from the edge of the image.
- Touching **Cursor Angle** when highlighted sets the angle to zero, except when **Intelligent Doppler** is active or the image is frozen.
- In **PW Spectral**, you can display **Heart Rate** from a Doppler trace and make a measurement.
To activate Triplex Doppler

1. Touch Color.

2. Touch PW, and optimize the image using the keyboard imaging controls. (If Depth Marks is set to Off in Setup, Spectral mode is automatically turned on).

3. Touch Triplex to turn Triplex mode on.

4. Touch Spectral and then optimize the image to optimize Color or Angio once Triplex is on.

**NOTE** If the scale settings are too low when Triplex is activated, adjust the Baseline to adjust the scale.

In Triplex mode, the color scale changes to match the Doppler scale.
Using CW imaging

Steerable CW

1. Optimize the 2D/BMode image using the keyboard imaging controls.

2. Position the cursor line with the trackball. Place the larger dot on the cursor line where you want the CW focal point (diamond) to be.
3. Touch CW. Touch Spectral to turn the spectral display on and off. Use the Volume slider to adjust the audio.

4. Adjust the Baseline, Gain, Filter, Compress, Reject, and Scale controls, as necessary.

5. Optimize the spectral display using any other CW touch controls.
Nonimaging CW

1. Activate the nonimaging transducer by touching **Probe** and **Nonimage** on the left touch panel. Use the Volume slider to adjust the audio.

2. Optimize the spectral display.
3. To return to imaging, touch 2D or BMode.
**PW and CW Troubleshooting**

Always make sure the active preset is appropriate for the study being performed. If necessary, adjust the \( \textstyle \Box \) and \( \square \) monitor controls for the ambient light.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not sensitive.</td>
<td>( \Box ) <strong>Power</strong>, ( \square ) <strong>Gain</strong>, ( \textstyle \Box ) <strong>Compress</strong>, and ( \textstyle \square ) <strong>Reject</strong> to increase the amount of Doppler information displayed.</td>
</tr>
<tr>
<td></td>
<td>For cardiac images, reposition the transducer to make the beam parallel to flow.</td>
</tr>
<tr>
<td></td>
<td>For vascular images, use <strong>Cursor Angle</strong> to obtain the optimal angle to flow. Position the cursor parallel to and in the same direction as blood flow. To change your preferred angle to flow, press ( \textstyle \Box ) <strong>Setup</strong> and adjust <strong>Optimum Angle</strong>.</td>
</tr>
<tr>
<td></td>
<td>Change to a lower frequency transducer.</td>
</tr>
<tr>
<td></td>
<td>Try using <strong>Colorize</strong>, to improve contrast resolution.</td>
</tr>
<tr>
<td>PW Only:</td>
<td><strong>Gate Length</strong> to increase the sample volume size.</td>
</tr>
<tr>
<td>CW Only:</td>
<td>Place the diamond (focal point) on the cursor line over the area where the greatest sensitivity is needed.</td>
</tr>
<tr>
<td>2D/BMode reference image does not update.</td>
<td>Make sure <strong>2D Hold</strong> or <strong>BMode Hold</strong> is turned off.</td>
</tr>
<tr>
<td></td>
<td>If an R-wave is present ( \textstyle \Box ) <strong>Delay</strong> or <strong>Beats</strong> and ( \textstyle \square ) <strong>Interval</strong> (all <strong>Physio Trigger</strong> controls). For systems without physios, make sure <strong>Duplex</strong> is off, press <strong>Setup</strong>, and adjust <strong>Interval</strong>.</td>
</tr>
<tr>
<td></td>
<td>Check ECG leads for proper placement.</td>
</tr>
<tr>
<td></td>
<td><strong>ECG Gain</strong> to ensure triggering.</td>
</tr>
<tr>
<td>Difficult to get a good acoustic window.</td>
<td>Try using a nonimaging transducer.</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Suggestions</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Signal is audible, but cannot see it.</td>
<td>Make sure the monitor is adjusted for the ambient light. See “Calibrating the Monitor” on page 1-13 for details.</td>
</tr>
<tr>
<td></td>
<td>Gain to display more Doppler information.</td>
</tr>
<tr>
<td></td>
<td>Compress and Reject to increase the range of echoes displayed.</td>
</tr>
<tr>
<td></td>
<td>Filter.</td>
</tr>
<tr>
<td></td>
<td>For cardiac, readjust the transducer position to get more parallel to flow.</td>
</tr>
<tr>
<td></td>
<td>For vascular, use Cursor Angle to adjust the estimated angle of flow.</td>
</tr>
<tr>
<td></td>
<td>Turn on Colorize.</td>
</tr>
<tr>
<td></td>
<td>Press Setup and make sure Baseline Suppress is off.</td>
</tr>
<tr>
<td></td>
<td>Make sure that ADP is turned on.</td>
</tr>
<tr>
<td>Spectrum is noisy.</td>
<td>Gain to display less Doppler information.</td>
</tr>
<tr>
<td></td>
<td>Filter to increase the hertz level below which audible signals are removed (fewer signals display).</td>
</tr>
<tr>
<td></td>
<td>Reject to increase the amount of low-level signal removed from the spectrum.</td>
</tr>
<tr>
<td></td>
<td>Compress to eliminate weaker signals and noise from the spectrum.</td>
</tr>
<tr>
<td></td>
<td>Make sure the sample volume is as small as possible.</td>
</tr>
<tr>
<td></td>
<td>Press Setup, Temporal Smooth and Velocity Smooth. Also make sure Baseline Suppress is on.</td>
</tr>
<tr>
<td>Area around the baseline is blackened out.</td>
<td>Filter to decrease the hertz level below which audible signals are removed (more signals display).</td>
</tr>
<tr>
<td></td>
<td>Press Setup and make sure Baseline Suppress is off.</td>
</tr>
<tr>
<td>Spectrum is speckled.</td>
<td>Press Setup, Temporal Smooth and Velocity Smooth.</td>
</tr>
</tbody>
</table>
## Spectrum is cut off.
Adjust **Baseline** to move the baseline down.
- **Scale** to increase the range of displayed velocities (also decreases the waveform size).

## Artifact in spectrum.
- **Gain**, **Filter**, and **Power**.

Tip: Mechanical heart valves occasionally cause unavoidable artifact. Artifact could also be caused by external sources such as lighting, other equipment, or telecommunications devices.
Angio Imaging

Introduction

Angio is an “amplitude-only” mode that translates the magnitudes of returning ultrasound echoes into shades of a single color. It is used mostly with Contrast Imaging, because it is more sensitive to reactions of contrast-agent microbubbles that are struck by ultrasound. Angio mode does not reveal movement velocities or directions.

NOTE

Angio imaging is not available in MMode.
Screen and Touch Panels

Angio/Color bar

Angio flow frequency

Preproc

Angio persist

Postproc

Packet size

Filter

Angio map

Angio area - adjust with trackball, and Position and Size keys

Frequency Fusion icon

<table>
<thead>
<tr>
<th>Angio Controls</th>
<th>Zoom PAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/W Suppress</td>
<td>Angio Suppress Angio Compare Sweep 50</td>
</tr>
<tr>
<td>Gain 40%</td>
<td>Density Threshold Filter</td>
</tr>
<tr>
<td>Frequency Fusion 2</td>
<td>Focus Scale Magnify 1.0</td>
</tr>
</tbody>
</table>
Controls

This section discusses controls for Angio. For information on using Angio with contrast agents in cardiac presets, see Using Contrast Imaging.

With Angio active, touch PW or CW to go into PW Angio or CW Angio (combination) mode. The second touch control (PW or CW) is highlighted, and the Angio control is outlined by a box, indicating that Angio mode is still active. To exit the combination mode, touch Angio. Now the Angio control is highlighted, indicating that only Angio mode is active.

Primary

Angio Suppress  Removes the color from an image while in Angio mode. When in combination with PW or CW, the Angio control is not lit, but is still active and the frame rate is unaffected.

Angio Compare  Compares an angio image with a grayscale version of the same image. The angio image is displayed on the right, and the grayscale version on the left.

B/W Suppress  Suppresses the black and white image that appears outside of the color image, thus increasing the frame rate. Available with sector and curvilinear array transducers.

Density  Trades off resolution versus frame rate by varying line density.

Filter  Removes low-level signals and reduces noise in image.

Focus  Repositions the acoustic depth of the angio focal zone. When Adaptive Angio is on, the focus chooses the optimal angio frequency.

Frequency Fusion  Optimizes frequencies for penetration, texture or resolution. Changes are reflected in the Frequency Fusion icon.
Imaging Modalities

Angio Imaging

Gain
Adjusts system sensitivity to received angio signals. Increasing the angio gain percentage increases the amount of color displayed.

Magnify
Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes.

Pan
When the Pan control is on, repositioning and resizing affect the color area.

Scale
Changes the range of angio flow velocities whose amplitude can be displayed. This affects the PRF. Lower the Scale to see slow flow, and increase it to see higher velocities.

Steering
Steers linear angio images to the right or left to achieve optimal angio angles. Only available with linear probes.

Sweep
Changes the sweep speed of the ECG waveform. Available speeds are 25, 50, 100, and 150 mm/sec.

Threshold
Eliminates the lowest amplitude signals, allowing you to adjust the noise level shown in the image. Available in real-time, and on acquired and retrieved loops.

Zoom
Turns zoom (magnification) on or off. To move the zoom preview area, use the trackball (Position is active when you first enter zoom preview). To resize the zoom preview area, press Size and use the trackball. Then touch Zoom again to enter full zoom mode.

Tip: When activated, Zoom is first outlined by a box. This indicates zoom preview. Touch Zoom a second time to go into full zoom.
Imaging Modalities
Angio Imaging

Secondary

**Adaptive Angio**
Changes the Angio frequency as a function of focal depth. When the Angio box is at the top (shallow depth), the highest frequency is displayed, and vice-versa.

**Angio Priority**
Displays all received Angio data by giving higher priority to Angio and overriding the BMode information.

**Backgnd**
Fills the entire color box with the lowest Angio flow velocity color.

**Colorize**
Optimizes contrast resolution by activating the current colorization map and overlaying the grayscale image. To change the active map, turn the color rotary control just under the **Colorize** touch control.

**LGCs**
(Lateral Gain Controls) Each of the eight sliders adjusts the amplification of returning signals within a specific lateral 2D/BMode or AQ image area. Available only with sector and curvilinear array transducers.

**LGC**
Touch control that turns the Lateral Gain Controls on and off.

**Magnify**
Increases or decreases the magnification factor of an image in Zoom or Zoom Preview modes. Appears as a secondary control when **Contrast** is on.

**Map**
Changes the Angio flow map used for real-time and looping. Provides a selection for user preferences.

**Packet**
Selects Angio packet size: S (small), M (medium), or L (large).

**Persist**
Adjusts the amount of frame averaging, which can give a smoother appearance.

**Power**
Adjusts transmit power in decibels (dB) where 0.0dB = maximum power and -30.0dB = minimum power. Is a primary right-touch-panel control when **Contrast** is on.
**Angio Imaging**

**Secondary Controls**
Switches between the primary and secondary touch panels. When the control is highlighted, the secondary controls are active.

**Smoothing**
Adjusts the amount of angio scan line averaging, affecting the smoothness and sensitivity of the angio display.

**Trapezoid**
Activates trapezoidal imaging, which widens the linear image to a trapezoid shape. Available only with transducers that offer this feature.
Using Angio Imaging

1. Optimize the 2D/BMode image using the keyboard imaging controls.

2. Touch Angio.
3. Adjust the location of the Angio area with the trackball. The Position key is active when you first enter Angio. To change the size of the Angio area, press Size and use the trackball.

Tip: The Angio controls work the same as the color flow (Map Invert is not available in Angio).

4. Adjust Gain.
Adaptive Angio

Adaptive Angio provides the best angio sensitivity at every depth, while keeping the PRF (Pulse Rate Frequency) scale constant. The following illustration shows Adaptive Angio side-by-side images with the color box set to different depths:

Tip: The system automatically provides the optimal angio frequency and focus.

