Vevo® 3100

User Manual

FUJIFILM | VISUALSONICS

Legal Notices

FUJIFILM | VISUALSONICS

North American Headquarters: FUJIFILM VisualSonics Inc., 3080 Yonge Street, Suite 6100, Box 66, Toronto, Ontario, CANADA, M4N 3N1

T. 1-416-484-5000

F. 1-416-484-5001

Toll free 1-866-416-4636

European Headquarters: FUJIFILM VisualSonics, Joop Geesinkweg 140, 1114 AB Amsterdam, The Netherlands

T. +31.20.808.2913

Toll free +800.0751.2020

Manufacturer: FUJIFILM SonoSite, Inc., 21919 30th Drive SE, Bothell, Washington, USA, 98021

T. 1-425-951-1200

F. 1-425-951-1201

Toll free 1-888-482-9449

Internet: www.visualsonics.com

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Contents

Getting Started

Warning: Do not use the system if it exhibits erratic or inconsistent behavior. Such behavior may indicate a system failure. Contact "Technical Support" on page 732.

About the system

The Vevo Imaging System is a software-controlled device that acquires and displays high-resolution, real-time ultrasound images. Available features depend on your system configuration, transducer, and operational mode.

This manual describes both the Vevo 3100 Imaging System and the Vevo LAZR-X Imaging System (includes a Vevo 3100 Imaging System with a Class 4 Laser).

Intended use

The Vevo Imaging System is a general purpose ultrasound system intended for diagnostic imaging and fluid flow analysis on small animals in the laboratory environment.

Warning: THIS EQUIPMENT IS NOT APPROVED FOR USE ON HUMANS.

The Vevo 3100 Imaging System and Vevo LAZR-X Imaging System have been designed and tested for use on laboratory research animals.

This equipment must not be used on any living human being.

Basic operating steps

Vevo 3100 Imaging System

1 Connect a transducer. See "Transducers" on page 57.

2 Turn on the system. See "Starting up and shutting down" on page 40 for the Vevo 3100 Imaging System.

3 Select an application type. See "Application" on page 65.

4 Scan. See "Scanning" on page 374.

5 Enter study and series information. See "Working with studies" on page 230.

6 Export data. See "Exporting images from the Study Browser" on page 253.

Warning: Do not use the Vevo 3100 Imaging System for human applications.

Warning: Use only the power cord provided by FUJIFILM VisualSonics with the system.

Caution: If the Vevo 3100 Imaging System is used in a manner not specified by FUJIFILM VisualSonics, you void the terms of the product warranty, and the protection provided by the equipment may be impaired.

Vevo LAZR-X Imaging System

Warning: Before you begin using the Vevo LAZR-X Imaging System, you must read the safety warnings and cautions provided in the "Vevo LAZR-X Imaging System safety" on page 709 to prevent unnecessary exposure to radiation.

Warning: If the laser is altered for any reason, you assume the risk that is associated with a Class 4 laser.

Laser radiation: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Laser radiation: Avoid eye and skin exposure to direct or scattered radiation.

1 Connect a transducer. See "Connecting and disconnecting transducers" on page 63 for the Vevo LAZR-X Imaging System.

2 Turn on the system. See "Starting up and shutting down" on page 67 for the Vevo LAZR-X Imaging System.

3 Select an application type. See "Application" on page 65.

4 Initialize the laser. See "Laser Calibration" on page 608.

5 Scan. See "Scanning" on page 374.

Note: Once the laser has been powered on (via the main power switch on the back of the laser cart, ON button on the top of the laser cart or releasing the emergency stop button), you must wait 20 minutes for the laser to warm up–until such time, the laser will not lase.

6 Enter study and series information. See "Working with studies" on page 230.

7 Export data. See "Exporting images from the Study Browser" on page 253.

Warning: Do not use the Vevo LAZR-X Imaging System for human applications.

Warning: Use only the power cord provided by FUJIFILM VisualSonics with the system.

Caution: If the Vevo LAZR-X Imaging System is used in a manner not specified by FUJIFILM VisualSonics, you void the terms of the product warranty, and the protection provided by the equipment may be impaired.

About the Vevo User Manual

The *Vevo User Manual* is intended for a user familiar with ultrasound. It does not provide training in sonography, ultrasound or lasers. Before using the Vevo 3100 Imaging System or Vevo LAZR-X Imaging System, in-depth training from an experienced user, such as a FUJIFILM VisualSonics Applications Specialist, is recommended.

This manual provides detailed descriptions and procedures for configuring and using the Vevo 3100 Imaging System and Vevo LAZR-X Imaging System. The first half of the manual provides an overview of the systems and the commonly used features, regardless of which imaging mode you are using. The second part of the manual covers image acquisition and the detailed analysis of your images, in each imaging mode.

Document conventions

Warning: Introduces precautions that prevent injury or death.

Laser radiation: Introduces precautions that prevent laser radiation exposure.

Caution: Introduces precautions that prevent damage to the equipment.

Important: Introduces important information that you need to be aware of.

Note: Introduces helpful information for you to better understand the subject matter.

- Numbered steps in procedures must be performed in order (includes lists using lower-case roman numerals).
- Lower alpha lists display choices.
- Bulleted lists in procedures can be performed in any order.
- The step in a single-step procedure begins with ♦.

Getting more information

In addition to the *Vevo User Manual*, the following are available:

- *Vevo 3100 Getting Started Guide* provided with the Vevo 3100 Imaging System.
- On-system version of the user guide can be accessed by tapping **MORE**, and then **Help**.

- Vevo Imaging System "Quick start tutorial for ultrasound sessions" on the next page.
- Technical Support, see "Technical Support" on page 732.
- Scientific Support, see "Scientific Support" on page 732.
- Vevo Integrated Rail System III Operator Manual (available in PDF).
- FUJIFILM VisualSonics Guides (available in PDF).

Quick start tutorial for ultrasound sessions

This tutorial provides a high-level overview for acquiring and analyzing an image and then exporting your data.

Acquiring, analyzing and exporting a B-Mode image analysis

Before you begin:

- Ensure that you have connected a transducer to the transducer port on the front of the cart.
- If you are imaging an animal ensure that the animal is properly prepared on the animal platform, and ensure that the animal is connected to the physiological data monitoring system.

Warning: Before using the Vevo 3100 Imaging System users must read and observe the safety warnings and precautions listed in "Vevo 3100 Imaging System safety" on page 697.

To acquire and analyze a B-Mode image and export your analysis

1 Ensure the system is plugged in, and the main power switch is on.

2 Push the Power button to start the system. See "Starting up and shutting down" on page 40.

3 Log in, or use the **Guest** button. See "Logging on for the first time" on page 207.

4 Choose an application from the transducer panel. The B-Mode imaging window appears and the system begins acquiring B-Mode data. See "Application" on page 65.

5 Refine your image using the various control panel controls such as Image Depth, Gain, and Orientation. See "Scanning" on page 374 and "B-Mode controls" on page 420.

6 Tap **Freeze** to stop the data acquisition. See "Freeze" on page 689.

7 Tap **Save Clip** to save the clip in the buffer. See "Saving images" on page 690.

8 Slide the **Slide to Scan** control to resume the data acquisition.

9 Continue imaging and use **Freeze** and **Save Clip** as required. You can also save during scanning using **Save Clip**.

10 Tap the **Current Series** navigation button to view all your saved images for the current series. You can also see these images in the **Study Browser**. See "Current series" on page 247 and "Data Management" on page 227.

11 Tap a thumbnail to open it for review. The mode window appears and plays the stored clip. You can navigate through the images stored in the series using the **Next/Previous** arrow buttons.

12 Pause the clip and navigate to a frame where you would like to place a measurement.

13 Tap **Measurements** and select a measurement. If you do not see the Measurements button on the controls bar, go to **More Controls**. See "Measurements" on page 271.

14 The measurement appears on the image. Place the measurement by dragging the calipers. When you are done, save your image by tapping **Save Clip**.

15 On either the Current Series page or the Study Browser, tap the **More** button and then the **Report** button to view the Report. See "Reports" on page 262.

16 From the Study Browser, tap the **Export** button. See "Exporting from the Study Browser" on page 252. Here, you can:

- Export **To Vevo LAB** to export your whole study for further analysis.
- Export to **Other File Types** to export clips, images, and other file formats.

If you have exported your files to Vevo LAB, you can continue with more advanced analysis tools that are only available in Vevo LAB software.

Acquiring, analyzing and exporting a PA-Mode image analysis

PA-Mode (Photoacoustics Mode) is available with the Vevo LAZR-X Imaging System.

To acquire and analyze a PA-Mode image and export your analysis

Before you begin:

- Ensure that you have connected the Vevo Optical Fiber to the appropriate port according to your imaging needs (Signal 680-970 nm, Idler 1200-2000 nm).
- Eye safety is the greatest concern. Be aware at all times that this is a Class 4 laser—the highest and most dangerous classification. Specular reflections from the main beam off a polished surface can cause severe eye damage. Use the following information and contact your Laser Safety Officer (LSO) to provide appropriate protection.

Wavelength (nm)	Nominal Optical Diameter (µm)	Maximum Permissible Exposure	Nominal Ocular Hazard Distance
1064	6.1	50 mJ/m^2	15.17 km
532	6.8	41.4 J/m^2	210 m

Warning: Before using the Vevo LAZR-X Imaging System users must read and observe the "Vevo 3100 Imaging System safety" on page 697 and "Vevo LAZR-X Imaging System safety" on page 709.

Laser radiation: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Laser radiation: Avoid eye and skin exposure to direct or scattered radiation.

1 Ensure the system is plugged in, and the main power switch is on. Push the power button to start the system. See "Starting up and shutting down" on page 40 for the Vevo 3100 Imaging System.

2 Ensure the laser is plugged in, and the main power switch is on. Turn the key to the Enable position, then push the power On button to start the laser. See "Starting up and shutting down" on page 40 for the Vevo LAZR-X Imaging System.

3 Log in, or use the **Guest** button. See "Logging on for the first time" on page 207.

4 Choose an application from the transducer panel. The B-Mode imaging window appears and the system begins acquiring B-Mode data. See "Application" on page 65.

5 Tap the **PA (Photoacoustics)** button, but do not tap Start.

6 If the laser hasn't been initialized, the system software will automatically begin the laser Initialization process and a progress bar will be displayed.

7 Once initialization is complete, the Laser Configuration panel will be displayed. To configure the laser, see "Laser Calibration" on page 608.

8 Adjust your region of interest within the PA-Mode Guide Area. (Optional) Enable the Guide Line, see "PA Guide" on page 559

9 Tap **Start**. Refine your image using the various control panel controls such as Image Depth, Width, and Gain. See "Scanning" on page 374 and "PA-Mode controls" on page 587.

10 The system will scan in PA-Mode (Single) at the default wavelength of 750 nm.

(Optional) Tap the Spectro, Oxy-Hemo or Multi-wavelength button to switch to that PA-Mode sub-mode.

11 Tap **Freeze** to stop the data acquisition. See "Freeze" on page 689.

12 Tap **Save Clip** to save the clip in the buffer. See "Saving images" on page 690.

13 Slide the **Slide to Scan** control to resume the data acquisition.

Continue imaging and use **Freeze** and **Save Clip** as required. You can also save during scanning using **Save Clip**.