View 1 - Angio box at shallow depth
View 2 - Angio box at deeper depth

Following are some Adaptive Angio guidelines:

- As the angio box moves to the top of the sector (shallow depth), the system uses a higher angio frequency (View 1).
- When the angio box moves to the bottom of the sector, the system uses a lower angio frequency (View 2).
- The user may override the selected frequency by
  - moving the Focus control to a new depth in the angio box
  - disabling Adaptive Angio Frequency
Angio Compare

Angio Compare mode allows you to quickly compare a live Angio image with a grayscale version of the same image. The live Angio image is displayed on the right, and the grayscale version on the left, as illustrated in the following diagram:

1. While displaying a live Angio image, touch **Angio Compare**. The live Angio image appears next to a live black-and-white image.

2. To freeze both images, press **Freeze**.

3. To display both images side by side with color suppressed, touch **Angio Suppress**.

4. To turn off compare mode, touch **Angio Compare** again.
## Angio Troubleshooting

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not sensitive.</td>
<td>☑️ Scale. Hub it could be too low.</td>
</tr>
<tr>
<td></td>
<td>Adjust <strong>Angio Gain</strong>; it could be too low.</td>
</tr>
<tr>
<td></td>
<td>Adjust <strong>Focus</strong> to point at the area of interest.</td>
</tr>
<tr>
<td></td>
<td>Choose a filter to reduce flash or improve sensitivity.</td>
</tr>
<tr>
<td></td>
<td>Reposition the transducers, or try another imaging window.</td>
</tr>
<tr>
<td></td>
<td>☑️ Power.</td>
</tr>
<tr>
<td></td>
<td>Turn <strong>Angio Priority</strong> on for small vessels.</td>
</tr>
<tr>
<td></td>
<td>Adjust <strong>Smoothing</strong>.</td>
</tr>
<tr>
<td>Need a higher frame rate.</td>
<td>Decrease the width of the Angio area by pressing <strong>Size</strong> and using the trackball.</td>
</tr>
<tr>
<td></td>
<td>For sector or curvilinear array transducers, remove the grayscale image outside the color area by turning on <strong>B/W Suppress</strong>.</td>
</tr>
<tr>
<td></td>
<td>☑️ <strong>Density</strong></td>
</tr>
<tr>
<td></td>
<td>☑️ <strong>Packet size</strong></td>
</tr>
<tr>
<td></td>
<td>☑️ <strong>Scale</strong></td>
</tr>
</tbody>
</table>
**Symptoms** | **Suggestions**
---|---
Need better Angio resolution. | Place transducer focus at location of interest with **Adaptive Angio** on.  
Vascular:  
With linear transducers, use **Steering** to achieve optimal Angio flow angles by steering the image to the right or left.  
Turn on **Angio Priority** to view small vessels.  
- **Line Density**.  
For small vessels, **Smoothing**.  
- **Packet** size.  
Go to highest frequency transducer possible.

Need better Angio filling. | **Angio Gain**.  
Adjust **Steering**.  
Adjust **Focus** with **Adaptive Angio** on.  
- **Scale**.  
- **Filter**.  
- **Packet** size.  
Use **Smoothing** to attain the desired display appearance.  
Turn **Adaptive Angio** off for evaluating deep structures.  
For slow-moving blood or structures, **Persist**.
### Imaging Modalities

#### Angio Imaging

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
</table>
| Cannot see slow moving velocities. | Adjust Gain.  
  📊 Scale to see more low-velocity blood flow information.  
  📊 Filter.  
  📊 Persist.  
  Use Steering to make color as parallel to flow as possible.  
  Adjust Focus to area of concern.  
  📊 Threshold.  
  Turn Angio Priority on to display more color.  
  Use full Power settings. |

Tip: Mechanical heart valves occasionally cause unavoidable flashing artifact. Artifact could also be caused by external sources such as lighting, other equipment, or telecommunications devices.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
</table>
| Angio image is noisy, flashing, or has artifacts. | 📊 Filter setting to remove flash.  
  📊 Angio Scale.  
  Adjust Angio Gain.  
  📊 Threshold to reject noise at lower levels.  
  📊 Smoothing to smooth the image.  
  For slow-moving blood or structures, 📊 Persist to increase frame averaging.  
  Narrow the color box to remove source of artifacts with Size control and the Trackball. |

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angio images are printed on the wrong printer.</td>
<td>Press Setup, touch Print, and adjust Color [printer] to display the printer to use for color and angio images.</td>
</tr>
</tbody>
</table>
Tissue Doppler Imaging

**Introduction**

Tissue Doppler enhances image information by translating tissue movement and vascular flow velocities into color.

**NOTE**

Tissue Doppler imaging is not available using a linear transducer.
Screen and Touch Panels (2D Tissue Doppler)

Color bar and baseline indicator

Color flow frequency

Highest mean velocity toward transducer

Preproc

Color persist

Postproc

Packet size/Filter

Color Map

Highest mean velocity away from transducer

Color Doppler area - adjust with trackball, and Position and Size keys

Color

Secondary Controls

Tissue Doppler

Zoom

B/W

Suppress

Color

Suppress

Compare

Frame Rate

Gain

50%

Baseline

Focus

Scale

Magnify

1.0

3.7 MHz

P R

T
Using Tissue Doppler Imaging

The following section describes Tissue Doppler controls and how to use them. Note the following Doppler mode guidelines:

- Touching **PW** or **CW** turns on **Spectral**, unless depth marks are used.
- In **PW** nonspectral mode, pressing the **[Enter]** key automatically turns on **Spectral**.
- **Spectral** is available in **2D/BMode**, **Color**, and **Angio** when depth marks are used.
- In **Spectral**, pressing **[Enter]** turns on **BMode Live** (**2D-Live** if in Cardiac).
- When **PW** is turned on, the gate automatically moves away from the edge of the image.
- Touching **Cursor Angle** when highlighted sets the angle to zero, except when **Intelligent Doppler** is active or the image is frozen.
- In **PW Spectral**, you can display **Heart Rate** from a Doppler trace and make a measurement.

For more information on PW and CW modes, see “PW and CW Imaging” on page 7-79.

Depending on the imaging mode being used, the **Tissue Doppler** controls include:

- **Color Gain**
- **Smoothing**
- **Color Map**
- **B/W Suppress**
- **PW Scale**
- **Reject**
- **Colorize**
- **Gate Length**
- **Compress**
- **Power**
Imaging Modalities

Tissue Doppler Imaging

These values can be adjusted and preset independently from the corresponding imaging control values outside of Tissue Doppler. Tissue Doppler is available on the s3, s4, s8, s12, and OmniPlane transducers and only in Cardiac presets. Tissue Doppler is not available when the image has been frozen using the Freeze key, and not in LVO or TCE contrast imaging modes.

There are three ways to use Tissue Doppler

- **2D Tissue Doppler:**
  a. With a 2D image displayed, touch Color in the right touch panel.
  b. Touch Tissue Doppler.

- **MMode Tissue Doppler:**
  With an image displayed and Tissue Doppler highlighted, touch MMode in the right touch panel.

- **Spectral Tissue Doppler:**
  a. Using the trackball, move the cursor into position on a color-mode or a black-and-white 2D image.
  b. Touch PW in the right touch panel.
  c. Touch Tissue Doppler in the right touch panel.
Introduction

The SONOS system allows you to add text, notes, and labels to your exam images. This chapter provides information about

- Annotation screen and touch panels (page 8-2)
- Controls (page 8-3)
- Annotation procedure (page 8-4)
- Using body markers (page 8-13)

NOTE: The annotation function is not available with Live-3D images.
To change the cursor’s home location, touch **Home Set**.

Annotation cursor – the label touched or letters typed appear here.

Active preset and mode determine labels shown – you can edit and store these.

<table>
<thead>
<tr>
<th>Annotate</th>
<th>BMode</th>
</tr>
</thead>
<tbody>
<tr>
<td>LONG</td>
<td></td>
</tr>
<tr>
<td>RIGHT</td>
<td></td>
</tr>
<tr>
<td>CCA</td>
<td></td>
</tr>
<tr>
<td>ICA</td>
<td></td>
</tr>
<tr>
<td>VERTEBRAL</td>
<td></td>
</tr>
<tr>
<td>TRANS</td>
<td></td>
</tr>
<tr>
<td>LEFT</td>
<td></td>
</tr>
<tr>
<td>BULB</td>
<td></td>
</tr>
<tr>
<td>ECA</td>
<td></td>
</tr>
<tr>
<td>JUGULAR</td>
<td></td>
</tr>
<tr>
<td>Body Marker</td>
<td>Home Cursor</td>
</tr>
</tbody>
</table>
## Controls

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arrow</strong></td>
<td>Puts an arrow graphic on the screen at the current Annotation cursor location.</td>
</tr>
<tr>
<td><strong>Body Marker</strong></td>
<td>Enters or exits the Body Marker function. When activated, displays a body marker on the screen and allocates the body marker control on the annotation touch panel.</td>
</tr>
<tr>
<td><strong>Clear All</strong></td>
<td>Removes all Annotation arrows and text from the screen.</td>
</tr>
<tr>
<td><strong>Erase Label</strong></td>
<td>Removes selected (outlined) Annotation arrows and text from the screen.</td>
</tr>
<tr>
<td><strong>Erase Marker</strong></td>
<td>Erases the body marker and exits the Body Marker function.</td>
</tr>
<tr>
<td><strong>Home Cursor</strong></td>
<td>Moves the Annotation cursor to the location specified with <strong>Home Set</strong>.</td>
</tr>
<tr>
<td><strong>Home Set</strong></td>
<td>Establishes a new home location for the Annotation cursor.</td>
</tr>
<tr>
<td><strong>Markers On/Off</strong></td>
<td>Toggles the Body Marker function on or off.</td>
</tr>
<tr>
<td><strong>Move</strong></td>
<td>Moves and anchors selected (outlined) Annotation text and arrows.</td>
</tr>
<tr>
<td><strong>Probe Size</strong></td>
<td>Selects the transducer icon. The values are a large transducer, a small transducer, an arrow, and a dot.</td>
</tr>
<tr>
<td><strong>Rotate Arrow</strong></td>
<td>Rotates the Annotation arrow displayed. If more than one arrow is displayed, you can select the arrow to rotate with the trackball.</td>
</tr>
<tr>
<td><strong>Rotate Probe</strong></td>
<td>Rotates the active transducer icon. Twelve different angles are available, corresponding to the positions on a clock.</td>
</tr>
</tbody>
</table>
Annotation Procedure

1. Touch Annotate. You can manually enter text whenever Annotate is active. To exit Annotation mode, touch Annotate again.

   The SONOS ultrasound system has a Quick Text feature that allows you to type text annotations starting from the Home location without pressing the Annotate touch control. For more information on Quick Text mode, see “Quick Text Mode” on page 8-12.

<table>
<thead>
<tr>
<th>Annotate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

   Tip: When Annotate is outlined instead of highlighted, you cannot use the trackball for Annotation. To return trackball control to Annotation, touch Annotate.

2. Use the trackball to place the Annotation cursor where you want to put a label.
3. Touch the label you want, or type your own.
Changing the Home Cursor Location

1. Touch **Annotate** and position the Annotation cursor with the trackball. Put the cursor where you want to see it when you touch **Home Cursor**.

2. Touch **Home Set**.
Editing Labels on the Screen

1. With Annotate active, use the trackball to select the label you want to change.

2. Type the new label and press Enter. If you make a mistake use \( \leftarrow \) to erase characters to the left of the cursor.
Annotation

Annotation Procedure

3. Edit additional labels, as needed. To put an arrow on the screen, place the Annotation cursor where you want the arrow. Touch Arrow, and if necessary, use the **Rotate Arrow** rotary control to change the orientation of the arrow.
Moving Annotation Labels and Arrows

1. With Annotate active, use the trackball to select the label or arrow you want to move.

2. Touch Move.

3. Reposition the label with the trackball, and press Enter to anchor it.
Erasing Annotation Labels and Arrows

1. With Annotate active, use the trackball to select what you want to delete. To delete all labels and arrows, press Erase or touch Clear All.

2. Touch Erase Label. To delete another label or arrow, repeat these steps.
Editing the Annotation Touch Panel Labels

1. With Annotate active, press [Setup].

2. Touch a label you want to edit. To remove a label, press [Erase].

3. Type the new label, and select [Okay].

4. Press [Setup] to exit Setup mode.

5. To keep your changes for future use, save them to a preset.

Tip: Hyphenate labels that do not fit on one line.
Quick Text Mode

Quick Text mode allows you to directly type a label from the Home position at any time, without entering Text Annotation mode. Quick Text mode is always active, except when you are using another application that requires the use of the keyboard, such as when you are entering patient ID information. The following figure shows a sample of Quick Text:

Using Quick Text

1. Use the keyboard to type a label to enter Quick Text mode.
2. Use the Tab key to jump from word to word when editing.
3. Press Erase when you want to erase all the text on the screen.