14 Tap the **Current Series** navigation button to view all your saved images for the current series. You can also see these images in the **Study Browser**. See "Current series" on page 247 and "Data Management" on page 227.

15 Tap a thumbnail to open it for review. The mode window appears and plays the stored clip. You can navigate through the images stored in the series using the **Next/Previous** arrow buttons.

16 Pause the clip and navigate to a frame where you would like to place a measurement.

17 Tap **Measurements** and select a measurement. If you do not see the Measurements button on the controls bar, go to **More Controls**. See "Measurements" on page 271.

18 The measurement appears on the image. Place the measurement by dragging the calipers. When you are done, save your image by tapping **Save Clip**.

19 On either the Current Series page or the Study Browser, tap the **More** button and then the **Report** button to view the Report. See "Reports" on page 262.

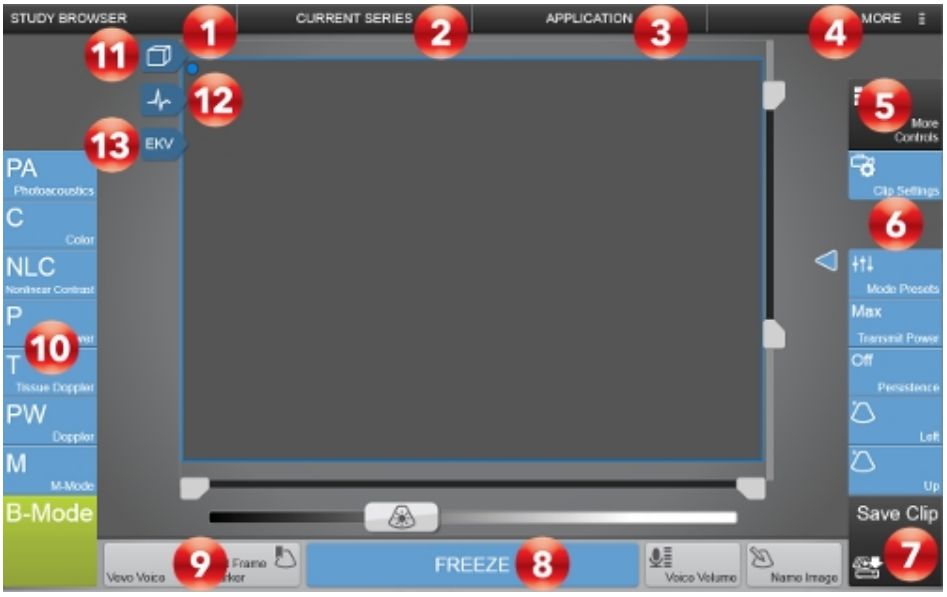
20 From the Study Browser, tap the **Export** button. See "Exporting from the Study Browser" on page 252. Here, you can:

- Export **To Vevo LAB** to export your selected study for further analysis.
- Export to **Other File Types** to export clips, images, and other file formats.

If you have exported your files to Vevo LAB, you can continue with more advanced analysis tools that are only available in Vevo LAB software.

Control panel

The control panel is where you adjust your imaging settings, select the study, series, transducer, or imaging mode and more. As you adjust the image settings or controls, the results appear on the image display. When an image is frozen, the control panel displays an outline of the image.



Control Panel Elements:

1. Study Browser
2. Current Series
3. Application
4. More
5. More Controls
6. Imaging controls bar

7. Save Clip
8. Freeze
9. General controls bar
10. Scanning modes
11. Physiology setup
12. 3D/4D tab
13. EKV/Laser tab*

*The EKV tab is displayed when acquiring in B-Mode, and the Laser Tab (not displayed in the image above, but is displayed below) is only displayed while acquiring in PA-Mode.

You interact with the control panel the same as with many other touchscreen devices:

- Drag – Move one or two fingers across the panel, usually to move an object from one location to another.
- Swipe – Move your finger quickly across the panel—faster than dragging.
- Tap – Quickly touch the panel once; for example, to activate a control.
- Double tap – Quickly touch the panel twice with one or more fingers.
- Pinch or spread – Slide two fingers together or apart on the panel.

You can also choose to use a stylus on the control panel. Please keep the following in mind when selecting your stylus:

- Use a stylus with a non-marking tip.
- Select a stylus with a touch area of ≥ 7 mm in diameter.
- Select a stylus that is designed for a capacitive touch screen.
- If using a stylus with a precision disc, take care to clean the disc before using it on the control panel and store the stylus in its original packaging when not in use.

Use the following gestures to perform the following actions:

Gesture	Action
Drag	• Adjust depth or gain • Move Color Doppler Mode or PA-Mode box • Move measurement calipers • Move PW Doppler Mode, PW Tissue Doppler Mode , or M-Mode sample volume line • Move PW Doppler Mode or PW Tissue Doppler Mode baseline • Move or drag annotations • Pan image in zoom area • Move through frames in a clip • Move controls to the Controls bar • Unfreeze a frozen image by dragging the **Slide to Scan** slider

Gesture	Action
Swipe	• Scroll through tables and pages • Scroll through PW Doppler Mode, PW Tissue Doppler Mode, or M-Mode data
Tap	• Freeze • Save an image • Select calipers • Select an imaging control or setting • Select a pane when reviewing a 3D or 4D-Mode image with multiple panes • Select a thumbnail in the Study Browser or Current Series screen to open it for review
Double tap	• Load an image into review from the Study Browser by double tapping the image row • To enable the caps lock function on the onscreen keyboard, double tap the shift key
Two finger spread or pinch	• Sample volume size • Resize zoom area by using a two finger spread action to zoom in and a two finger pinch to zoom out

Onscreen keyboard

You can enter text into text boxes using the onscreen keyboard.

Onscreen keyboard:

1. Alpha keys. Tap and hold the alpha keys to reveal options for selecting accented versions of the characters.
2. Shift key. Changes alphabet keys to capitals, caps lock and international characters.
3. Displays the number keys, symbols, and special characters keyboards.
4. Jumps to previous text box.
5. Advances to next text box.
6. Spacebar.
7. Hides the keyboard or saves entered text.
8. Starts a new line or advances to next text box.
9. Deletes character on left side of pointer.

To enter text using the onscreen keyboard

1 Tap a text box (for example, the study name) and the onscreen keyboard appears.

2 Tap keys as needed.

To switch keyboards

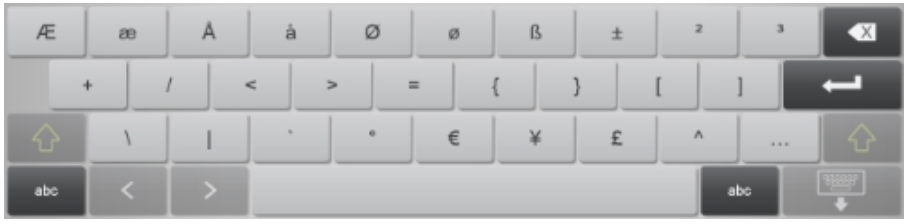
1 Tap a text box (for example, the study name) and the onscreen keyboard appears.

2 Tap the **123#?** button. The number and symbols keyboard is displayed.

3 To return to the alpha keyboard, tap the **abc** button.

4 Tap the shift key to display the arrow outlined in green.

5 The special characters keyboard is displayed.



To enable the caps lock function

1 Tap a text box (for example, the study name) and the onscreen keyboard appears.

2 Double tap the shift key to display the arrow in solid green.

Vevo 3100 Imaging System overview

The Vevo 3100 Imaging System houses the electronics, software and monitors that control the transducer and laser functions, and processes the image data.

The Vevo 3100 Imaging System provides various imaging modes. Frame-based image modes capture images in frames, based on two-dimensional B-Mode data. Time-base imaging modes capture images measured in seconds, based on unique source data characteristics.

Vevo 3100 Imaging System imaging modes

Frame-based image modes	Time-based image modes	Additional modes
B-Mode	M-Mode and Anatomical M-Mode (AM-Mode)	3D Mode
Color Doppler Mode	Pulsed Wave (PW) Doppler Mode	4D-Mode
Power Doppler Mode	PW Tissue Doppler Mode	RF Mode
Nonlinear Contrast Mode		
EKV Mode		
PA-Mode		

Starting up and shutting down

Before you power up the Vevo 3100 Imaging System, ensure that the AC power cord is plugged into the wall outlet using the proper plug, and that the main power switch on the back of the bottom of the system base is turned on.

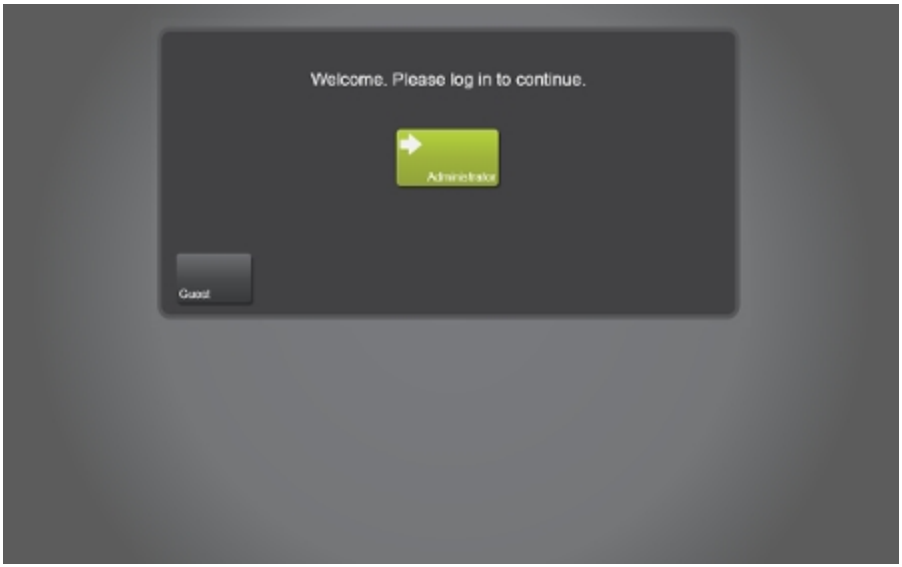
Press the power button and once the system is on you must log in to begin your imaging session.

Location of power cord connection and main power switch.

Location of the Power button.

To login for a typical imaging session

1 Once powered on, the system software starts and displays the login page.



2 The user ID defaults to the Administrator. If you are not the Administrator tap the **Guest** button, or select your user ID.

Note: Your user account must be created by the administrator before it can be used for log in. See "User Management" on page 206.

3 Enter your password and tap **Log in**.

4 The home page is displayed.

To log out and leave the system in standby

1 Tap the **Log Out** button located at the top of the control panel.

If Log Out is not displayed, tap **More** to see the other available options.