Tip: Pressing Erase while Annotate is off, removes all text unless a measurement is on the screen.
Using Body Markers

Your system allows you to display exam-appropriate body-marker icons on images and to indicate transducer positions.

Body markers are available for all presets. The body marker normally is displayed in the bottom right corner of the image. A graphic representing the transducer can be positioned on top of the body marker. If Dual imaging mode is on, two body markers appear (one for each image). The following figure shows a sample body marker:
Annotation

Using Body Markers

Controls

The following illustration shows the location of the individual body marker controls on the left touch panel:

- **A** **Body Marker** on/off
- **B** Select **Body Marker** rotary control
- **C** Select **Small Parts** rotary control
- **D** **Erase Marker**
- **E** **Rotate Probe** rotary control
- **F** **Probe Size** selection rotary control
- **G** **Left Active/Right Active** control (Dual mode only)
Using Body Markers

1. Touch Annotate on the left touch panel.

2. Touch Body Marker.

3. Turn the marker-category rotary control (the second from left rotary control below the left touch panel) to choose the body marker category.

4. Turn the marker-selection rotary control (the far-left rotary control below the left touch panel) to select the body marker.

5. Turn the Probe Size rotary control to select the probe graphic you want to use.

6. Use the trackball to position the probe graphic on the body marker.

7. Use the Rotate Probe rotary control to angle the probe graphic as desired.

8. Do one of the following:
   - Touch Erase Marker to remove the current Body Marker icons from the screen.
   - Touch Body Marker or Annotate to exit Body Marker Annotation mode, while continuing to display the body markers.

In Dual Mode

Using the Body Marker function in Dual mode displays two body markers, one associated with each image. You can use the trackball and body marker controls to make only one body marker active at a time.

To display body markers in Dual mode:

1. Touch Annotate in Dual imaging mode.

2. Touch Body Marker. Both body markers are displayed, but only one is active. The active image for annotation is indicated on the touch panel as Left Active or Right Active.

3. Touch the Left Active/Right Active control to select the image you want to make active and annotate.
Annotation

Using Body Markers

4. Follow the directions under “Using Body Markers” on page 8-15 to specify the body marker for the active image.

Disabling/Enabling the Body Marker Function

You can disable or enable the Body Marker function through Annotation Setup.

1. Press [Setup].

2. Touch Annotate on the left touch panel.

3. Touch Markers On/Off to disable or enable body markers.

![Markers On/Off interface]
9 Measurements

Introduction

The SONOS system allows you to extract a variety of physical measurements from live and videotaped exam images. This chapter provides information about

- Measurement screen and touch panels (page 9-1)
- Controls (page 9-2)
- Measurement setup (page 9-7)
- Online measurements (page 9-9)
- One-point depth measurements (page 9-19)
- Calibrating videotaped images for measurement (page 9-22)
- Measurement troubleshooting (page 9-24)

NOTE Measurements are not enabled on 3D renderings.

Screen and Touch Panels

The screens and touch-panel controls for each type of measurement are illustrated in the sections starting on page 9-9.
Controls

Cardiac Primary

The set of “Quick Cals” and measurements available varies with measurement type, and the active imaging mode and preset.

Box Position

Changes the placement of the measurement box currently on the screen. **Box Position** is part of the **Image** control set (left touch panel). Appears only when a measurement is on the screen.

- **Caliper**
  - Places a caliper (+) on the screen.

- **Enter**
  - Completes the active measurement.

- **Erase**
  - Removes measurements from the screen. If a trace is active, press **Erase** to back up and delete one dot at a time. To delete a series of trace dots, hold down **Erase**.

- **Freeze**
  - Freezes and unfreezes the display. Press **Freeze** and use the trackball to scroll to the best measurement site.

Hide Box

Displays or hides the measurement box. **Hide Box** is part of the **Image** control set (left touch panel). Appears only when a measurement is on the screen.

- **Trace**
  - Enables tracing on the screen.

Trackball

Positions calipers or traces areas on the screen.
Cardiac Setup

When you press [Setup] and touch Measure, the following controls appear on the right touch panel. Additionally, the Measurements Setup window appears on the imaging screen. This window is specific to the mode the system is in. See “Measurement Setup” on page 9-7 for more information.

**Ellipse Trace**
Enables area and circumference tracing by using the Trace key. Volume calculations cannot be obtained with this tracing method.

**Manual Trace**
Enables area and circumference manual tracing, which is needed for volume calculations. When Manual Trace is activated, the different methods of volume calculations, Volume MOD (Method of Discs), and Volume SPE (Single Plane Ellipse) are available.

**M-Mode Ref Line**
Provides a fixed, solid vertical line that helps you more accurately position calipers during MMode protocol measurements.
**Measurements**

**Controls**

---

**Noncardiac Primary**

The set of “Quick Calcs” and measurements available varies with measurement type, and the active imaging mode and preset.

**Box Position**

Changes the placement of the measurement box currently on the screen. **Box Position** is part of the Image control set (left touch panel).

**Caliper**

Places a caliper (+) on the screen.

**Enter**

Completes the active measurement.

**Erase**

Removes measurements from the screen. If a trace is active, press **Erase** to back up and delete one dot at a time. To delete a series of trace dots, hold down **Erase**.

**Freeze**

Freezes and unfreezes the display. Press **Freeze** and use the trackball to scroll to the best measurement site.

**Hide Box**

Displays or hides the measurement box. **Hide Box** is part of the Image control set (left touch panel).

The **Meas Bar** controls are only available when you are doing an automatic Doppler trace. You must enable Doppler Trace by pressing **Setup** and touching **Doppler Trace** on the right touch panel. To activate the **Meas Bar** control, press **Freeze** and then **Trace**.

To do a manual Doppler trace, press **Caliper** and then **Trace**.

**Meas Bar D (time)**

Adjusts the position of the Measure Bar D time markers on a Doppler Trace. The Measure Bar D markers indicate the end-diastolic velocity and time points (D) that have been automatically chosen by the system.

**Meas Bar D (vel)**

Adjusts the position of the Measure Bar D velocity markers on a Doppler Trace. The Measure Bar D markers indicate the end-diastolic velocity and time points (D) that have been automatically chosen by the system.
Measurements

Controls

<table>
<thead>
<tr>
<th>Meas Bar</th>
<th>Adjusts the position of the Measure Bar S time markers on a Doppler Trace. The Measure Bar S markers indicate the systolic velocity and time points (S) that have been automatically chosen by the system.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S (time)</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Meas Bar</td>
<td>Adjusts the position of the Measure Bar S velocity markers on a Doppler Trace. The Measure Bar S markers indicate the systolic velocity and time points (S) that have been automatically chosen by the system.</td>
</tr>
<tr>
<td>S (vel)</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Meas Bar</td>
<td>Adjusts the position of the Measure Bar S1 time markers on an automatically selected and traced spectral segment. The Measure Bar S1 markers indicate the systolic point of the next complex in the automatically traced spectral segment.</td>
</tr>
<tr>
<td>S1 (time)</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Meas Bar</td>
<td>Adjusts the position of the Measure Bar S1 velocity markers on an automatically selected and traced spectral segment. The Measure Bar S1 markers indicate the systolic point of the next complex in the automatically traced spectral segment.</td>
</tr>
<tr>
<td>S1 (vel)</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Trace</td>
<td>Enables tracing on the screen.</td>
</tr>
<tr>
<td>Trackball</td>
<td>Positions calipers or traces areas on the screen.</td>
</tr>
</tbody>
</table>
Noncardiac Setup

When you press [Setup] and touch Measure, the following controls appear on the right touch panel. Additionally, the Measurements Setup window appears on the screen. This window is specific to the mode the system is in. See “Measurement Setup” on page 9-7 for more information.

- **Doppler Trace**: Enables automatic tracing of a frozen Doppler spectrum.
- **Ellipse Trace**: Enables area and circumference tracing by using the Trace key. Volume calculations cannot be obtained with this tracing method.
- **Manual Trace**: Enables area and circumference manual tracing that is needed for volume calculations.
- **M-Mode Ref Line**: Provides a fixed, solid vertical line that helps you more accurately position calipers during MMode protocol measurements.
Measurement Setup

You can set up the measurements you want for each mode through the Measurements Setup window. You can then save the measurement configuration to a preset.

1. Press **Setup** to enter Setup mode.

2. Touch **Measure** on the right touch panel. The Measurements Setup window for the mode you are in appears. (The following illustration shows an example of a 2D Measurements Setup window.)
Measurements

Measurement Setup

3. Use the trackball to highlight the measurements you want and press [Enter]. You must check at least one box under each heading. The measurements you select appear in the measurement box on the imaging screen when you are performing the measurements.

To see the Measurements Setup window for another mode, highlight the mode and press [Enter].

4. To enable Doppler Trace, (vascular, abdominal, and OB/GYN presets) Ellipse Trace, or Manual Trace, touch the appropriate control on the right touch panel. Press [Setup] when you are done with your changes.
Online Measurements

The SONOS system allows you to perform the following online measurements:

- MMode or 2D/BMode (page 9-10)
- 2D/BMode trace (page 9-12)
- LV volume (page 9-13)
- Doppler velocity (page 9-14)
- Manual Doppler trace (page 9-15)
- Doppler auto trace (noncardiac presets) (page 9-16)
- Doppler trace (noncardiac presets) (page 9-18)
Measurements
Online Measurements

**MMode or 2D/2Mode Linear Measurements**

1. Press Freeze, scroll to the appropriate area, and press Caliper.

2. Position the starting point with trackball, and press Caliper.

3. Position the end point with trackball, and press Enter.

4. To perform additional measurements (up to four per screen), press Caliper and repeat steps 2 and 3.

AX DIST 5.5 CM
TIME 0.030 SEC
SLP 192. CM/S
The MMode Reference Line

The MMode reference line is a fixed, solid vertical line that helps you more accurately position calipers during MMode protocol measurements. When displayed, this line can be aligned with the ECG. It is locked in the vertical plane, and calipers can not be moved left or right of the line.

To enable the MMode reference line:

1. Press [Setup].
2. Touch Measure.
3. Touch MMode Ref Line.

To use the MMode reference line:

1. Press [Caliper].
2. Move the MMode reference line until it marks the point on the ECG where you want to make measurements.
3. Make MMode measurements along the reference line.
2D/BMode Trace Measurements

1. Press **Freeze**, and press **Trace**.

2. Position the starting point with trackball, and press **Trace**.

3. Trace the area to measure with the trackball, and press **Enter**.

4. To perform additional measurements (up to four per screen), press **Trace** and repeat steps 2 and 3.

If you stop moving the caliper before finishing the trace, the system closes the trace from the caliper’s position to the first dot, and the measurement values are automatically displayed. If you complete the trace manually, the new values also display.

**Erase** deletes individual trace points during an active trace, or all measurement text and graphics for completed measurements.
LV Volume Measurements

1. Press [Freeze].

2. Press [Trace] and place the caliper at the MV annulus.

3. Press [Trace], outline the endocardium area to other MV annulus with the trackball, and press [Caliper]. (The line will automatically close, giving you a better long axis.)

   To change the long axis, reposition the caliper and press [Enter].

4. To confirm line automatically drawn, press [Enter].

To use Single Plane Ellipse, see Volume SPE in the Control Summary.

If you stop moving the caliper before finishing the trace, the system closes the trace from the caliper’s position to the first dot, and the measurement values are automatically displayed. If you complete the trace manually, the new values also display.

[Erase] deletes individual trace points during an active trace, or all measurement text and graphics for completed measurements.
Doppler Velocity Measurements

1. Press [Freeze], scroll to the appropriate area, and press [Caliper].

2. Position the caliper with the trackball.

3. For velocity, press [Enter].

4. For two-point measurements, press [Caliper], put a caliper at the second point, and press [Enter].

5. To perform additional measurements (up to a total of four per screen), press [Caliper] and repeat step 2.

The active preset determines the available measurements.
Manual Doppler Trace Measurements

The active preset determines which measurements are available.

If a vascular, OB/GYN, or abdominal preset is active and Doppler Trace is on in Measurements Setup, the system can trace a portion of the spectrum you mark. Press Trace, position a caliper on the left side of the waveform, position a caliper on the right side of the waveform, and press Enter.
Doppler Auto Trace Measurements (Noncardiac Presets)

In this example Doppler Trace is turned on in Measurements Setup.

1. Press Freeze, and press Trace. Adjust Threshold if necessary to perform an accurate trace. Note that Waveform Suppress must be off to activate the blue trace line as a visual feedback for Threshold control. The system automatically traces a waveform and displays measurements and calculations according to the selected preset.

2. If necessary, use the Meas Bar time and velocity controls on the right touch panel and the related rotary controls to reposition any measurement bar on the traced segment.

The dotted line below the trace displays the mean velocity flow.

S marks the highest point detected by the system in the selected complex.

D marks the end-diastolic point.

S1 marks the highest point in the next complex.

To perform an additional measurement (up to two per screen), press Enter and repeat steps 1 and 2.
Measurements

Online Measurements

Tip: With a manual trace, up to three additional measurements can be made per screen.

To manually trace a portion of a frozen spectrum, press [Freeze], then [Caliper], and use the trackball to place the starting point to the left of the waveform. Press [Trace] and use the trackball to outline the waveform. Press [Enter] to complete the process.
Doppler Trace Measurements (Noncardiac Presets)

This section describes how to use Doppler Trace, a system function that speeds up your exam by automatically tracing the frozen spectral Doppler display, calculating key measurements, and displaying all information you need.

The SONOS system uses the end-diastolic velocity for the pulsatility index (PI) and resistivity index (RI) calculations. Some members of the medical community recommend calculating PI and RI from the minimum diastolic velocity, which may not be at end diastole. See the Measurements and Calculations Reference for more information.

1. Press [Setup] to enter Setup mode.

2. Touch [Measure] and [Doppler Trace] to disable Doppler Trace functions.
One-Point Depth Measurement

When you are scanning in BMode using a noncardiac preset, one-point depth measurement permits you to measure the depth of a caliper from the top of an image by pressing the caliper key.

Depth is calculated from the apex of the image to the center of the crosshair for sector probes, and from the transducer-edge of the image to the center of the crosshair for linear and curvilinear probes.

Pressing Enter while the crosshair is active displays the current measurement in the results box as a 2D/BMode one-point measurement.

Once you enter Analysis mode, the one-point depth measurement is unavailable.

In a trapezoidal image, one-point depths are measured:

- From the caliper along the steering angle to the skin line (depth=0) for caliper points in the linear part of the image
- From the caliper to the skin line radially towards the origin of the sector in the left-sector and right-sector parts of the image
Measurements
One-Point Depth Measurement

Making a One-point Depth Measurement

To make a one-point depth measurement press \texttt{Caliper}. The caliper is displayed on the imaging screen, and the depth measurement in a results box.

\begin{center}
\includegraphics{caliper_depth.png}
\end{center}

Making Angle Measurements in the OB Preset

To make an angle measurement in the OB preset:

1. Touch \texttt{OB/GYN Exam} on the left touch panel.
2. Touch \texttt{OB} preset.
3. Touch \texttt{Analysis}.
4. Touch \texttt{Limbs}.
5. Touch \texttt{Angle}.
6. Touch \texttt{Baseline}.
7. Use the trackball to position the free crosshair that appears, and then press \texttt{Caliper} to anchor the crosshair and get a second free crosshair.
8. Use the trackball to move the second crosshair to create and position a line. Press \texttt{Enter} to confirm.
9. Touch **α Line** to get a new crosshair, and repeat steps 7 and 8 to position and approve the α line.

10. To establish another angle, touch **β Line** to get a new crosshair, and repeat steps 7 and 8 to position and approve the β line.

Your alpha (α) and beta (β) angle measurements are displayed in a box at the top right of the screen and on the report, as shown in the illustration.
Calibrating Videotaped Images for Measurement

These steps pertain to any images that have been videotaped, even if you are viewing those images in Loop mode or Disk mode.

1. Press [Freeze].

2. Press [Caliper].

3. Use the trackball to select the mode, and then press [Enter].

4. Place the measurement caliper on a marker according to the mode, as indicated on the screen, and then press [Enter].

5. Move the caliper to another marker of the same kind. Place the second caliper as far away as possible from the first marker, and then press [Enter].

**NOTE**
For time measurements, be sure the second caliper is to the right of the first caliper. If it is not, the calculated mean values will be incorrect.

When reviewing the results of measurements made from videotape, if the maximum and mean gradients are the same value, the calibration was done incorrectly. Recalibrate the image as described in this section.

6. Enter the corresponding value indicated between the two points, and then press [Enter]. Follow any additional instructions that are displayed for this mode.

**NOTE**
When entering Doppler values, it is important to be sensitive to numeric signs. When entering a velocity value, if the value is negative, be sure to enter a negative sign with the value.

7. When you finish a measurement, press [Enter]. The system displays a “Calibration complete” message.
8. To perform additional measurements of the same type on the same frozen image, press [Caliper], highlight Same Cal, and press [Enter]. To use this method for loops, you must be making measurements on the same loop.

9. If the measurement parameters are different, or to perform a different type of measurement, repeat the above steps, starting with Step 2.
Measurement Troubleshooting

Be sure to calibrate any images that have been videotaped (or were stored with older systems), even if you are viewing those images in Loop or Disk, before making measurements.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot erase a measurement.</td>
<td>Linear measurements:</td>
</tr>
<tr>
<td></td>
<td>Press [Erase] once to remove a completed measurement; for incomplete measurements, press [Erase] twice.</td>
</tr>
<tr>
<td></td>
<td>Trace measurements:</td>
</tr>
<tr>
<td>The measurements box does not update during scrolling.</td>
<td>This can happen if the position of the Doppler line, the size of the PW gate, or the cursor angle changed.</td>
</tr>
<tr>
<td>Loop measurements disappear.</td>
<td>When you make measurements on loops acquired from videotape, measurements on loops acquired from real-time imaging are erased.</td>
</tr>
</tbody>
</table>
10 Analysis

Introduction

The SONOS system allows you to perform a variety of computations using your exam measurements. This chapter provides information about

- Analysis screen and touch panels (page 10-2)
- Controls (page 10-3)
- Customizing analysis touch controls (page 10-7)
- Analysis procedure (page 10-10)
- OB growth curves (page 10-13)
- Analysis troubleshooting (page 10-17)
Analysis

Screen and Touch Panels

Touch to see a brief description of the active measurement.

Touch these controls to use the measurements that are displayed on the screen.

The active preset and mode determine the measurement groups that are displayed here. You can customize these.

The active group above determines the displayed measurements. You can customize this.

Results are displayed only after you finish all needed measurements, shown here.

Measurements already made are outlined.

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Controls

Primary

Erase Box
Clears all entries from the results box. Available only when no measurement is active.

Explain
Briefly describes the active measurement in a window on the screen.

Keyboard Entry
Lets you enter data for any active measurement, except an MOD (Method of Discs) measurement.

Left
Selects measurements and calculations to be made for the left side of the body.

Mid/Main
Selects the report for the mid-region of the body, when performing bilateral studies, such as carotid or extremity exams. Available only with vascular, abdominal, or OB/GYN presets.

Report
Displays the Analysis report page on the screen, showing all measurements and calculations completed for the current patient. The touch controls change to pertain to the report page (whose controls are described below). Available only when no measurement is active.

Results Box
Continuously displays the most recently completed measurement or calculation value on the screen. When Results Box is off, this information is displayed for five seconds after each completed measurement or calculation. Available only when no measurement is active.

Right
Selects measurements and calculations to be made for the right side of the body.

Tip: The Measurements and Calculations training toolkit contains details on Analysis use and customization.
### Analysis

**Controls**

### Reports

When **Report** is active, controls showing report types based on the active mode and preset, appear. Touch a report type to view it.

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquire Report</td>
<td>Captures the displayed report onto a page in loop memory.</td>
</tr>
<tr>
<td>Analysis Report</td>
<td>Indicates that a report page is displayed on the right touch panel. Touching <strong>Analysis Report</strong> returns the system to the previous imaging mode.</td>
</tr>
<tr>
<td>Clear Field</td>
<td>Deletes information in the current field. Available only when <strong>Edit Data</strong> is on.</td>
</tr>
<tr>
<td>Edit Data</td>
<td>Enables editing of report data, using the trackball and keyboard. If the information entered affects other calculations, they are updated. An asterisk (*) indicates an edited value, or a calculation that used an edited value.</td>
</tr>
<tr>
<td>Erase All</td>
<td>Deletes all report data for this patient.</td>
</tr>
<tr>
<td>Left</td>
<td>Selects the report for the left side of the body when performing bilateral studies such as carotid or extremity exams. Available only with vascular, abdominal, or OB/GYN presets.</td>
</tr>
<tr>
<td>Long Format</td>
<td>Displays a report showing all measurements and calculations that are active in Setup for this preset.</td>
</tr>
<tr>
<td>Mid/Main</td>
<td>Selects the report for the mid-region of the body, when performing bilateral studies such as carotid or extremity exams. Available only with vascular, abdominal, or OB/GYN presets.</td>
</tr>
<tr>
<td>Next Page</td>
<td>Displays the next page of the report, for reports longer than one page.</td>
</tr>
<tr>
<td>Prev Page</td>
<td>Displays the previous page of the report, for reports longer than one page.</td>
</tr>
</tbody>
</table>

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Revision D.0

Analysis
Controls

Right
Selects the report for the right side of the body, when performing bilateral studies. Available only with vascular, abdominal, or OB/GYN presets.

Serial Output
Connects to a separate serial printer.

Short Format
Displays a report showing only measurements and calculations that are active in Setup and that contain data.

Setup
Of groups

With Analysis and the appropriate preset active, press [Setup]. Use the trackball and [Enter] key to highlight and confirm the choices that appear on the Analysis Setup window.

Copy
Adds a copy of the currently highlighted group to the touch panel. You can then rename that group and edit the measurements and calculations in it.

Create
Creates a new, empty group that does not contain any measurements or calculations. Use Edit (in the Meas/Calc section of the Analysis Setup window) to select the measurements and calculations to include with this group.

Delete
Removes a group and the measurements and calculations within that group from the touch panel.

Rename
Lets you enter a new name for a group on the touch panel.
**Analysis**

**Controls**

**Of measurements and calculations**

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Edit</strong></td>
<td>Lets you add, delete, or move measurements or calculations that are part of the active group.</td>
</tr>
<tr>
<td><strong>Multiple Delete</strong></td>
<td>Removes multiple measurements and calculations at one time.</td>
</tr>
</tbody>
</table>

**Of reports**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>English/Metric</strong></td>
<td>Sets the units to be used for body surface area (inches and pounds, or centimeters and kilograms).</td>
</tr>
<tr>
<td><strong>Weight Percentiles</strong></td>
<td>Enables or disables the use of weight percentile growth tables with the OB/GYN presets.</td>
</tr>
</tbody>
</table>
Customizing Analysis Touch Controls

1. Make sure the active preset and mode are appropriate for the changes you want to make. Analysis touch controls are preset and mode dependent.

<table>
<thead>
<tr>
<th>Preset</th>
<th>BMode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular Exam</td>
<td></td>
</tr>
<tr>
<td>TCD</td>
<td></td>
</tr>
</tbody>
</table>

2. Touch **Analysis** and press **Setup**.

<table>
<thead>
<tr>
<th>Analysis</th>
<th>BMode</th>
<th>PW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Analysis

Customizing Analysis Touch Controls

3. Touch the group you want to customize.

4. Highlight the task you want to do with the trackball and press Enter. Follow the instructions on the screen.

5. To customize another group, touch it and repeat the previous step.

6. When you are done, press Setup to leave Setup.

Tip: To make these changes permanent, save them to a preset.
Configuring Weight Percentiles Report Display

1. Touch **OB/GYN Exam**.
2. Touch the **OB** preset.
3. Touch **Analysis**.
4. Press **Setup**.
5. Use the trackball to select **Weight Percentiles** and press **Enter**. The **Weight Percentiles** window is displayed.

   ![Weight Percentiles Window]

6. Use the trackball and press **Enter** to select the desired fetal weight percentile:
   - Use no fetal growth curves
   - Use Brenner’s fetal growth curve
   - Use percentiles

7. Press **Setup** to exit analysis setup. See the *Measurements and Calculations Reference* for fetal weight percentiles.
Analysis Procedure

1. Touch **Analysis**. Be sure that the active mode and preset are appropriate for the measurement or calculation you want to perform.