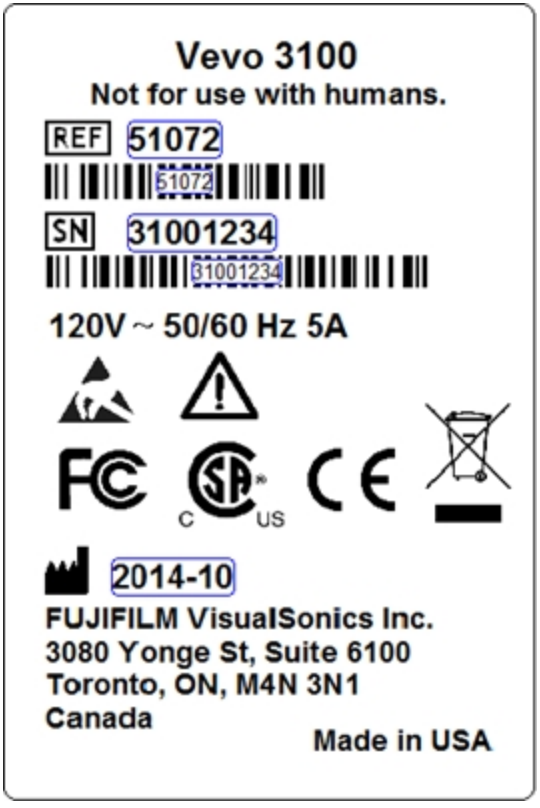
Vevo 3100 Imaging System components

Vevo 3100 Imaging System views

Vevo Imaging System front view

Vevo Imaging System back view

System label



The system label is located on the top of the system enclosure.

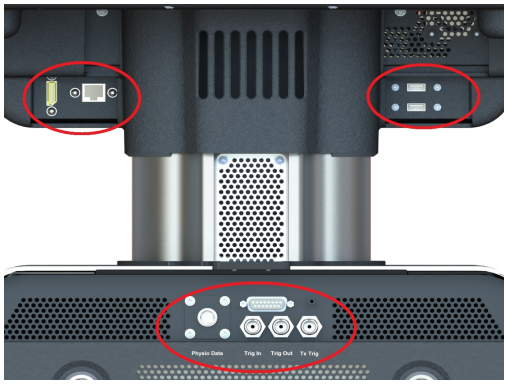
Symbols on the system label

Symbol	Description
	Conformité Européenne. Product meets the safety requirements of the European Union.
	Proof of product compliance (electrical, gas and other safety standards) to North American safety standards.
	Device authorized under the FCC Declaration of Conformity procedure.
	European Union WEEE (Waste Electrical and Electronic Equipment) Directive. Identifies the directive on waste electrical and electronic equipment.
	Catalog number.
	Serial number.
	Manufacturer.
	Caution, consult the user guide.

System connections

System connectors on the bottom of back of stand base. Includes: Fuse box and AC in.

System connectors on the back of image display. Includes: HDMI and headphone jack connectors.



System connectors on the back of system. Includes: Physio/ECG 10-pin locking connector, 3D motor connector, TX Trigger, Trig In, Trig Out, Ethernet connector, USB connectors, and Display Port Connector.

System connectors on side of system. Includes: USB connectors.

Warning: Do not modify the power plug or use an adapter. This could cause an electrical hazard. If you need to use a different plug, contact Technical Support. See "Technical Support" on page 732.

Warning: Do not move the system when the plug is connected to the power outlet.

Warning: Before connecting the system ensure that the voltage is correct.

Warning: Ensure the power cable is undamaged before plugging the system directly into the wall outlet. Do not connect the system's power supply to an MPSO or extension cord. The voltage is specified on the composite safety warning label, located on the top of the system enclosure.

Connections on the back of the system

Connector	Description
Fuse box	The fuse box is located between the Main Power switch and the AC In socket. The fuse box contains replaceable fuses that must be replaced by a FUJIFILM VisualSonics service technician.
AC In	Connect the power cable here.
Physio Data	*Connect the animal physiological monitoring system cable here.
3D motor	*Connect your 3D motor stage cable here.
TX Trigger	Not used for any Vevo Imaging System.
Trig In	If you have a Vevo LAZR-X Imaging System connect a BNC cable from here to the Lamp Sync Out connector on the back of the laser.
Trig Out	If you have a Vevo LAZR-X Imaging System connect a BNC cable from here to the Q Trig In connector on the back of the laser.

Connector	Description
USB connectors	Connect your USB equipped data storage device here. If you have a Vevo LAZR-X Imaging System connect the USB/DB-9 cable from here to the RS232 Remote connector on the back of the laser.
Ethernet	Connect your network data cable here.
DisplayPort++	Connect an optional monitor here. DisplayPort++ is V1.2. **Note:** FUJIFILM VisualSonics recommends using the HDMI port for a second monitor.
** Optional FUJIFILM VisualSonics accessory.*	

Connections on the side of the system

Connector	Description
USB connectors	Connect your USB equipped data storage device here.

Connections on the image display

Connector	Description
HDMI	Connect a second monitor via an HDMI video cable here. The software will automatically detect a remote monitor and mirror what is displayed on the image display. HDMI video output resolution is 1920 x 1080.

Connector	Description
Headphone jack	Connect a headphone jack for audio left and right output (TRS or TRRS plug configuration). **Note:** Once a headphone jack is connected, the internal speakers and HDMI audio will be disabled.

With the exception of the Ethernet network cable, cables being connected to the ultrasound cart must be 3 m (9' 10") in length, or shorter.

Handles

Use the front and back handles (grab bars) when you are moving the system. Don't use the handles to lift the system as they are not designed to bear the weight of the system.

Transducer and gel holder

Use the transducer or gel holders located on the left and right sides of the system to store gel bottles and transducers. Store both items facing up.

FUJIFILM VisualSonics recommends the use of an ultrasound gel that is acoustically correct for the range of frequencies used and is completely aqueous—use gels with properties similar to *Aquasonic® 100 Ultrasound Transmission Gel*.

Transducer connector storage

Store an inactive transducer by sliding the transducer connector into one of the four shelves in the transducer connector storage.

Transducer connector storage with transducer connector

Castors

Castors allow the Vevo Imaging System to be moved easily. The four castors can be locked using a lever located above each castor. The castors are locked when their levers are down.

Warning: Lock the castors whenever the system is unattended or stationary.

Internal data storage devices

- Hard drive 1 (Windows® operating system, Vevo software)
- Hard drive 2 (study storage)
- USB connectors (4) for exporting image data to an external device

Note: You do not need to eject a connected USB device before removing.

Network connection

The computer unit includes a 100 MB/s Ethernet network connection.

Image display

The LED monitor features an adjustable mounting arm so you can position the monitor according to your needs.

The image display shows the ultrasound image as well as details about the imaging session and system status.

To adjust the image display angle

♦ Grasp the image display on both sides and then tilt or rotate it.

To collapse the image display

Always collapse the image display before moving or shipping the system.

1 Adjust the control panel angle to the lowest position.

2 Grasp the image display on both sides, and then align it squarely above the control panel.

3 Fold the image display downward over the control panel until it is horizontal.

Important: Folding the image display past the horizontal position may damage the monitor or support.

Image display collapsed for system transport.

Warning: To avoid possible injury from an unexpected image display collapse when moving a system, collapse the image display before the system is moved.

Warning: Do not place anything on the collapsed image display.

Control panel

The control panel can be adjusted at any angle from flat to vertical. The control panel provides a touch screen user interface. See "Control panel" on page 32.

To adjust the control panel angle

♦ Grasp the sides of the control panel, and then pull forward or push backward to the desired angle.

Speakers

Integrated speakers on the image display provide audio for the following situations:

- An audio representation of the blood flow acquired in PW Doppler Mode to complement the image on the PW Doppler spectral display.
- Confirmation that an image was saved. See "System Sounds" on page 173.
- Keyboard tones when typing with the onscreen keyboard. See "System Sounds" on page 173.

Note: If you have a headphone jack plugged into the back of the image display, the internal speakers and HDMI audio will be disabled.

Isolation transformer

The isolation transformer that powers the system is located inside the system and protects you and the equipment from electrical shock and power surges.

The Vevo 3100 Imaging System is designed to operate according to the electrical specifications of the region to which the system has been shipped.

The composite safety warning label on the top of the system enclosure specifies the electrical requirements.

The Vevo 3100 Imaging System features a power module that integrates the AC In socket, the power switch, and a removable fuse box with replaceable fuses.

To protect the AC mains (the power switch on the system) from overcurrent damage, the Vevo 3100 Imaging System fuses can be replaced. If the fuse blows, it must be replaced by a FUJIFILM VisualSonics service technician.

Warning: If you cannot power on the system, unplug the machine immediately and contact "Technical Support" on page 732.

Plug

Your Vevo 3100 Imaging System is equipped with the appropriate plug for a wall outlet. Check the power plug to ensure that the plug is suited for the configuration of your wall outlet.

Important: For optimal system performance, use a dedicated, interference-free grounded/earthed wall outlet.

The power cable is securely connected to the Vevo 3100 Imaging System with a cable retainer. If you need to remove the power cable from the cart, unlock the retainer.

Power cord connector and cable retainer.

Warning: Do not modify the power plug or use an adapter. This could cause an electrical hazard. If you need to use a different plug, contact Technical Support . See "Technical Support" on page 732.

Warning: Do not move the system when the plug is connected to the power outlet.

Warning: Before connecting the system ensure that the voltage is correct.

Warning: Ensure the power cable is undamaged before plugging the system directly into the wall outlet. Do not connect the system's power supply to an MPSO or extension cord. The voltage is specified on the composite safety warning label, located on the top of the system enclosure.

Transducers

Caution: Only MX transducers manufactured by FUJIFILM VisualSonics may be used with the Vevo 3100 Imaging System or Vevo LAZR-X Imaging System.

The transducer offers the following features:

- Designed ergonomically for rapid screening procedures.
- 256-element linear array detector.
- Delivers a usable frame rate of more than 500 frames per second depending on the transducer model you use and the field of view you have set for your image acquisition.
- Connects to the front of the Vevo Imaging System.

The following table lists the transducers that can be used with both the Vevo 3100 Imaging System and the Vevo LAZR-X Imaging System.

Transducer	Description	3100	LAZR-X*
MX201	• Rat cardiovascular and abdominal (>400 g) • Rabbit (cardiovascular)	✓	✓

Transducer	Description	3100	LAZR-X*
MX250	• Rat cardiology and abdominal (<400 g) • Large tumor imaging (up to 23 mm in diameter) • All contrast applications	✓	✓
MX250S	• Rat abdominal (<300 g) • Mouse cardiology for aortic banding models • Mouse abdominal • Small tumor imaging (up to 15 mm in diameter) • All contrast applications	✓	✓
MX400	• Optimized for mouse cardiovascular • Rat abdominal • Rabbit eye • All vascular (mouse, rat, rabbit)	✓	✓

Transducer	Description	3100	LAZR-X*
MX550D	• Mouse vascular • Mouse/rat embryology • Mouse abdominal • Reproductive • Small tumor imaging (up to 14 mm in diameter) • Small rat vascular • Some abdominal (kidney)	✓	✓

Transducer	Description	3100	LAZR-X*
MX550S	• Optimized for mouse/rat embryology • Some abdominal (kidney) • Epidermal imaging • Mouse abdominal • Reproductive • Small tumor imaging (up to 13 mm in diameter) • Mouse vascular • Small rat vascular • Some abdominal (kidney) • Ophthalmology	✓	✓
MX700	• Mouse embryology • Epidermal imaging • Superficial tissue • Subcutaneous tumors (<9 mm) • Mouse vascular • Ophthalmology	✓	

Transducer	Description	3100	LAZR-X*
**When imaging with the Vevo LAZR-X Imaging System, you must use a Vevo Fiber Jacket and a Vevo Optical Fiber with an MX transducer to image successfully in PA-Mode. The transducers listed for the Vevo LAZR-X Imaging System are transducers that are available for use when imaging in PA-Mode (Photoacoustics) only.*			

Caution: Only use coupling gels with properties similar to *Aquasonic® 100 Ultrasound Transmission Gel* for use with your Vevo Imaging System.