2. Touch the group containing the measurement or calculation you want to perform.
3. Touch the measurement or calculation you want to perform. To enter a measurement value, touch **Keyboard Entry** and type a value. To use a measurement value, touch the symbol corresponding to the value that you want.

Tip: All needed measurements appear for a calculation.

4. Complete the measurement.

5. Touch the appropriate control to perform additional measurements and calculations. To perform the same measurement again, press **Trace** or **Caliper** to begin. You may have to touch another group to see the measurement or calculation you want.
6. To view the report for this patient, touch Report. Use Report controls to edit data, as necessary. Touching Report again removes the report from the screen.

The results box shows the measurement or calculation just completed.
OB Growth Curves

You can display growth graphs for obstetrical studies (obstetrical presets only). The resulting growth curves plot gestational age (GA) on the x-axis against the measurement upon which the derived age is based (for example, BPD) on the y-axis. X, O, or Δ is used when there are multiple fetuses:

- X = baby A
- O = baby B
- Δ = baby C

The fetuses are all part of the same study. The study is referred to by the patient ID, which should be the mother’s name.

The fetus under study (X, O, or Δ) is plotted against the normative curves shown on the graphs. The type of calculation plotted depends on your Obstetrics Calculation setup and the measurements you make. You can display growth graphs for up to three fetuses.
The following illustration shows a sample gestational age graph. Each biometry has its own growth curve. The curves displayed represent the 50th percentile gestational ages from established studies. Depending upon the measurements in use, curves showing +/- standard deviation from the 50th percentile are also shown. The middle curve is the norm, and curves on each side represent the standard deviations.

If an expected GA has been entered, then that value is used to determine the values shown on the x-axis. If no expected GA has been entered, but a Last Menstrual Period (LMP) has been entered, the x-axis uses the LMP value. For estimated fetal weight (EFW), you can choose to display EFW against age by LMP or against average ultrasound age (AUA) if both are available.

If you want to use the GA (LMP) parameter, an LMP value must be entered.

If more than one measurement is made for a biometry, the system plots the average value for that measurement.
Displaying Obstetrical Growth Graphs

SONOS displays obstetrical growth graphs for configured gestational age calculations. When appropriate data is acquired, SONOS plots a fetus on the graph. If data has not been acquired to produce a graph, the system displays the normative curves with the text NO DATA at the top left of the graph. The following figure shows the obstetrical growth graph controls.

To display obstetrical growth graphs:

1. Touch **OB/GYN Exam** and then the **OB Early** or **OB** preset.

2. Touch **Analysis** and then **Report**.

3. Touch **Graphs**. The system displays the first in the series of available graphs.

4. Turn the **Page** rotary control, which now appears to select the desired graphs.

5. If this is an EFW, touch **EFW vs LMP** or **EFW vs AUA** to select whether you want the graph to plot the fetal weight against a GA (LMP) parameter or against the AUA.

6. Turn the **Author** rotary control to select among the authors you have configured for EFW calculations.
Displaying OB Graphs for Multiple Fetuses

You can graph up to three fetuses on one display. By observing the different markers for each fetus (X for Fetus A; O for Fetus B; Δ for Fetus C), you can compare the data among the fetuses as well as between each fetus and the established-norm curves. You must specify the number of fetuses in the patient ID to enter and display data for more than one fetus. Data from only one study can be represented on any one graph at a time. If there is more than one calculation for a biometry, only the calculation that contributes to the AUA is plotted. If you have used different calculations to contribute to the AUA for different fetuses, a window allows you select which calculation to use. For example, if fetus A uses GA(BPD) Hadlock and fetus B uses GA(BPD) Jeanty, a window appears offering a choice between the two.

The following illustration shows a sample gestational graph for triplets.
Analysis Troubleshooting

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed calculation does not display.</td>
<td>Make sure you have completed all measurements displayed on the touch panel for this calculation.</td>
</tr>
<tr>
<td>Measurement or calculation is unavailable.</td>
<td>Touch the other groups displayed to see if the measurement or calculation you want is there. If not, press [Setup], highlight Edit under Meas/Calc, and page through the choices until you find the one you want. Touch it to add it to the touch panel, under the currently active group.</td>
</tr>
<tr>
<td>Wrong report appears.</td>
<td>Touch the report label that matches the report you want to view.</td>
</tr>
<tr>
<td>Report control is not on the touch panel.</td>
<td>Either complete the active measurement, or turn it off by touching it.</td>
</tr>
<tr>
<td>Report pages are printed on the wrong printer.</td>
<td>Press [Setup], touch Print, and adjust Report [printer] to display the printer to use for report pages.</td>
</tr>
</tbody>
</table>

**CAUTION**

On some systems, characters may appear blurred, particularly in frozen or paused studies played back from a video recording.

To assure the best possible legibility, Philips recommends the following:

- When possible, review reports and measurements live, as they are produced. Make prints at that time for later review.
- When viewing videotaped studies that contain unclear characters on paused or frozen displays, unfreeze the tape and view the information in play mode.

For additional information, consult your Philips representative.
Analysis
Analysis Troubleshooting
11 Loops

Introduction

SONOS loop controls allow you to acquire, store, retrieve, bookmark, and review looping sequences of images. This chapter provides information about

- Loop screen and touch panels (page 11-2)
- Controls (page 11-3)
- Setting up loop images (page 11-9)
- Acquiring loop images (page 11-11)
- Acquiring images in Compare Mode (page 11-16)
- Acquiring Quick Review images (page 11-18)
- Reviewing studies (page 11-21)
- Loop troubleshooting (page 11-31)

**NOTE**

See the *Using 3-Dimensional and BiPlane Imaging Guide* for details about loop controls for Live-3D imaging.
Screen and Touch Panels

This illustration shows frozen acquired images displayed in split format.

Patient ID
Newton, S.

Selected loop image

Selected image

Frame
ECG trace

Time - frame - line

Loop length - time

Page number

Loop speed

<table>
<thead>
<tr>
<th>Loop</th>
<th>2D</th>
<th>Loop Display</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Colorize</td>
</tr>
</tbody>
</table>

System Generate Edit Start | Edit End | Page 3/5 | Select Loop 1

Same Start Align Acquire Frame Delete Loop 1
Controls

Primary

The number of frames acquired in a loop varies, depending on how the loop was acquired (that is, beats versus time), the frame rate of the system, and how much memory is in the system.

- **Acquire** Captures a frame or the next series of frames onto a page in loop memory. You can also use the **Acquire Loop** touch control.
  - If **Auto Display** is on, press **Acquire** to delete the loop and press **Acquire** again to capture a new loop. Press **Enter** to accept the loop.

- **Acquire Loop** Captures the next series of frames onto a page in loop memory. You can also use the **Acquire** key.

- **Acquire Frame** Captures the next frame into loop memory. You can also use the **Acquire** key.

- **Align** Synchronizes the start and end time of two or more acquired loops.

- **Beats** Sets the number of heart beats acquired per loop. Is available only when **Loop Type** is set to **Beats**.

- **Bookmark Loop** Marks the selected loop for display when **Show Bookmarks** is touched. Touch **Bookmark Loop** again to remove bookmarking.

- **Bookmark Page** Marks the selected page for display when **Show Bookmarks** is touched. Touch **Bookmark Page** again to remove bookmarking.

- **Border** Suppresses AQ borders on looping AQ images.

- **Cancel** Cancels loop store or retrieve operations.
### Loops

#### Controls

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Suppress</td>
<td>Removes color from looping color images.</td>
</tr>
<tr>
<td>Colorize</td>
<td>Optimizes contrast resolution by activating the current colorization map and overlaying the grayscale image. To change the active map, turn the color rotary control just under the Colorize touch control.</td>
</tr>
<tr>
<td>Compare</td>
<td>Displays a real-time image beside one or more looping images. Available when Vsplit, Cropped, or Reduced Formats are active.</td>
</tr>
<tr>
<td>Delete All Pages</td>
<td>Deletes all pages in loop memory.</td>
</tr>
<tr>
<td>Delete Page</td>
<td>Marks a page for deletion while in Display mode. Once you touch Delete Page, the control changes to Undelete Page. If you change your mind, touch Undelete Page. Touching Display or Loop Display after touching Delete Page deletes a loop from loop memory.</td>
</tr>
<tr>
<td>Disk Autostore</td>
<td>Automatically stores a loop or frame to the hard or optical disk after you acquire and accept it. Images are stored under the current patient ID.</td>
</tr>
<tr>
<td>Disk Retrieve</td>
<td>Retrieves the selected study from the disk and displays it. If you want to display only selected images from a study, highlight List Contents and select the images you want to retrieve.</td>
</tr>
<tr>
<td>Disk Store</td>
<td>Stores the currently selected loop, frame, or analysis report to disk and keeps the current patient ID information.</td>
</tr>
<tr>
<td>Display</td>
<td>Shows acquired loops and frames. Touch Display again to exit Display mode.</td>
</tr>
<tr>
<td>Edit End</td>
<td>Changes the end point of a selected loop.</td>
</tr>
<tr>
<td>Edit Start</td>
<td>Changes the beginning point of a selected loop.</td>
</tr>
</tbody>
</table>
Format

Lets you select the format for acquiring and displaying loops. The formats are

- **Full**—Acquires in full screen format.
- **Cropped**—Acquires within a region of interest, the highest quad format resolution.
- **Reduced**—Acquires a quad format that lets you display the entire imaging sector.
- **Vsplit**—Acquires within a region of interest a side-by-side format. Can be used to compare two images side-by-side.

**Note:** If you turn the **Format** rotary control to **Full** before you retrieve a study, the study is displayed in the previously stored format.

While in live imaging:

- Press **Freeze** to enter Quick Review. Use the trackball for frame review.

To display frames in a looping format:

- Touch **Replay**. Press **Freeze** and touch **Acquire Frame** to acquire a frame. Press **Acquire** or touch **Acquire Loop** to acquire a loop.

**Loop Display**

Indicates that an acquired loop is on the screen. Touch **Loop Display** to return to live imaging. Appears on the right primary touch panel.

**Loop Type**

Lets you determine the length of an acquired loop. Choices are

- **Beats**—By number of heart beats
- **Time**—By seconds
Loops
Controls

Manual Entry
One of the selections available when you turn the Comment rotary control. Lets you type or change the disk storage comment. In Disk Setup the comment can be set to System Generate, Manual Entry, or an exam type. See “Setup” on page 12-6 for more information on Comment Options.

Map
Changes the color flow map used for selected color loops. Maps represent conventions and flow characteristics assigned to the active BART (Blue Away, Red Toward) or RABT (Red Away, Blue Toward) map. (Appears on the primary right touch panel when a color image is displayed.)

Map Invert
Switches between the BART (Blue Away, Red Toward) and RABT (Red Away, Blue Toward) color map conventions for selected color loops. (Appears on the primary right touch panel when a color image is displayed.)

Memory Gauge
Turns the display of the memory gauge on and off. The memory gauge shows you how much loop memory has been used and how much is available.

Replay
Shows captured frames in a loop. Available after you press Freeze during live imaging.

Same Start
Makes two or more stored loops begin at the same time. Available under the Loop Display controls.

Select Loop
Outlines the selected loop on the screen, if there is more than one loop on the page. Enables bookmarking, editing, and storing of the selected loop.

Select Off
Removes the outlines from the displayed loops.

Select Page
Outlines one page of loops on the screen. Enables bookmarking, editing, and storing of the selected page.

Select Region
Displays the markers that outline the area of the screen to be acquired as a loop. Available only when Vsplit and Cropped formats are active. Touch Select Region again to remove the markers.
<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show</td>
<td>Displays only the bookmarked loops and frames. Touch <strong>Show Bookmarks</strong> again to see all of the acquired images.</td>
</tr>
<tr>
<td>Time</td>
<td>Sets the loop length in seconds. Available only when <strong>Loop Type</strong> is set to <strong>Time</strong>.</td>
</tr>
<tr>
<td>T-Set</td>
<td>A T-Set is a multiple frame triggered set of frames. The <strong>T-Set</strong> control adjusts the number of T-Sets. The <strong>T-Set</strong> control is located in the <strong>Loop</strong> touch panel.</td>
</tr>
<tr>
<td>Zoom</td>
<td>Expands or contracts a frozen image during Loop Replay.</td>
</tr>
</tbody>
</table>
Loops

Controls

**Setup**

**Display Options**
Sets the loop display options to **Manual Display** or **Auto Display**.

**Manual display**—Does not display a loop after it has been acquired. You must manually enter Display mode by touching the Display control.

**Auto display after each acquire**—Automatically enters Display mode after a loop has been acquired, showing the acquired loop.

**Frame Lock**
Prevents video frames from being generated with different acoustic data on the even and odd fields. This touch control is active in CLR or Stress paused mode.

When active, loops are acquired at or below the video rate (30 Hz in the U.S.A., 25 Hz elsewhere), regardless of the acoustic frame rate. Eliminates jitter during slow motion playback. This control has no effect on acoustic cine acquisitions, which capture loops at the acoustic rate with no jitters.

**Scroll Right**
When **Scroll Right** is active, roll the trackball to the right to see Doppler and MMode data from the period before the image was frozen. When **Scroll Right** is inactive, roll the trackball to the left to see this data.
Setting Up Loop Images

Tip: Many loop and disk settings can be preset. You can choose many combinations to best meet your needs and store them to your own preset.

1. Press \textit{Setup}, touch \textit{Loop}, and touch \textit{Display Options} to choose the display options.

2. Using the trackball, highlight the display option you want and press \textit{Enter}. (\textit{Auto Display} is the suggested setting for cardiac presets.)
   \begin{itemize}
   \item[a] Choose \textit{Manual Display} if you do \textbf{not} want the acquired loop to display after each acquisition.
   \item[b] Choose \textit{Auto display after each acquire} if you want the acquired loop to automatically display after each acquisition.
   \item[c] Highlight \textit{Okay} and press \textit{Enter}.
   \end{itemize}
3. Press `Setup` again to leave Setup mode.
Acquiring Loop Images

You can acquire images onto multiple pages of loop memory and review them after each acquisition or review them at the end of all of the acquisitions. If your system has the digital storage and retrieval option, you can automatically store all images to disk, store the currently selected image, or bookmark certain images and store only the bookmarked images to disk.

This section discusses how to acquire loops, and the next section tells you how to acquire high-frame-rate images. Chapter 12 discusses how to store images to the optical disk. If your system has the Integrated Digital Interface option, see the Using Integrated Digital Interface (IDI) User’s Guide for setup and storage information.

Auto Display

If Auto display after each acquire is enabled, the acquired loop automatically is displayed after the acquisition.

Manual Display

If Manual Display is enabled, a white box appears in the screen’s lower right corner. The appearance of the box indicates the loop format, as follows:
Loops

Acquiring Loop Images

During acquisition, the box disappears, indicating that acquisition is in progress. When the box reappears, the acquisition is complete. You can continue acquiring or touch Display to review all acquired loops using the Page rotary control.

1. With 2D, BMode, Color, Angio, or AQ active, touch Loop. Select the desired loop length, using the Loop Type rotary control.

   You can determine the length of the loop display in seconds or by number of heart beats.

   Tip: If you want to capture a longer sweep, set the Loop Type/Beats rotary controls to a higher number, such as 10 beats.

2. Select the desired loop format. If you acquire the loop in a smaller format (Quad, Cropped, or Vsplit), you cannot view it in Full format.
3. To see how much memory the acquired loops have used, touch Memory Gauge.

4. Touch Acquire Loop or press [Acquire] to capture the upcoming series of frames into loop memory. Note that the light on the [Acquire] key turns on during the acquisition and turns off when the acquisition is complete.
5. If you are using the touch controls or if Manual Display is enabled and you want to reacquire the loop, touch Display, Delete Page, Display, and then touch Acquire Loop.

If you are using the key and Auto Display is enabled, see the next section for information on how to reacquire a loop.

NOTE: You cannot use the key to reacquire a loop if you manually enter Display mode by touching Display.
Using the Acquire and Enter Keys in Auto Display Mode

When Auto Display is enabled, you can use the Acquire and Enter keys to easily acquire, delete, accept, and reacquire loops.

1 Press Acquire to capture the upcoming series of frames into loop memory, which are displayed automatically.

2 If you are satisfied with the loop, press Enter to accept it.

3 Or, if you want to reacquire the loop:
   a Press Acquire to delete the loop.
   b Press Acquire again to capture the upcoming series of frames into loop memory.
      The light on the Acquire key turns on during the acquisition and turns off when the acquisition is complete.
   c If you are satisfied with the loop, press Enter to accept it.

When Auto Display and Disk Autostore are enabled, the loop is not automatically stored to disk until you take one of the following actions:

- Touch 2D.
- Press Enter.
- Turn the Page rotary control.
- Select another loop on a page.
- Exit Display mode.
Acquiring Images in Compare Mode

Use the **Compare** control to display a live image next to an acquired image. This can be helpful in the operating room when you want to compare a prebypass image with a postbypass image. **Compare** is only available when **Vsplit**, **Cropped**, or **Reduced** formats are selected.

The acquired loop in memory is displayed on the screen’s left side when the **Vsplit** format is selected and a live image is displayed on the screen’s right side.

1. After acquiring one or more looping images, touch **Compare**. If you are in Display mode, touch **Display** to leave Display mode.

2. To acquire a live image into loop memory, touch **Acquire Loop** or press **Acquire**.
Loops

Acquiring Images in Compare Mode

3. The newly acquired image is automatically displayed, even if your display option is set to Manual Display. Touch Display to leave Compare mode.

```
Loop

Display  Acquire Loop

Loop
```

NOTE

If you do not want the newly acquired image added to loop memory, touch Delete Loop or Delete Page to mark it for deletion. The loop is deleted when you leave Display mode.
Acquiring Quick Review Images

Quick Review allows you to capture and display images at higher frame rates, up to 300 Hz. You can use Quick Review to view an image frame by frame by scrolling with the trackball. Quick Review is always available regardless of loop format or loop memory.

When you capture an image in Quick Review by pressing `Freeze`, it is not stored in loop memory but is stored in a separate memory location. To store an image to disk, you must first transfer it to loop memory by acquiring the loop when in Replay mode.

1. With 2D or Color mode active, press `Freeze` to enter Quick Review.

   The frames that are displayed before you pressed `Freeze` are captured.
2. Use the trackball to scroll through the frames. If you want to see the loop in real time, touch **Replay**. The end points of the loop automatically cycle on the last R-to-R interval that occurred before you pressed **Freeze**.

3. Use the trackball to control the speed of the loop. Press **Freeze** and use the trackball to scroll through the image frame by frame.
Loops
Acquiring Quick Review Images

4. Use **Edit Start** and **Edit End** to adjust the start and end points of the loop.

5. Select the desired loop Format (**Full**, **Vsplit**, **Reduced**, or **Cropped**). Touch **Acquire Loop** or press **Acquire** to transfer the loop onto a page in loop memory. The system automatically returns to live imaging.

6. To acquire a frame, press **Freeze** and touch **Acquire Frame** or press **Acquire** to transfer the frame onto a page in loop memory.
Reviewing Studies

Once you have acquired all of the loops and frames for your study, you can display them and review the entire study. When you review the study, you can

- Edit the loops by changing the start and end points or synchronizing the start and end times
- Bookmark individual loops or pages so that only the bookmarked loops or pages display
- Delete individual loops or pages from loop memory
- Store individual loops or pages to disk. You also have the option of storing bookmarked loops to the current study or to a new study for the current patient.

Displaying Loops

1. If Auto Display is enabled, loops automatically are displayed after acquisition. If Manual Display is enabled, touch Display to review the loop.
Loops

Reviewing Studies

2. If you acquired more than one loop, the Page rotary control appears on the left touch panel. Turn Page to view all of the pages in the study.

The number of loops on a page varies, depending on the loop format.

3. Use the trackball to change a loop’s play back speed.

4. Press Freeze and use the trackball to view individual frames of a loop.
**Editing Loops**

**NOTE** Depending on how your storage options are set up, loops may or may not be automatically stored to disk. If loops are stored to disk, the frames between the start and end points are the portion of the loop that is stored to disk. See Chapter 12 for more information on storing images.

1. To synchronize loops, touch **Same Start** or **Align**. (You must display more than one loop on a page to see the Same Start and Align controls.)
   - **Same Start** causes loops to begin at the same time.
   - **Align** causes loops to begin and end at the same time.

2. Adjust **Edit Start** or **Edit End** to change the beginning or end point of the selected loop.
Bookmark Loops

You can bookmark individual loops or pages so that only those loops or pages are displayed on the screen. For example, you might want to bookmark the loops that you want a physician to review.

1. Turn the Page rotary control to find the loop or page that you want to bookmark.

2. If there is more than one loop on a page, turn the Select rotary control to the loop that you want to bookmark. Touch Bookmark Loop.

   The bookmark icon (a small rectangle), located in the loop’s lower left corner, appears.

3. If you want to bookmark the entire page, turn the Select rotary control to Select Page, to select all of the loops on the page. Touch Bookmark Page.

   The bookmark icon appears.

Tip: To remove a bookmark from a loop or page, select the loop or page and touch Bookmark Loop or Bookmark Page again.
4. Touch **Show Bookmarks**.

The loops or pages you bookmarked are displayed. Touch **Show Bookmarks** again if you want to see all of the acquired loops and pages.
Storing Bookmarked Loops to a New Study

You can create a subset of your study by storing only the bookmarked loops to a new study.

1. Touch Disk.

2. Touch Store All Loops.

The following window appears.

3. Highlight Bookmarked Loops and press Enter.

A new study is created for the current patient that only contains the bookmarked loops. Patient ID information is cleared after being stored with current patient information.
Deleting Loops from Loop Memory

You can mark loops and pages for deletion by using the Delete Loop and Delete Page controls. The loops are not deleted from loop memory until you exit Display mode and return to live imaging. To set up delete options, see “Setting Up Loop Images” on page 11-9.

NOTE

By default, Delete Loop and Delete Page only delete images from loop memory. Images stored on disk are not affected unless the user has selected Delete loop from disk when manually deleted from loop memory? under the Delete Options.

1. Touch the Display control to show the loops in the study.

2. Turn the Page rotary control to find the loop or page that you want to delete.
Loops

Reviewing Studies

3. If there is more than one loop on a page, turn the Select rotary control to highlight the loop that you want to delete and touch Delete Loop.

The message “Marked for Deletion” appears on the loop and the Delete Loop control changes to Undelete Loop. If you change your mind, touch Undelete Loop.

4. If you want to delete the entire page, touch Delete Page.

The message “Marked for Deletion” appears on the page and the Delete Page control changes to Undelete Page. If you change your mind, touch Undelete Page.
5. To delete the marked loops and pages from loop memory, return to live imaging by touching **Display** or **Loop Display**.
Deleting All Pages

You can delete all loops and pages from loop memory by using the Delete All Pages control.

1. Touch Display to show the loops in the study.

2. Touch Display again to unhighlight it.

3. Touch Delete All Pages. You must be in a live imaging mode to see this function.

Note: Delete All Pages only deletes from loop memory, not from the disk.
# Loop Troubleshooting

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot see frames removed from a loop.</td>
<td>Move the start and end points of the loop to their original locations with <strong>Edit Start</strong> or <strong>Edit End</strong>.</td>
</tr>
<tr>
<td>Looping image or text flickers, or looks blocky.</td>
<td>The loop was acquired when the system’s frame rate exceeded the monitor’s maximum frame rate (that is 25 Hz for European screens and 30 Hz for U.S.A. screens). If possible, reacquire the loop with a lower frame rate. Use Quick Review to acquire loops at the displayed frame rate. Or touch the <strong>Frame Lock</strong> control in <strong>Loop Setup</strong>.</td>
</tr>
<tr>
<td>Image or text on a frozen loop looks blocky.</td>
<td>If the frame rate is 40 Hz or less, scroll forward or backward one frame. Touch the <strong>Frame Lock</strong> control in <strong>Loop Setup</strong>. Use Quick Review to acquire loops at the displayed frame rate.</td>
</tr>
</tbody>
</table>
Loops

Loop Troubleshooting
12 Disk

Introduction

The standard SONOS system configuration includes an

- Internal hard disk—For temporary storage of exam images
- Optical disk drive—For permanent offline storage of exam images
- Floppy disk drive—For saving and loading system presets, upgrading software, installing software options, and servicing the system

This chapter provides information about

- Disk screen and touch panels (page 12-2)
- Controls (page 12-3)
- Formatting a disk (page 12-11)
- Initializing a disk (page 12-13)
- Configuring disk storage (page 12-14)
- Storing images to disk (page 12-21)
- Retrieving loops from disk (page 12-29)
- Deleting disk files (page 12-32)
- Optical disk troubleshooting (page 12-34)

NOTE For more information about the system floppy disk drive, see Chapter 4.