Caution: Only transducers manufactured by FUJIFILM VisualSonics may be used with your Vevo Imaging System.

Storing transducers

Store the nose of the transducer in the transducer and gel holder on either side of the Vevo 3100 Imaging System. Position the transducer nose upward.

You can also store the transducer cables on the cable hooks; there are four hooks available.

Store an inactive transducer by sliding the transducer connector into one of the four shelves in the transducer connector storage.

Transducer connector storage with transducer.

When you move a transducer from one facility to another, always use the supplied packaging. Follow these guidelines when you store the transducer in its packaging:

- Make sure that the transducer is clean and dry before you store it in the supplied packaging.
- Place the transducer in the supplied packaging carefully so the cable doesn't kink.
- Don't store the transducer in areas of extreme temperatures or in direct sunlight.
- Store the transducer separately from other instruments so it is does not get damaged accidentally.

Transducer and gel holder

Use the transducer or gel holders located on the left and right sides of the system to store gel bottles and transducers. Store both items facing up.

FUJIFILM VisualSonics recommends the use of an ultrasound gel that is acoustically correct for the range of frequencies used and is completely aqueous—use gels with properties similar to *Aquasonic® 100 Ultrasound Transmission Gel*.

Connecting and disconnecting transducers

Important: Be aware that you can switch a transducer at any time. You can switch during a live scan, after acquiring an image and during review of an image. The Vevo 3100 Imaging System software allows for users to switch transducers without any negative affect to the current study or imaging session.

Caution: If damage is evident, do not use the transducer, and contact Technical Support.

Transducer interface	Transducer connector
	

To connect a transducer to the Vevo 3100 Imaging System

1 Turn the handle on the transducer clockwise to the vertical (unlocked) position; follow the directional label on the transducer to lock and unlock the handle.

2 Slide the transducer connector into the transducer bay underneath the control panel.

3 Push the transducer connector into the transducer interface.

4 Rotate the handle on the transducer counterclockwise to the horizontal (locked) position and push down on the handle to lock the transducer.

Transducer bay with transducer connected

To disconnect a transducer from the Vevo 3100 Imaging System

1 Flip the transducer connector handle up and rotate clockwise to the vertical (unlocked) position.

2 Pull the transducer connector away from the transducer interface.

3 Slide the connector up and out of the transducer bay.

Cleaning and disinfection

For information on cleaning and disinfecting the system and transducers, see "Cleaning and disinfecting" on page 736.

Application

An application is a predefined group of image acquisition settings that allow you to acquire an optimal image to work with in a very short period of time.

The system includes various default system applications depending on the transducer you are working with.

When you start the system, select the application package for the work you are doing.

MX250 transducer with the Rat (Small) Cardiology application selected.

To switch applications for the attached transducer

♦ Switch to another application by tapping the **Application** navigation button and selecting the desired application for the attached transducer.

See "Applications and Presets" on page 135 for more information on customizing applications and their associated mode-based presets.

Vevo LAZR-X Imaging System overview

The Vevo LAZR-X Imaging System includes the Vevo 3100 Imaging System and a Class 4 laser. A Class 4 laser is the highest and most dangerous classification. Take precautions to prevent accidental exposure to both direct and reflected beams.

Warning: Before you attach the laser to the system and acquire data, read all of the safety warnings, cautions and procedures included in "Vevo LAZR-X Imaging System safety" on page 709.

To connect the laser, see "Starting up and shutting down" below.

To calibrate the laser, read "Laser Calibration" on page 608

The Vevo LAZR-X Imaging System provides various imaging modes. Please see the modes listed in the "Vevo 3100 Imaging System imaging modes" on page 39.

Starting up and shutting down

Warning: Only those who have been formally trained by FUJIFILM VisualSonics to use this laser system may operate the Vevo LAZR-X Imaging System.

Laser radiation: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

1 Ensure that the AC power cord from the system is plugged into the wall outlet using the proper plug.

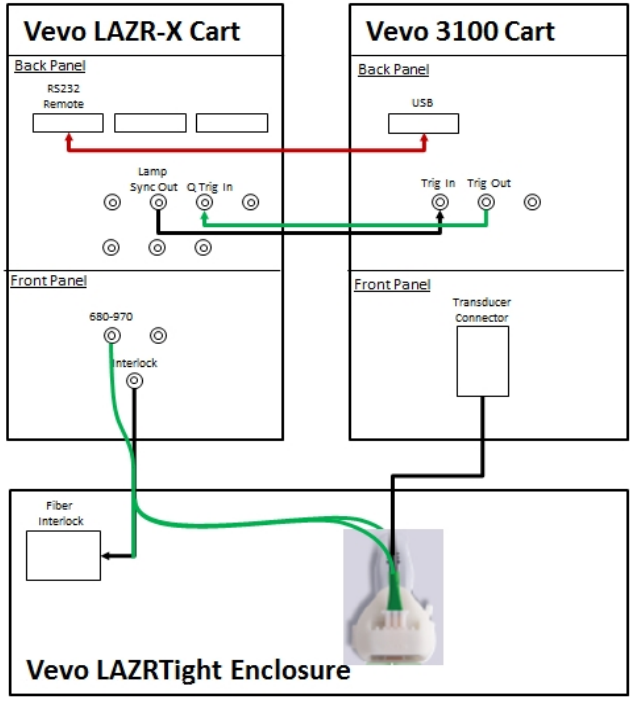
2 Turn on the main power switch on the back of the system.

3 Ensure that the AC power cord from the laser cart is plugged into the wall outlet using the proper plug.

4 Turn on the main power switch on the back of the laser cart.

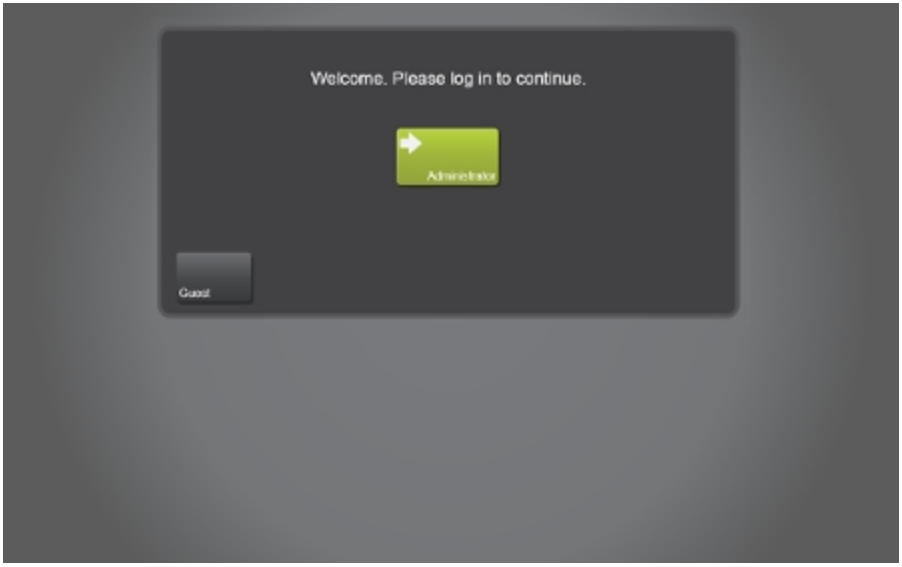
5 Confirm the following cables are connected from the system to the laser cart. If using a Vevo LAZRTight, refer to the diagram below.

System	Laser
Trig Out	Q Trig In
Trig In	Lamp Sync Out
USB	RS232/Remote



6 Ensure the key switch is turned to the 'Enable' position and that the ON button is pushed on the top of the laser cart.

7 Once powered on, the system software starts and displays the log in page.



8 The user ID defaults to the Administrator. If you are not the Administrator tap the **Guest** button, or select your user ID.

Note: Your user account must be created by the administrator before it can be used for log in. See "User Management" on page 206.

9 Enter your password and tap **Log in**.

10 The home page is displayed.

To log out and leave the system in standby

1 When you want to log out and leave the system running in standby, tap the **Log Out** button located at the top of the control panel.

If the button is not displayed, tap the **More** button to see the other available options.

Vevo LAZR-X Imaging System components

The Vevo LAZR-X Imaging System includes a Vevo 3100 Imaging System and a Class 4 Laser; all of the components listed in the "Vevo 3100 Imaging System components" on page 43 apply to the Vevo LAZR-X Imaging System.

Vevo LAZR-X Imaging System views

Vevo LAZR-X Imaging System front view.

Vevo LAZR-X Imaging System back view.

Vevo LAZR-X laser cart label

The laser cart label is located on the top of the Vevo LAZR-X Imaging System laser.

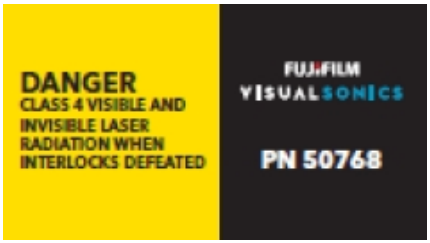
Symbols on the Vevo LAZR-X laser cart label

Symbol	Description
CE	Conformité Européenne. Product meets the safety requirements of the European Union.
FC	Device authorized under the FCC Declaration of Conformity procedure.

Symbol	Description
	European Union WEEE (Waste Electrical and Electronic Equipment) Directive. Identifies the directive on waste electrical and electronic equipment.
	Catalog number.
	Serial number.
	Manufacturer.
	Read usage instructions. This symbol instructs the user to consult the instructions of the device for information on how to properly use it. See the Vevo LAZR-X Getting Started Guide, Vevo Help and this manual.
	Laser radiation warning. Danger of laser radiation when performing certain operations and when the danger of exposure is at its greatest. Also used when optical hazards are present.

Additional warnings

Label	Location
	Laser radiation warning. Danger of laser radiation when performing certain operations and when the danger of exposure is at its greatest. Also used when optical hazards are present. Located on the front of the laser below the fiber ports and on the transducer fiber optic ferrule.
	Indicates the presence of high voltage which may pose a danger to the user or equipment. Disconnect the power supply before servicing the system. Located on the side panel and also to the right of the AC plug connector.
	Located on the top panel.
	Possible laser radiation exposure warning. Located on the front of the laser below the fiber ports.

Label	Location
	Laser defeater warning label. When the laser defeater is plugged into the delivery interlock on the laser cart, visible and invisible laser radiation is emitted.

Additional labels

Label	Description
	OEM label. Includes the address, model number, part number, serial number, CDRH declaration of conformity and the date/country of manufacture.
	Voltage rating. Located below the AC power cord connector on the back of the laser.

Vevo LAZR-X laser connections

Front of laser

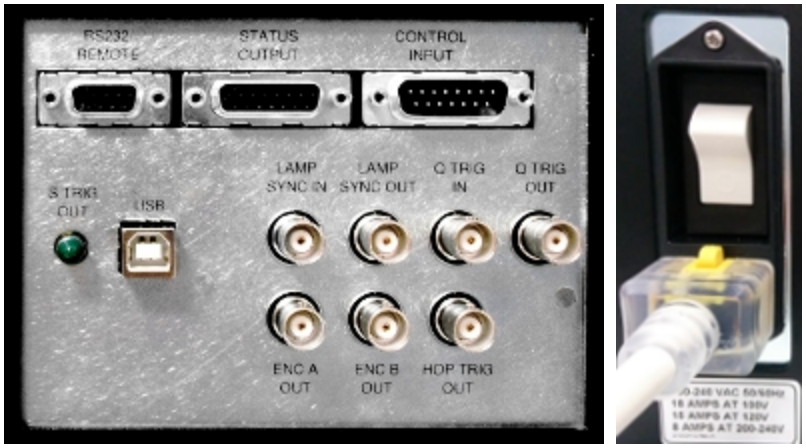
680-970 nm fiber port, 1200-2000 nm fiber port, delivery interlock and external power meter connector.

Top of laser

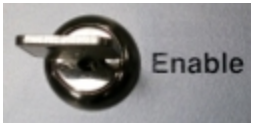
Enable/disable key switch, OFF button, ON button.

EMERGENCY STOP button.

Back of laser



RS232/REMOTE, STATUS OUTPUT, CONTROL INPUT, S TRIG OUT, USB, LAMP SYNC IN, LAMP SYNC OUT, Q TRIG IN, Q TRIG OUT, ENC A OUT, ENC B OUT, HOP TRIG OUT, and AC power cord.

Connector	Description
Key switch	Designed as a safety switch. Laser operating commands will only be accepted by the laser when the key is in the Enable position. 
Emergency stop button	See "Emergency Stop button" on page 80.
Left fiber port	Idler fiber port with a tuning range of 1200 - 2000 nm.

Connector	Description
Right fiber port	Signal fiber port with a tuning range of 680 - 970 nm.
Delivery interlock	A safety interlock that controls the delivery of laser light. The laser defeater or transducer interlock cable must be connected in order for the laser to operate.   *Defeater* *Transducer interlock cable (top) and fiber optic ferrule (bottom)*
External energy sensor	Connect the external energy sensor when you need to calibrate the laser. See "Laser Calibration" on page 608.
RS232 REMOTE	Communication cable. Connect the USB/DB-9 cable from here to an USB connector on the system.
STATUS OUTPUT	Used by Technical Support only.
CONTROL INPUT	Used by Technical Support only.
USB 2.0 B	Used by Technical Support only.
LAMP SYNC IN	Used by Technical Support only.
LAMP SYNC OUT	Connect a BNC cable from here to the Trig In connector on the back of the system.

Connector	Description
Q TRIG IN	Connect a BNC cable from here to the Trig Out connector on the back of the system.
Q TRIG OUT	Used by Technical Support only.
S TRIG OUT	Used by Technical Support only.
ENC A OUT	Used by Technical Support only.
ENC B OUT	Used by Technical Support only.
HOP TRIG OUT	Used by Technical Support only.
AC In	Connect the power cable here. Located on the back of the laser. Warning: Do not modify the power plug or use an adapter. This could cause an electrical hazard. If you need to use a different plug, contact "Technical Support" on page 732.

Emergency Stop button

Located on the top of the laser. Push this button in the case of an emergency situation, when you want the laser to stop firing immediately. When the Emergency Stop button is used, the pump and high voltage power supply (hvps) are both off.

When you need to turn the laser back on, twist the emergency button clockwise (follow the arrows on the button) to release the button back up.

Note: Once the laser has been powered on (via the main power switch on the back of the laser cart, ON button on the top of the laser cart or releasing the emergency stop button), you must wait 20 minutes for the laser to warm up–until such time, the laser will not lase.

Laser ports

Insert the Vevo Optical Fiber bundle into the appropriate port for your imaging session (Signal port at 680 – 970 nm or Idler port at 1200 – 2000 nm), then tap the **LAZR Port** button on the PA-Mode control panel and select the corresponding wavelength range.

Note: The LAZR Port button is only available when the PA button displays 'Start'. Find the LAZR Port button on the PA-Mode controls panel via More Controls.

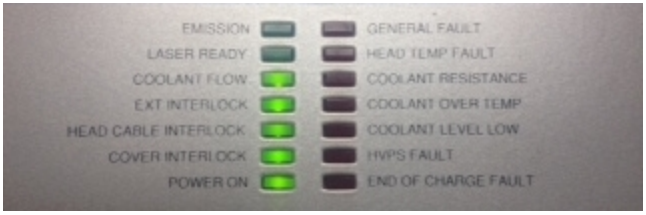
When switching between ports, buttons and imaging functionality will update as follows:

- PA-Mode (Oxy-Hemo) – This PA-Mode submode is not available when using the Idler (1200-2000 nm), therefore the PA-Mode (Oxy-Hemo) button will be disabled.
- PA-Mode (Single) - The slider flyout range will change according to which wavelength range you are using and the default single wavelength will automatically change to something applicable. If the previous set of bookmarks are outside of the current wavelength range, the bookmarks will become disabled.

  See "Single Wavelength Bookmarks" on page 187 for more information about creating and deleting bookmarks.

- Imaging parameters – The Wavelength Range under the Acquisition section in the Mode Setting panel will display the current range being used.
- PA-Mode (Multi-wavelength) - In the Multi-wavelength Scan Settings panel there are no default components listed for the Idler port (1200-2000 nm)—Signal port default components are Oxyhemoglobin and Deoxyhemoglobin.
- PA-Mode (Spectro) - Spectro Scan Settings Scan Method section will update the Start and Stop wavelengths according to the current wavelength range being used.

Laser menu



Menu Item	Description
EMISSION	If the internal shutter is open, then the laser emission is occurring and the light will be on.
LASER READY	Light is on to indicate that all subsystems are on and functioning and that the laser is ready to accept flashlamp fire and Q-Switch inputs.
COOLANT FLOW	Light is on when the cooling system is on and producing adequate flow.
EXT INTERLOCK	When the external interlock is violated, the light is on. **Note:** This only refers to the 15-pin port on the back of the system.
HEAD CABLE INTERLOCK	Laser head cable interlock. The light is on when the interlock is engaged.
COVER INTERLOCK	Optics cover interlock. The light is on when the interlock is engaged.

Menu Item	Description
POWER ON	When the power ON button is pressed, this light will also be on.
GENERAL FAULT	Light is on if there is a laser fault or error condition.
HEAD TEMP FAULT	When the laser head temperature is above the maximum limit (approximately +70°C/158°F), the light will be on.
COOLANT RESISTANCE	This light might be on if the laser hasn't been used for some time, however, if the light remains on after a couple of minutes, the DI filter needs to be replaced. Call Technical Support.
COOLANT OVER TEMP	Light is on when the temperature of coolant in the cooling system reservoir is above the minimum temperature.
COOLANT LEVEL LOW	Light is on when the volume of coolant in the cooling system reservoir is below the minimum level.
HVPS FAULT	High voltage power supply. Light is on if the power supply detects an overage in internal temperature.
END OF CHARGE FAULT	Light is on if the laser pulse forming network (PFN) hasn't charged to the programmed energy level.

Castors

Castors allow the laser to be moved easily. The four castors can be locked using a lever located above each castor. The castors are locked when their

levers are down.

Warning: Lock the castors whenever the Vevo LAZR-X Imaging System laser is unattended or stationary.

Handles

Use the handle (grab bar) when you are moving the laser.

Don't use the handle to lift the system, it is not designed to bear the weight of the laser.

Plug

Your Vevo LAZR-X Imaging System laser is equipped with the appropriate plug for a wall outlet. Check the power plug to ensure that the plug is suited for the configuration of your wall outlet.

Important: For optimal system performance, use a dedicated, interference-free grounded/earthed wall outlet.

Warning: Do not modify the power plug or use an adapter. This could cause an electrical hazard. If you need to use a different plug, contact "Technical Support" on page 732.

Warning: Do not move the Vevo LAZR-X Imaging System laser when the plug is connected to the power outlet.

Warning: Before connecting the laser ensure that the voltage is correct.

Warning: Ensure the power cable is undamaged before plugging the laser directly into the wall outlet. Do not connect the laser's power supply to an MPSO or extension cord. The voltage is specified on the label located under the AC power cord connector on the back of the laser.

Transducers

For more information on what transducers are available with the Vevo LAZR-X Imaging System, see "Transducers" on page 57.

Vevo Fiber Jacket and Vevo Optical Fiber

The Vevo LAZR-X Imaging System uses some of the same transducers as the Vevo 3100 Imaging System however, when imaging in PA-Mode an additional Vevo Fiber Jacket and Vevo Optical Fiber are required.

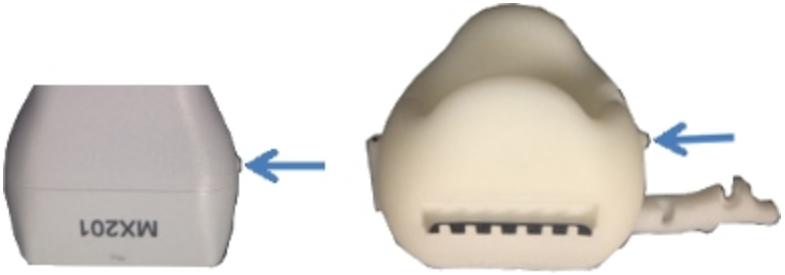
Vevo Fiber Jacket and Optical Fiber transducer compatibility

Transducer	Vevo Fiber Jacket	Vevo Optical Fiber*
MX201	(PN52929)	Yellow = 34 mm (PN52928) Blue = 24 mm (PN52927) Green = 14 mm (PN52926)
MX250	(PN52930)	Blue = 24 mm (PN52927) Green = 14 mm (PN52926)
MX250S	(PN52930)	Blue = 24 mm (PN52927) Green = 14 mm (PN52926)

Transducer	Vevo Fiber Jacket	Vevo Optical Fiber*
MX400	(PN52931)	Green = 14 mm (PN52926)
MX550D	(PN52932)	Green = 14 mm (PN52926)
MX550S	(PN52932)	Green = 14 mm (PN52926)
**When the flashlamp is on, the Vevo Optical Fiber will emit white light which is only a by-product of reflections and scattering from the flashlamp within the laser unit. If the laser is not firing (Q-Switch disabled), this light has not been amplified and is not dangerous; however, it is still recommended by FUJIFILM VisualSonics to never direct the Vevo Optical Fiber towards your eyes.*		

To attach the Vevo Fiber Jacket and Vevo Optical Fiber to an MX series transducer

1 First, locate the orientation bump on the transducer, and note the similar bump on the fiber jacket. When the jacket is put on the transducer, make sure that these bumps are on the same side.



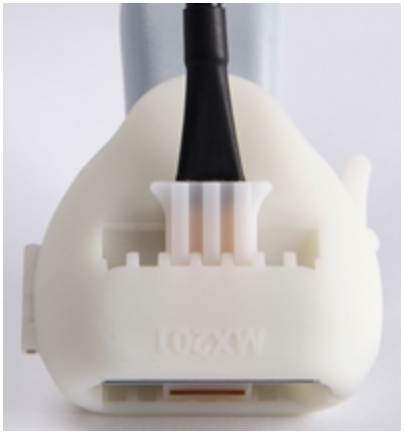
2 Open the jacket by pulling the lever slightly open.