NOTE For information about storing and retrieving Live 3D images, see the Using 3-Dimensional and BiPlane Imaging Guide. (BiPlane images are stored using the system’s normal 2D loop disk controls.)
NOTE
You must be in Loop mode and touch Disk Retrieve to see the above window.
NOTE
The Optical Disk feature may not be available on your system. If your system has the Integrated Digital Interface, see the *Using Integrated Digital Interface (IDI) User’s Guide*.

### Primary

- **Copy to Optical**
  Copies disk storage and retrieval (DSR) files from the IDI hard disk to the optical disk. You can select one or more studies or files to copy.

- **Delete File**
  Lets you select and delete files or studies from the optical or hard disk.

- **Disk Space**
  Shows the amount of remaining space on one side of the optical or hard disk, in kilobytes (kB) and the approximate number of loops available.

- **End Study**
  Closes the current study and stores all loops, frames, and analysis data to disk. Patient ID information is cleared. All loops are deleted and analysis data is erased. If the system has the IDI option, all files from the ended study are sent to the network. Also is displayed as part of the **Stress** controls.
Disk Controls

Init Disk
Prepares one side of a preformatted optical disk for storage and retrieval. You must initialize each side of an optical disk before using it for the first time.

When you initialize or format a disk, you are always prompted with a window to select the target device, regardless of whether Enable Optical is on.

CAUTION: The SONOS system hard disk is initialized before shipment. Do not initialize the SONOS hard disk unless a Philips Service Representative asks you to do so. Initializing the SONOS hard disk erases all information on the disk.

List Files
Shows the names of files and studies stored on the current side of the inserted optical disk or the IDI hard disk.

Loop Display
When the Loop control is on, an image from the optical or hard disk is displayed on the screen. Touch Loop Display or 2D to return to live imaging.

Manual Entry/ System Generate
Lets you select the disk storage comment. In Disk Setup under Comment Options, the comment can be set to System Generate, Manual Entry, or an exam type.

Rebuild Database
Allows you to choose whether to reconcile or rebuild the database on the hard disk or optical drive.

The Reconcile option scans the database for the studies that are supposed to exist on the disk. If a study no longer exists on the disk, the study is removed from the database. The Reconcile option is quick, since the entire disk does not need to be scanned.

The Rebuild option scans the entire disk looking for studies and images, and creates a new database with references to each study and image found on the disk. The Rebuild option can be time consuming, since the entire disk must be scanned.
Rescue Study  Sends untransferred studies that are on the hard disk to the network storage server.

Store All Loops  Displays the Store All Loops window, which gives you the option of storing all unstored loops to the current study, storing all loops to a new study, or storing all bookmarked loops to a new study for the current patient.

Note: If Store All Loops or Bookmarked Loops is selected, the patient ID information is cleared after being stored with the current patient information. If Unstored Loops is selected, the patient ID information remains.

NOTE  To avoid possible file corruption, it is recommended that you write protect the optical disk medium prior to installing or retrieving files on a Philips SONOS or EnConcert System when using a third party program.
Disk Controls

Setup

Press [Setup] and touch Disk to adjust these controls. Press [Setup] again to exit from Setup mode.

Comment Options

Lets you choose either Exam-Type, System Generate, or Manual Entry comments. Also allows you to choose Automatic Commenting on or off and Comment Auto-Advance on or off. These comments are displayed when you store a file. See “Commenting Options” on page 12-9 for an explanation of the different options.

Format Disk

If you need to format an optical disk, you must power cycle the ultrasound system after the operation is complete. This is necessary before any further digital storage and retrieval operations can be attempted.

If you do not power cycle the ultrasound system, the following message appears: “A Format Disk has been done. The system must be powered off and powered back on before using Disk operations.” This error message occurs even if the format operation fails. For example, the error message will appear if you attempt to format a write-protected optical disk.

CAUTION: The SONOS system hard disk is formatted before shipment. Do not format the SONOS hard disk unless a Philips Service Representative asks you to do so. Formatting the SONOS hard disk erases all information on the disk.
Tip: For details on how to use Enable Optical with the IDI hard disk, see the Using Integrated Digital Interface (IDI) User’s Guide.

Note: Before viewing files on the optical disk, Philips recommends that you write-protect the optical disk on both the A and B sides before inserting it into a viewing station such as a Windows NT computer.

Enable Optical

Lets you select the optical disk as the target device when both a hard disk and an optical disk are installed. When Enable Optical is on, all system data is stored to the optical disk. When Enable Optical is off, all system data is stored to the hard disk.

This control is off by default. It is a system-wide control that, when set, remains set until you change it. The Enable Optical window appears before every disk retrieval or utility operation, and also before the first disk storage operation in a study.

When Study Mode is off and Enable Optical is on, every disk storage operation goes to the optical disk without the window prompt. However, retrieval and utility operations still require the window prompt. If Enable Optical is off, all disk operations go to the hard disk.

Network Autosend

Available under the Disk controls when you press [Setup]. Sending a complete study to a network can take some time. When you enable Network Autosend, as soon as an image is stored to the local disk, IDI begins sending the image to the network server. When Network Autosend is not enabled, the IDI system does not start sending the study to the network server until you touch End Study.

Delete Options

Lets you choose whether or not to automatically delete an acquired loop from loop memory after it is stored to disk. Also lets you choose whether to automatically delete files from the disk when they are manually deleted from loop memory.

Maximize Transfer/Frames

Works in conjunction with the Acquire 120Hz/300Hz control in 2D imaging Setup. Maximize Frames acquires images up to 300 Hz. Maximize Transfer acquires images up to 120 Hz.
Disk

Controls

Tip: To facilitate file management, **Study Mode** is on by default.

**Study Mode**

Selects a subdirectory storage format (study format) for saving images to disk. Storing and retrieving images with **Study Mode** on facilitates study management. **Study Mode must be on** to transfer studies to the network storage server. This control is “on” (highlighted) by default. **Study Mode** is a control that is stored as a preset.
# Commenting Options

<table>
<thead>
<tr>
<th>Comment Option</th>
<th>Description and Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exam-Type List</strong></td>
<td>Selects a comment from a customizable comment list. Can be used in conjunction with <strong>Comment Auto-Advance</strong>. Highlight <strong>View Exam Contents</strong> to view and edit the comment list.</td>
</tr>
<tr>
<td><strong>Tip:</strong> The comment list can be customized and saved to a preset.</td>
<td></td>
</tr>
<tr>
<td><strong>System Generate</strong></td>
<td>Generates a comment automatically for the acquisition. Comments are unique and include references to exam type, preset, system mode, and a unique counter (for example, <em>Vas Carotid PW01</em>). Each system-generated comment includes a mnemonic symbol to identify the imaging mode that produced the image, such as <strong>PW</strong> in the above example. The mnemonic symbols are</td>
</tr>
<tr>
<td></td>
<td><em>2d</em>—2D/Bmode, PW (spectral off), or CW (spectral off)</td>
</tr>
<tr>
<td></td>
<td><em>3D</em>—Live 3D</td>
</tr>
<tr>
<td></td>
<td><em>3DZ</em>—3D Zoom</td>
</tr>
<tr>
<td></td>
<td><em>4FV</em>—3D Full Volume</td>
</tr>
<tr>
<td></td>
<td><em>Ang</em>—Angio in 2D/BMode, PW (spectral off), or CW (spectral off)</td>
</tr>
<tr>
<td></td>
<td><em>AQ</em>—Acoustic Quantification</td>
</tr>
<tr>
<td></td>
<td><em>BP</em>—BiPlane</td>
</tr>
<tr>
<td></td>
<td><em>Col</em>—Color in 2D/BMode, PW (spectral off), or CW (spectral off)</td>
</tr>
<tr>
<td></td>
<td><em>CW</em>—CW (spectral on)</td>
</tr>
<tr>
<td></td>
<td><em>CWA</em>—CW Angio (spectral on)</td>
</tr>
<tr>
<td></td>
<td><em>CWC</em>—CW Color (spectral on)</td>
</tr>
<tr>
<td></td>
<td><em>IBS</em>—IBS</td>
</tr>
<tr>
<td></td>
<td><em>M</em>—MMode</td>
</tr>
<tr>
<td></td>
<td><em>MC</em>—MMode Color</td>
</tr>
<tr>
<td></td>
<td><em>PW</em>—PW (spectral on)</td>
</tr>
<tr>
<td></td>
<td><em>PWA</em>—PW Angio (spectral on)</td>
</tr>
<tr>
<td></td>
<td><em>PWC</em>—PW Color (spectral on)</td>
</tr>
</tbody>
</table>

Tip: The comment list can be customized and saved to a preset.
### Disk Controls

<table>
<thead>
<tr>
<th>Comment Option</th>
<th>Description and Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manual Entry</strong></td>
<td>Allows you to enter a comment for each acquisition file, if <strong>Automatic Commenting</strong> is off.</td>
</tr>
<tr>
<td><strong>Automatic Commenting on</strong></td>
<td>Disables the DSR comment box. The image is stored with the current comment automatically applied to the file. Select the comment using the <strong>Comment</strong> rotary control before storing the loop.</td>
</tr>
<tr>
<td><strong>Automatic Commenting off</strong></td>
<td>Enables the DSR comment box, which appears on the imaging screen when storing a loop. The DSR comment box displays the comment that will be saved when the image is stored to disk. You can edit the comment before the file is stored.</td>
</tr>
<tr>
<td><strong>Comment Auto-Advance on</strong></td>
<td>Used only in conjunction with exam-type commenting. On each subsequent loop store, the comment is advanced to the next item on the exam-type list. If the Auto-Advance feature is off, the comment remains the same unless it is changed with the <strong>Comment</strong> rotary control.</td>
</tr>
</tbody>
</table>
Formatting a Disk

You must format an optical disk before using it for the first time, if the manufacturer did not preformat the disk. (The SONOS hard disk comes preformatted.) If you need to format an optical disk, you must power cycle the SONOS system (that is, turn the system off and then on again) after formatting has completed, to continue with digital storage and retrieval operations.

**CAUTION**

Do not format or initialize the hard disk unless requested to by your Philips service representative. Formatting an optical disk or hard disk erases all information on the disk.

1. Touch Disk, and press **Setup**.

2. With the **Enable Optical** touch control on, touch **Format Disk**.
3. Select **Optical Disk**, highlight **Okay** with the trackball, and press **Enter**.

Depending on disk capacity, formatting can take up to one hour. You can continue to image while the disk is being formatted. To format the other side of the disk, turn it over and touch **Format Disk** again.

<table>
<thead>
<tr>
<th>Target Disk Selection</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>〇 Hard Disk</td>
</tr>
<tr>
<td></td>
<td>● Optical Disk</td>
</tr>
<tr>
<td><strong>Okay</strong></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE** If your system has the Integrated Digital Interface option, you must power cycle the system after formatting a disk. See the *Using Integrated Digital Interface (IDI) User’s Guide* for more information.
Initializing a Disk

Initializing a disk prepares the preformatted disk for storage and retrieval and also erases all files on the disk. You can initialize both hard disks and optical disks. (The hard disk comes preinitialized.) The optical disk must be initialized before use. You must initialize each side of an optical disk before using it for the first time.

**CAUTION**

Do not format or initialize the hard disk unless requested to by your Philips service representative. Initializing an optical disk or hard disk erases all information on the disk.

1. Touch Disk.

2. Touch Init Disk. It takes about 10 seconds per side to initialize a disk, depending on disk capacity.
Configuring Disk Storage

Use the following controls to set up the disk options:

- Study Mode
- Enable Optical
- Delete Options
- Network Autosend
- Comment Options
- Maximize Transfer/Frames

1. With a formatted disk in the optical disk drive, press Setup, and touch Disk.

<table>
<thead>
<tr>
<th>Maximize Transfer</th>
<th>Format Disk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Mode</td>
<td>Enable Optical</td>
</tr>
<tr>
<td></td>
<td>Delete Options</td>
</tr>
<tr>
<td></td>
<td>Network Autosend</td>
</tr>
<tr>
<td></td>
<td>Comment Options</td>
</tr>
</tbody>
</table>

2. **Study Mode** is on by default. Storing and retrieving files with **Study Mode** on facilitates file management.
3. Touch **Enable Optical** if you want to store data on an optical disk. **Enable Optical** is off by default.

4. Touch **Delete Options** to choose the autodelete settings.
5. Use the trackball to select the autodelete options and press Enter. The system defaults to No for both options, including **Delete loop from memory after successful store to disk?** This means that loops that have been stored on the disk are not deleted from loop (CLR) memory. You may review and edit your studies on the ultrasound system. When you choose **Delete loop from disk when manually deleted from loop memory?**, the manually selected image is deleted from loop memory and the optical or hard disk simultaneously. (Touching **End Study** clears all loops from loop memory.)

**Note:** Delete options can be preconfigured depending on the selected preset. Always check setup to be sure that the delete options are adjusted appropriately before you begin loop acquisition.

Note: If you select Yes for **Delete loop from disk when manually deleted from loop memory?** and then touch **Delete all pages**, the system deletes only from loop memory.
6. Touch **Network Autosend** when you want to send images to the network server while the session is in progress. This command is available under the **Disk** touch controls when you press **Setup**.

Sending a complete study to a network can take some time. When you enable **Network Autosend**, as soon as an image is stored to the local disk, IDI begins sending the image to the network server. When **Network Autosend** is not enabled, the IDI system does not start sending the study to the network server until you touch **End Study**.

7. Touch **Comment Options**.
8. Use the trackball to select the comment options, select Okay, and press Enter.

When you store a loop:

- If System Generate is on and Automatic Commenting is on, the image is automatically stored to disk with the system-generated comment. No DSR comment box appears and you cannot edit the comment.
- If System Generate is on and Automatic Commenting is off, the DSR comment box appears containing the system generated comment (in the screen’s lower left corner). You can accept the comment by using the trackball to choose Okay, or you can press Erase and type in your own comment.

Comment: Car Adlt Col

Okay Cancel
Disk

Configuring Disk Storage

- If Manual Entry is on and Automatic Commenting is off, the DSR comment box is blank. Type in the comment or use the Manual Entry control on the left touch panel to select a comment, use the trackball to select Okay, and press Enter.

9. Select View Exam Comments to display the exam-type comments.

10. To edit a comment, select it with the arrow and press Enter. Type in the desired comment, highlight Okay and press Enter to accept the new comment list. Press ← on the keyboard to move to the next comment.

11. (Optional) To clear all of the comments, highlight the entire box and press Erase.

12. Touch Maximize Transfer. The control changes to Maximize Frames. Touching the control switches between the two options. Maximize Transfer sets the maximum frame rate to 120 Hz. Maximize Frames sets the maximum frame rate to 300 Hz.
Disk
Configuring Disk Storage

13. Press \textit{Setup} to leave Setup mode.
Storing Images to Disk

You can store images to disk by touching one of the following controls:

- **Disk Autostore**—Available under the *Loop* control. Automatically stores a loop or frame after you acquire and accept it. Images are stored under the current patient ID. Disk Autostore allows both automatic and manual displays.

- **Disk Store**—Available under the *Loop* control. Stores the currently selected loop, frame, or analysis report to disk. Images are stored under the current patient ID.

- **Store All Loops**—Available under the *Disk* control. Displays the *Store All Loops* window, which gives you the option of storing all unstored loops to the current study, storing all loops to a new study, or storing all bookmarked loops to a new study.

**NOTE**

If *Store All Loops* or *Bookmarked Loops* is selected, the patient ID information is cleared after being stored with the current patient information. If *Unstored Loops* is selected, the patient ID information remains.

Using these storage controls in conjunction with *Auto Display on* or *Auto Display off* provides you with a variety of acquisition and storage options. The following pages give you some examples of the most common scenarios. You can choose the options that best fit the needs of your environment.

**NOTE**

Always use *End Study* to close the current study and store all loops, frames, and analysis reports to disk. *End Study* also clears memory and patient ID and analysis information, so you are ready to start your next study.
Disk
Storing Images to Disk

Using Disk Autostore with Auto Display

Use Disk Autostore in conjunction with Auto Display to acquire a loop, review it, and decide whether or not you want to store it to disk. This configuration provides you with a quality check on the loops stored to disk because you can review the loops during the exam and easily reacquire them, if necessary. Then, if the loops are acceptable, you can accept them, and they are automatically stored to disk.

NOTE
Disk Autostore on and Auto Display on are the suggested settings for cardiac presets.

1. Touch Loop.

2. To automatically display each loop after you acquire it:
   a. Press [Setup].
   b. Touch Display Options.
   c. Select Auto Display after each acquire.
   d. With the trackball highlight Okay and press [Enter].
   e. Press [Setup].

NOTE
When Network Autosend is enabled, Disk Autostore is forced on. The Disk Autostore control is not available.
3. Touch **Disk Autostore** to enable it.

4. Press **Patient ID** and enter the patient information. (See “Setting up the Exam” on page 6-2 for more information.)

5. Acquire the desired loops, frames, or report pages.

   Each image is acquired to a page in loop memory, and the system automatically displays the image.

6. If the image is acceptable, press **Enter**.

   As the image is being stored to disk, a disk icon appears in the screen’s upper right corner. The system returns to live imaging, and you can continue acquiring images during the disk storage process. However, you cannot perform any disk utility or retrieval operation until the storage process is complete.

7. If the image is unacceptable, press **Acquire** or touch **Delete Page**.

   The image is deleted from loop memory and is not stored to disk. The system returns to live imaging.
Using Disk Autostore with Manual Display

Use **Disk Autostore** in conjunction with **Manual Display** to automatically store acquired loops without stopping to review them. Everything you acquire is automatically stored to disk and you can continue acquiring while the images are being stored. This configuration can be helpful if you want to review your studies off-line or at a later time.

1. Touch **Loop**.

2. To store the loops directly to disk without reviewing them:
   a. Press **Setup**.
   b. Touch **Display Options**.
   c. Select **Manual Display**.
   d. With the trackball highlight **Okay** and press **Enter**.
   e. Press **Setup**.

3. Touch **Disk Autostore** to enable it.

4. Press **Patient ID** and enter the patient information. (See “Setting up the Exam” on page 6-2 for more information.)
5. Acquire the desired loops, frames, or report pages.

Each image is acquired to a page in loop memory and is automatically stored to disk. During acquisition, the white box in the screen’s lower right corner disappears, indicating that acquisition is in progress. A disk icon appears in the screen’s upper right portion while the image is being stored. The system returns to live imaging, and you can continue acquiring images during the disk storage process. But you cannot perform any disk utility or retrieval operation until the storage process is complete.

6. When you are done imaging, you can touch **Display** to see the images you have acquired and stored.

All of the images have the disk icon in the screen’s lower left corner indicating that they have been successfully stored to disk.
Using Disk Store with Auto Display

Use Disk Store in conjunction with Auto Display to acquire a loop, to review it, and to decide whether you want to store it to disk or reacquire it. This configuration provides you with a quality check and can be helpful if you want to review the images during the exam so you can easily reacquire them, if necessary.

1. Touch Loop.

2. To automatically display each loop after you acquire it:
   a. Press [Setup].
   b. Touch Display Options.
   c. Select Auto Display after each acquire.
   d. With the trackball highlight Okay and press [Enter].
   e. Press [Setup].

3. Press [Patient ID] and enter the patient information. (See “Setting up the Exam” on page 6-2 for more information.)

4. Acquire the desired loops, frames, or report pages.

   Each image is acquired to a page in loop memory and the system automatically displays the image.

5. If the image is acceptable, touch Disk Store.

   The image is stored to disk, and a disk icon appears in the screen’s upper right portion while the image is being stored. The system returns to live imaging, and you can continue acquiring images during the disk storage process. But cannot perform any disk storage or retrieval operations until the storage process is complete.

6. If the image is unacceptable, press [Acquire] or touch Delete Page.

   The image is deleted from loop memory and is not stored to disk. The system returns to live imaging.
Using Store All Loops

Use Store All Loops to

- Store all of the unstored loops to the current study. For example, you can enable Manual Display, continually acquire loops without stopping to review them, and then store them all to disk at the end of the study. The patient ID is retained.
- Store all loops to a new study with current patient data. You can choose this option to make a copy of your study. The patient ID is cleared after storage.
- Store all bookmarked loops to a new study with current patient data. You can create a subset of your study by bookmarking specific loops and storing only those bookmarked loops to a new study. (This is described in Chapter 11.) The patient ID is cleared after storage.

1. Touch Loop on the left touch panel.

2. If you do not want to review the loops, set the loop display options to Manual. If you want to display each loop after acquiring it, set the loop display options to Auto after each acquire.
   a. Press Setup.
   b. Touch Display Options.
   c. Select Auto Display after each acquire or Manual Display.
   d. With the trackball, highlight Okay and press Enter.
   e. Press Setup.
Disk

Storing Images to Disk

3. Press [Patient ID] and enter the patient information. (See “Setting up the Exam” on page 6-2 for more information.)

4. Acquire the desired loops, frames, or report pages.

5. Bookmark specific loops, if desired. (See Chapter 11 for details on bookmarking.)

6. Touch Disk.

7. Touch **Store All Loops**. The following window appears.

8. Choose one of the following options:

   - **Unstored loops**—Stores all of the loops to the current study. A disk icon appears in the screen’s upper right corner while the image is being stored. Patient ID is retained.

   - **All Loops**—Stores all of the loops to a new study with current patient data. The message “Creating Study for” and a disk icon appear in the screen’s upper right corner while the image is being stored. Patient ID is cleared after storage.

   - **Bookmarked Loops**—Stores all of the bookmarked loops to a new study with current patient data. The message “Creating Study for” and a disk icon appear in the screen’s upper right corner while the image is being stored. Patient ID is cleared after storage.
Retrieving Loops from Disk

1. Touch **Loop**.

2. Touch **Disk Retrieve** to see studies matching the current patient ID.

   The system displays a list of studies that match the current patient ID information. If there is no match, a message appears telling you that the patient ID does not exist.
Disk

Retrieving Loops from Disk

3. To see a list of just the patient IDs on the current side of the disk, select Change Patient. To see a list of all of the patient IDs and associated studies on current side of the disk, select Display All from the Change Patient window.

4. Use the trackball to position the arrow over the study you want to retrieve and press Enter.

   With the trackball highlight Okay and press Enter. You can also choose the study to retrieve by pressing Enter twice. To select multiple items from the list, check Select Multiple Items.

   You can select multiple items in the List Contents window only.

   All of the images in the selected study are loaded into loop memory for review. You can start reviewing the images using the Page rotary control before all of the images have been loaded into loop memory.
5. To see a list of all of the files in the study, highlight **List Contents** and press **Enter**.

![List Contents](image)

6. To return to live imaging, touch **Loop Display** or **2D** on the right touch panel.

![Loop Display](image)
Deleting Files from Disk

1. Touch Disk and then touch Delete File.

2. Using the trackball, move the arrow to the study you want to delete. Press Enter to highlight each selection. If you want to delete files from within a study, highlight the study and select List Contents.

Tip: To quickly delete all files on the hard disk or one side of an optical disk, touch Init Disk.
3. With the trackball highlight **Okay** and press **Enter**. A window appears asking you to confirm the deletion.

4. Highlight **Okay** and press **Enter** to delete the file.
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<tr>
<th>Symptoms</th>
<th>Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot store files to the disk.</td>
<td>Make sure the image or loop you want to store is displayed.</td>
</tr>
<tr>
<td></td>
<td>Make sure the optical disk is initialized.</td>
</tr>
<tr>
<td></td>
<td>Make sure the optical disk is not write-protected.</td>
</tr>
<tr>
<td></td>
<td>Make sure the optical disk media is compatible with the current SONOS revision. See the table on page 4-5 for more information.</td>
</tr>
<tr>
<td>Optical disk fills up prematurely and gives a “Disk Full” message, even when sufficient disk space is available.</td>
<td>Rebuild the Optical Disk Database weekly to update the database files, and to allow full capacity use of the optical disk. Do these steps:</td>
</tr>
<tr>
<td></td>
<td>1. Touch <strong>Disk</strong>.</td>
</tr>
<tr>
<td></td>
<td>2. Touch <strong>Rebuild Database</strong>.</td>
</tr>
<tr>
<td></td>
<td>3. Touch <strong>Rebuild</strong>.</td>
</tr>
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