3 Insert the transducer in the jacket, and close the jacket. The transducer should settle into a stable position within the jacket.

4 Close the lever, locking the jacket into place.

5 Obtain the fiber bundle and insert each piece into either side of the jacket.

6 When using a fiber bundle smaller than the transducer width (for example, the narrow fibers with the MX201) ensure the fibers are centered with respect to the transducer.



Storing transducers

Store the nose of the transducer in the transducer and gel holder on either side of the Vevo 3100 Imaging System. Position the transducer nose upward.

You can also store the transducer cables on the cable hooks; there are four hooks available.

Store an inactive transducer by sliding the transducer connector into one of the four shelves in the transducer connector storage.

Caution: FUJIFILM VisualSonics does not recommend storing transducers in the transducer holders with a Vevo Fiber Jacket and Vevo Optical Fiber attached—remove both and store in their original packaging.

Transducer connector storage with transducer.

When you move a transducer from one facility to another, always use the supplied packaging. Follow these guidelines when you store the transducer in its packaging:

- Disconnect the Vevo Optical Fiber from the Vevo Fiber Jacket and place it in the original packaging.
- Disconnect the Vevo Fiber Jacket from the transducer and place it in the original packaging.
- Make sure that the transducer, Vevo Fiber Jacket and Vevo Optical Fiber are clean and dry before you store them in their supplied packaging.
- Place the transducer in the supplied packaging carefully so the cable doesn't kink.
- Don't store the transducer in areas of extreme temperatures or in direct sunlight.
- Store the transducer separately from other instruments so it is does not get damaged accidentally.

Connecting and disconnecting transducers

Caution: If damage is evident, do not use the transducer and contact Technical Support.

Caution: When connecting and disconnecting transducers, grasp the transducer fiber optic ferrule, do not grasp the transducer fiber cable.

Important: Be aware that you can switch a transducer at any time. You can switch during a live scan, after acquiring an image and during review of an image. The Vevo LAZR-X Imaging System software allows for users to switch transducers without any negative effect to the current study or imaging session.

Caution: If damage is evident, do not use the transducer and contact Technical Support.

Transducer interface	Transducer connector
	

Laser ports	Transducer fiber optic ferrule
	

To connect a transducer to the Vevo LAZR-X Imaging System

Connect the Vevo Fiber Jacket and Vevo Optical Fiber to the transducer before your proceed. See "To attach the Vevo Fiber Jacket and Vevo Optical Fiber to an MX series transducer" on page 86.

1 Turn the handle on the transducer clockwise to the vertical (unlocked) position; follow the directional label on the transducer to lock and unlock the handle.

2 Slide the transducer connector into the transducer bay underneath the control panel.

3 Push the transducer connector into the transducer interface.

4 Rotate the handle on the transducer connector counterclockwise to the horizontal (locked) position and push down on the handle to lock the transducer.

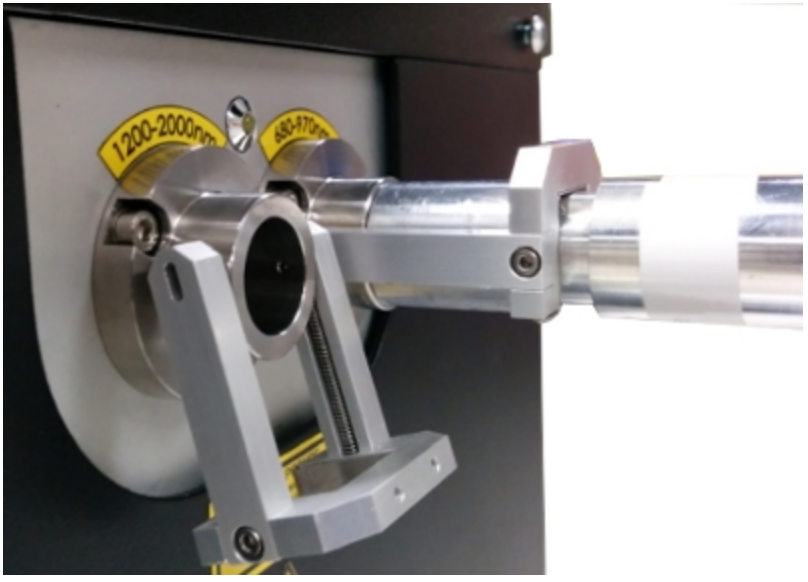
5 On the laser, raise the lever lock on the port you want to use.

6 Insert the transducer ferrule into a port on the laser. Push the ferrule in to the port until it cannot go in any further.

Transducer ferrule that is not pushed all the way in to the port.

Transducer ferrule that is pushed all the way in to the port.

7 Lock the transducer ferrule by lowering the lever lock.

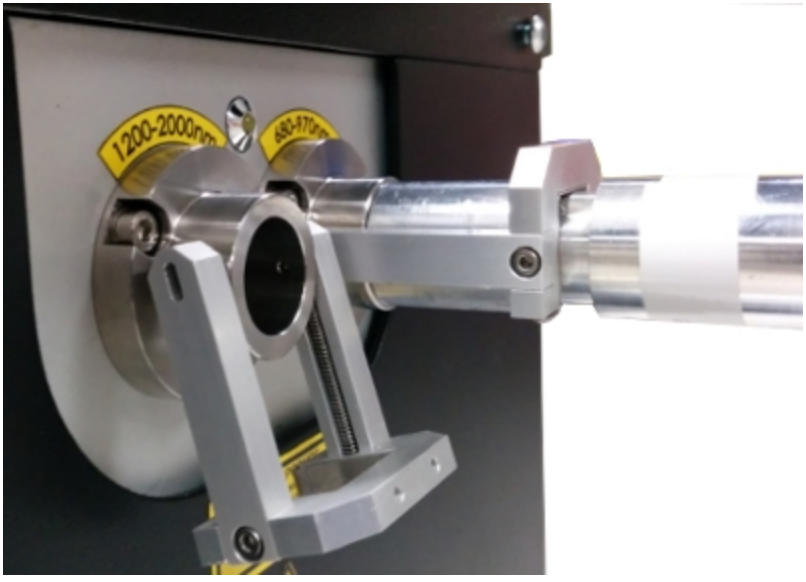


Vevo LAZR-X Imaging System with transducer connected to system and laser.

To disconnect a transducer from the Vevo LAZR-X Imaging System

1 On the laser, raise the lever lock from the port and remove the transducer ferrule from the laser port.

2 On the system, flip the transducer connector handle up and rotate clockwise to the vertical (unlocked) position, pull the transducer connector away from the transducer interface then slide the connector up and out of the transducer bay.


1200-2000nm

Vevo Imaging Station

The Vevo Imaging Station is an advanced system for managing anesthetized mice and rats during imaging procedures.

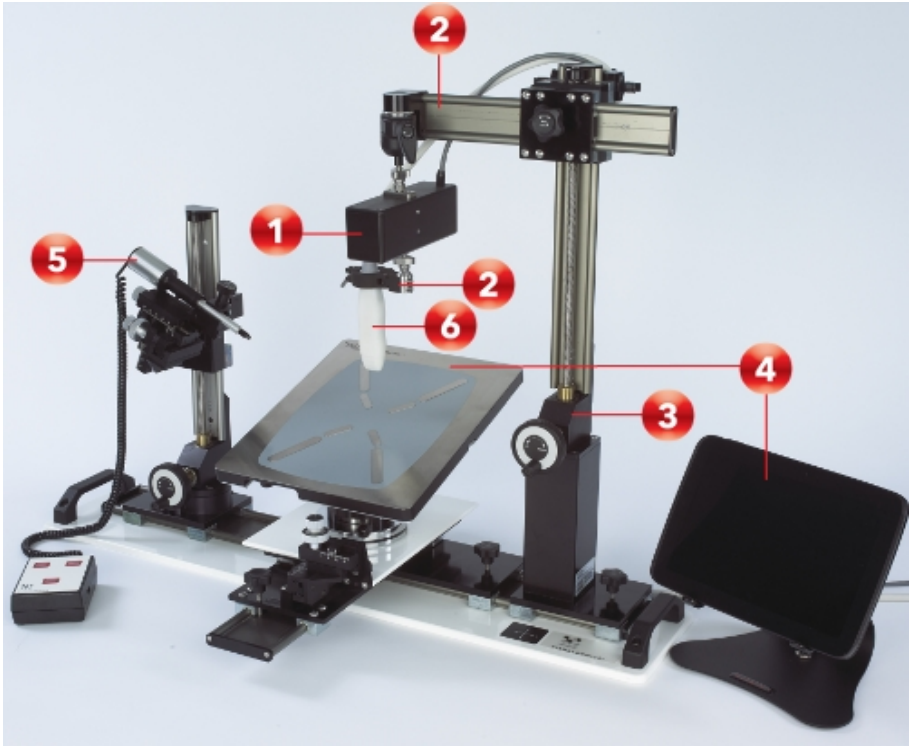
This Vevo Imaging Station helps you to position the animal in a stable position in relation to the transducer so you can:

- maintain the optimal image plane during an imaging session.
- monitor the animal's ECG, heart rate, respiration and core body temperature and display and record this data in real time.
- manipulate the animal for image-guided injection and embryonic aspiration procedures.

Refer to the Vevo Integrated Rail System III Operator Manual for details of installing, configuring and using the imaging station.

Vevo Imaging Station setup

The following picture and descriptions show the typical Vevo Imaging Station setup.



Number	Component	Description
	3D motor system	Captures data sets for 3D Mode volumetric measurements. The transducer connects to the bottom of the motor system. The system moves the transducer from one side to the other as the transducer acquires cross sectional slices. The slices combine to create 3D Mode/4D-Mode images. Caution: The 3D motor could cause a hazard to fingers during a 3D Mode scan as the motor moves. Ensure that your fingers are kept away from the 3D motor during a 3D Mode/4D-Mode scan and that the motor can move freely and is not obstructed.
	Transducer mounting system	Secures the transducer in a stationary position when you position it at the desired image plane. In this configuration, the 3D motor system is attached to the mounting system and the transducer clamp is connected to the bottom of the 3D motor system.
	Integrated rail base	Provides a stable rail for attaching, sliding and securing the animal platform system, transducer mounting system, and Vevo Infusion Pump. You can interchange these systems and set them up for left-handed or right-handed users.

Number	Component	Description
	Animal physiological monitoring system	Use this system to secure the animal, support the manipulation of the animal, ensure the comfort of the animal, and monitor the animal's blood pressure, ECG, temperature, respiration, and heart rate during an imaging session. Includes either the Mouse Handling Table or the Rat Handling Table.
	Image-guided injection system	Provides precision control over every aspect of the image-guided injection and aspiration procedures. The mounted controls set the needle's insertion point and angle of penetration, and the remote control automates the injecting, filling and emptying tasks. Includes the injector mount, the micro-injector unit and the injector remote control.
	Transducer	For available transducers, see "Transducers" on page 57.

Vevo LAB

FUJIFILM VisualSonics offers Vevo LAB for additional data analysis of images acquired on the Vevo 1100, 2100, 3100, LAZR and LAZR-X Imaging Systems. Vevo LAB also contains additional analysis features such as protocol based measurements and software including Vevo CQ, Vevo Strain, and Vevo Vasc.

Vevo LAB is required to perform some analysis tasks such as 3D Mode and 4D-Mode volume analysis. Additionally the software provides access to more advanced measurement packages.

Vevo LAB can be installed on any Windows-based system that meets the technical requirements.

Note: You cannot acquire images using Vevo LAB.

Vevo CQ

Vevo CQ is a powerful addition to Nonlinear Contrast Mode imaging on the Vevo Imaging System. This software allows for the study of contrast uptake kinetics as well as late phase targeted enhancement. It provides advanced curve fitting algorithms for quantitative assessment of perfusion parameters as well as color-coded parametric images useful for qualitative assessment of the spatial distribution of the same parameters. The software is a post-processing tool which can be used on numerous tissues, organs and tumor models, including subcutaneous tumors, abdominal organs and hind limb.

Vevo Strain

Vevo Strain software is the only commercial strain analysis package optimized for assessing cardiac function in preclinical rodent studies. Optimized for use with the Vevo Imaging System, this advanced post-processing tool provides

the preclinical researcher with multi-measurement capabilities used in the assessment of myocardial abnormalities and therapeutic interventions. Features such as global strain and time-to-peak analyses assess early biomarkers for understanding disease processes and serve as the first step towards clinical translation of therapeutics.

Vevo Vasc

Vevo Vasc is a vascular strain analysis package that utilizes advanced speckle tracking algorithms on high-resolution ultrasound data to quantify vascular pathologies non-invasively and *in vivo*. It is the first software of its kind available for preclinical researchers studying vascular disease (optimized for mouse and rat models). The software includes both qualitative and quantitative tools to study various vascular disease models. By taking advantage of the Vevo Imaging System's high spatial and temporal resolution, it is now possible to visualize and quantify early indicators of vascular disease and/or tissue remodeling.

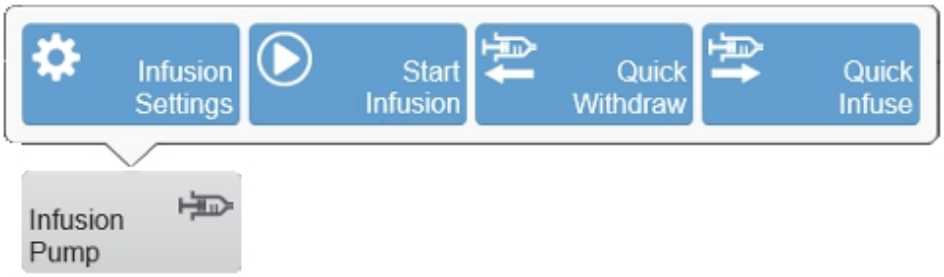
Vevo Infusion Pump

The Vevo Imaging System software supports infusions from a syringe using the Vevo Infusion Pump.

Contrast agents are used in a variety of pre-clinical applications. For example, Vevo MicroMarker contrast agents are used to enhance tissue and vascular imaging. Also, a variety of optical dyes and metallic nanoparticles are used for photoacoustic imaging with the Vevo LAZR-X Imaging System.

To eliminate potential interoperator variability during infusion, FUJIFILM VisualSonics recommends that delivery of contrast agents, optical dyes or metallic nanoparticles, be performed with the Vevo Infusion Pump.

Find the Infusion Pump button on the General Controls tab. Drag and drop the Infusion Pump button to the general controls bar for quick access.



When an infusion is performed, an annotated frame marker is added when the infusion starts and stops, see "Add Frame Marker" on page 393.

Once the infusion begins, the Infusion Pump parameters are added to the Mode Settings Panel on the image display–Mode, Final Volume and Final Time.

Note: The Infusion Pump parameters (Mode, Final Volume, Final Time) are the sum from the infusion/withdraw performed in a scan.

The frame marker values listed for the same parameters may be different if more than one infusion/withdraw was performed in a scan, if the target infusion was not reached or if the infusion/withdraw was performed across two different scans.

The following documents are available as references to you:

- *PN50252 Preparation Protocol for Vevo MicroMarker Non-Targeted Contrast Agent Kits*
- *PN50332 Customer Instructions for the Vevo Infusion Pump*

- *EDU00537 In Vivo Characterization of Photoacoustic Contrast Agents with the Vevo LAZR-X*

Start and stop infusions

To start an infusion

- Select to perform one of the following:

  a. Tap **Start Infusion**.

  b. Tap and hold **Quick Infuse**.

  c. Start the Infusion Pump manually.

To stop an infusion

- Select to perform one of the following:

  a. Tap **Stop Infusion**.

  b. Release the **Quick Infuse** button.

  c. Release the **Quick Withdraw** button.

  d. Allow the target volume/time to be reached.

  e. Stop the Infusion Pump manually.

Quick Infuse and Quick Withdraw

Use either function when you do not wish to use a set of infusion parameters (presets). When you use either function, the maximum withdraw and infusion rate of the Vevo Infusion Pump will be used.

To use either function, tap and hold. To stop the infusion or withdraw, release your finger from the button.

Note: The infusion pump will continue to move until you release your finger when using either Quick Infuse/Quick Withdraw, even when the target volume has been reached.

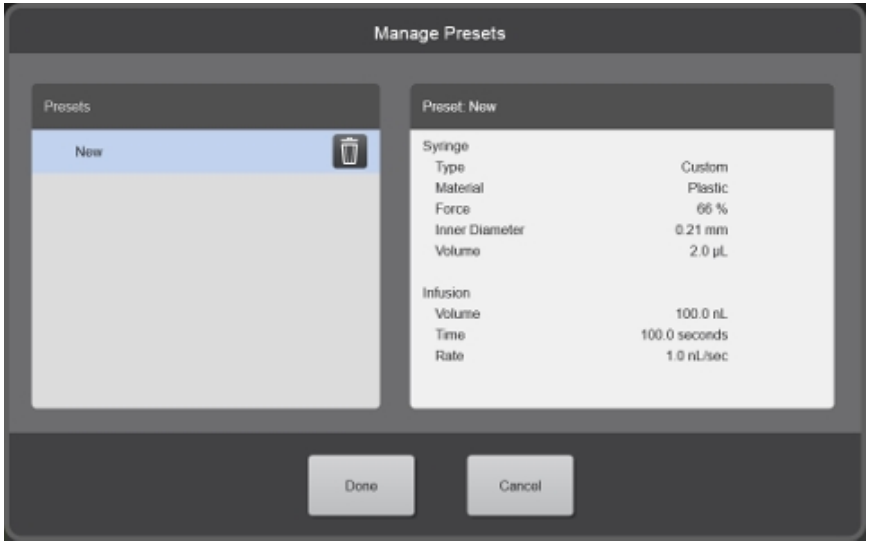
Infusion Settings

Load a preset, create a custom preset or change the type of syringe or infusion by using the settings on the Infusion Settings panel. You can make changes on the Infusion Settings panel while scanning continues in the background.

Note: If the Infusion Volume or Time is not specified, then the Infusion Rate will be blank.

Preset

- Drop down menu – Tap a saved preset to load the parameters of that preset.
- Save Preset – Saves a custom preset or replaces an existing preset. If you save a custom preset, a Save Infusion Preset panel is displayed– enter the name of your preset and tap **Save**. If you are replacing an existing preset, tap **Replace**.
- Manage Presets – Tap to load the Manage Presets panel. Review existing preset parameters and delete presets from the Presets list on the left.



Syringe

- Type – Tap a syringe type from a predefined list to load the parameters of that syringe. Inner Diameter, Volume (including units), Material and Force fields will be automatically filled in once the syringe type is selected, however these fields can be edited.
- Inner Diameter – Enter the syringe diameter. This field will be automatically filled in once the Syringe Type is selected, however it can be edited.
- Volume – Enter the syringe volume and units (µL or mL). This field will be automatically filled in once the Syringe Type is selected, however it can be edited. The Vevo Infusion Pump can accommodate syringe volumes ranging from 0.5 µL to 60 mL.
- Material – Select either Glass, Plastic or Other. This field will be automatically filled in once the Syringe Type is selected, however it can be edited.
- Force – The force of the infusion will be determined once you select the Syringe Material and Volume. Select either Glass, Plastic or Other. The force of a Glass or Plastic syringe is automatically set to the following and is not editable, (selecting Other will allow you to use the Force slider):
    - Plastic (≤ 5 mL): 50% force
    - Plastic (> 5 mL): 100% force
    - Glass (< 0.5 mL): 30% force
    - Glass (≥ 0.5 mL): 50% force

Infusion

Note: The Infusion Volume and Time will reset to '0' each time a new scan is started or the current scan is restarted.

- Volume – Enter the infusion volume and select the unit (mL, µL, nL).
- Time – Enter the length of time (rate) the syringe volume will inject (seconds).
- Rate – Enter the infusion rate and select the unit (mL/sec, µL/sec, nL/sec) . This field will be automatically filled in once the Volume and Time have been entered. If you edit the Volume or Time, the Rate value will be adjusted accordingly.

Vevo Brain Stereotactic Frame

When you purchase the Vevo Brain Stereotactic Frame, a Vevo Brain Neuroanatomical Atlas is also included. The Neuroanatomical Atlas is a study that will help you when imaging the brain. You can install the Neuroanatomical Atlas on your system and Vevo LAB and will be found in the Study Browser.

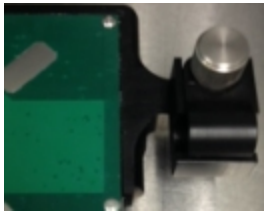
Note: The Neuroanatomical Atlas cannot be edited.

The Vevo Brain Stereotactic Frame works with the Vevo Mouse Handling Table II; the frame attaches to the platform to secure an animal's head to limit movement while imaging the brain.

Number	Description
1	Large thumb screw.
2	Anesthetic tube tightening screw.
3	Anesthetic tube.
4	Anesthetic hose.
5	Anesthetic tube height adjustment screw.
6	Left and right ear piece thumb screws.
7	Left and right ear piece.

To install the Vevo Brain Stereotactic Frame on the Animal Handling Table II

1 Remove the existing animal aesthetic hose clamp by unscrewing the large thumb screw until the clamp separates from the table.



Before

After

2 Place the Stereotactic Frame such that the large thumb screw sits in the hole that was left when removing the animal aesthetic hose clamp.

3 Tighten the large thumb screw until tight.

4 Adjust the right and left ear piece by adjusting it back or forth then tighten with the thumb screws to secure its location.

5 (Optional) Adjust the height of the animal aesthetic tube.

6 (Optional) Adjust the length of the animal aesthetic tube.

Completed assembly of the Vevo Brain Stereotactic Frame mounted on the Vevo Mouse Handling Table II.

To use the Vevo Brain Neuroanatomical Atlas and Stereotactic Frame on the Vevo LAZR-X Imaging System

1 Attach the Stereotactic Frame to your platform, see procedure above.

2 Install the Neuroanatomical Atlas.

3 Go to the Study Browser and search for the study *Adult Mouse Brain Atlas*; double tap on the image *Adult CD 1 Mouse brain atlas* to load it into review.

4 From the mode window, go to More Controls and under the General Tab, tap **Split Screen**–the Atlas will be displayed on the left side.

5 Tap **Split Screen** again and select the **R**ight side. Begin acquiring data on one side, while using the Anatomical Atlas study as a reference on the other.

To install the Vevo Brain Neuroanatomical Atlas on the system

> **Important:** Installing the atlas on your system will require a system restart, be sure to save your work before beginning the installation process.

1 Insert the USB containing the atlas installer files, into one of the system's USB ports.

2 Go to System Settings.

3 Go to System Information.

4 Tap **System Upgrade**. The Upgrade window will be displayed.

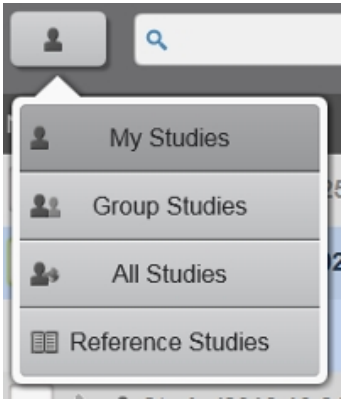
5 Navigate to the USB folder location containing the Vevo Reference Studies installer and tap to select the file named *Vevo Reference Studies 3.0.0.XXXXX*.

6 Tap **Upgrade**.

7 Follow the instructions on the image display; the system will need to shut down and restart to complete the upgrade.

8 Once the installation is complete, turn the system on and go to the Study Browser.

9 Tap the privacy settings button.



10 Tap **Reference Studies**.

11 Go to the Study Browser and search for the study *Adult Mouse Brain Atlas*; double tap on the image *Adult CD-1 Mouse Brain Atlas* to load it into review.

12 From the mode window, go to More Controls and under the General Tab, tap **Split Screen**–the Atlas will be displayed on the left side.

13 Tap **Split Screen** again and select the **R**ight side. Begin acquiring data on one side, while using the Anatomical Atlas study as a reference on the other.

To install the Vevo Brain Neuroanatomical Atlas on Vevo LAB

1 Insert the USB containing the atlas installer files, in to one of your PC's USB ports.

2 Go to Preferences.

3 Go to Maintenance.

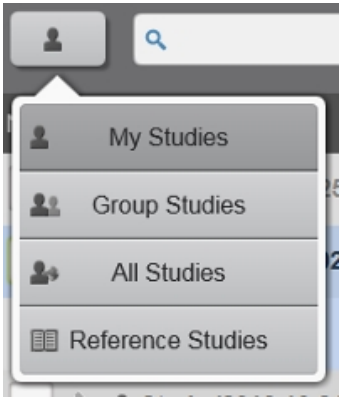
4 Click **Upgrade**. The Upgrade window will be displayed.

5 Go to and click to select the file named *Vevo Reference Studies 3.0.0.XXXXX*.

6 Click **Upgrade**.

7 Once the installation is complete, go to the Study Browser.

a. If UMM (User Management Mode) is enabled, click the privacy settings button, then click to select **Reference Studies**. Go to the Study Browser and search for the study *Adult Mouse Brain Atlas*; double click on the image *Adult CD-1 Mouse Brain Atlas* to load it into review.



b. If UMM is not enabled, search for the study *Adult Mouse Brain Atlas*; double click on the image *Adult CD-1 Mouse Brain Atlas* to load it into review.

8 Enable Split Screen by clicking **Split Screen**—the study will be loaded to the left side of the screen.

9 Click on the right (blank) side of the screen.

10 Click the Study Browser icon and select another image to load into review. You can now compare your image to the Neuroanatomical Atlas.

Physiology

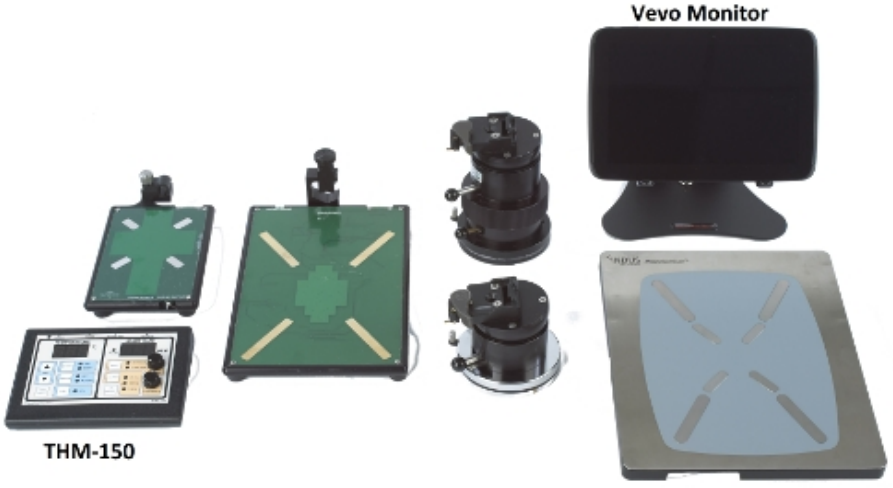
The animal physiological monitoring system, in conjunction with either the Mouse Handling Table or Rat Handling Table, tracks the animal's heart rate, temperature, respiration rate and blood pressure (optional with a third-party blood pressure device).

For more detailed information on preparing the animal and the animal platform, refer to the Vevo Integrated Rail System III Operator Manual.

The Vevo Imaging System is compatible with two monitoring systems, the THM-150 Advanced Physiological Monitoring Unit and the Vevo Monitor.

THM-150 and Vevo Monitor

Note: The THM-100 is not supported.



Physiological data sources

The Vevo Imaging System can monitor, display, and record the physiological data when the subject is connected to the animal physiological monitoring system. The required data source connections are described in the following table.

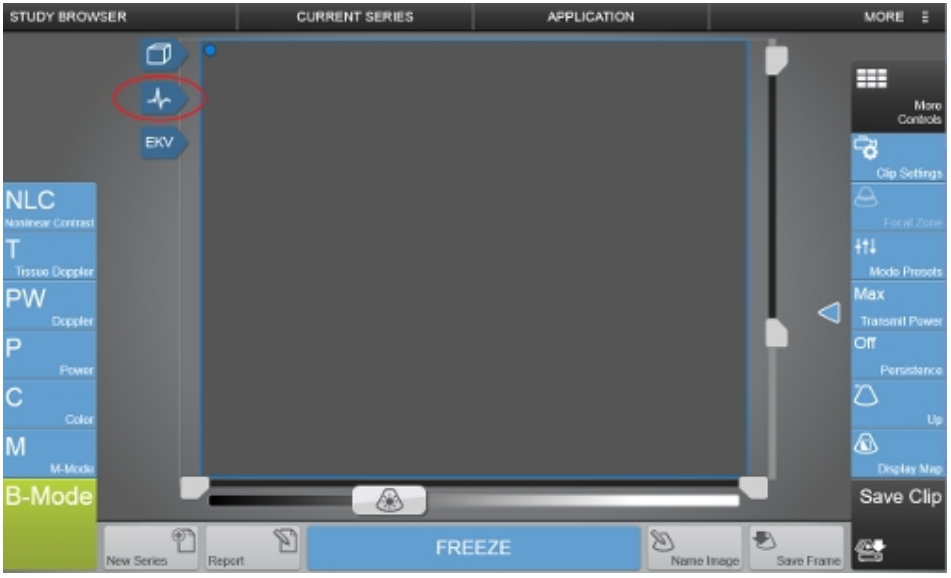
Physiology	Description
ECG	The animals ECG signal is captured through the electrode pads on the animal handling table. The pads transmit the animal's ECG to a controller box. Connect the ECG cable to the controller box, and connect the keyed end of the cable to the Vevo Imaging System. Displayed in green on the system.
Respiration	The animal's respiration rate is monitored through the electrode pads on the animal handling table and is derived from the ECG signal. Displayed in yellow on the system.
Blood Pressure	The animal's blood pressure can be monitored by a third-party blood pressure monitoring system. The signal is sent through the animal physiological monitoring system to the Vevo Imaging System and the blood pressure trace is viewed on screen with the software. Displayed in red on the system. The BP derivative is displayed in purple.
Body Temperature	The animal's temperature is monitored through the rectal probe connected to the animal physiological monitoring system. Displayed in blue on the system.

Configuring the physiology data display settings

When you are acquiring image data, tap the physiology tab to display the physiology panel. The panel displays options for controlling the individual physiology data inputs that appear in the physiology trace window on the image display. This section describes how to configure these options.

To display the physiology data display settings

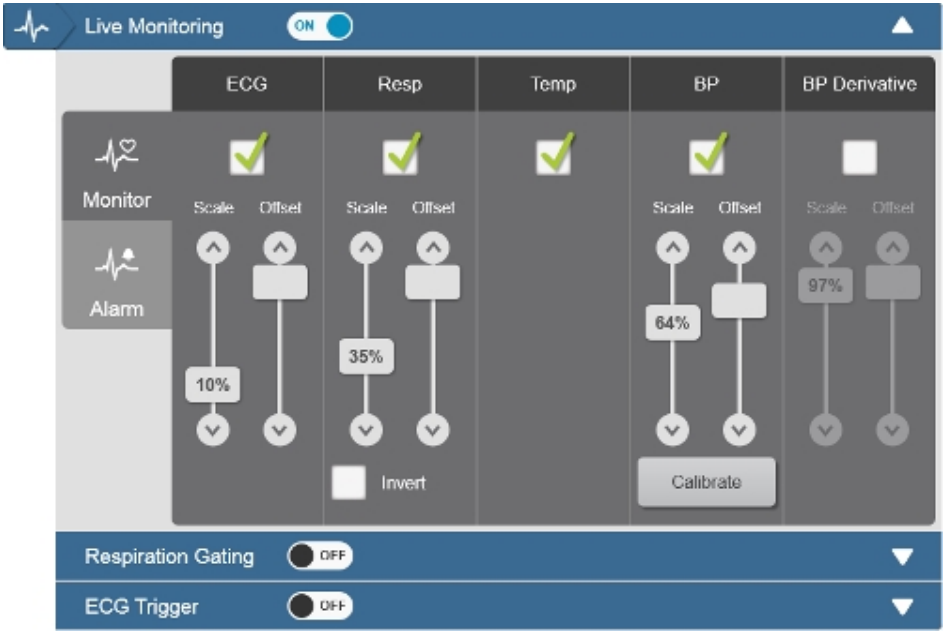
- Tap the physiology tab



Configuring Live Monitoring

To configure Live Monitoring

1 Use the **Monitor** tab in the Live Monitoring section of the physiology panel to activate or deactivate the display of the individual physiology data inputs on the image display.



2 Tap the **On/Off** control on the Live Monitoring section to toggle the display of the physiology trace window on the image display.

Note: Turning off the live monitoring will disable all other physiology controls.

Configuring the display of a particular input

To configure the display of a particular input

1 Tap the checkbox under the input name to toggle the display of the input. Turning off the display does not turn off the data collection. The display of this data on a saved image can always be turned on later.

2 Adjust the Scale slider. Dragging the slider up increases the amplitude of the signal in the physiology trace window on the image display.

3 Adjust of the Offset slider. Dragging the slider up will move the baseline of the signal up relative to the physiology trace window on the image display.

4 (Respiration only) Invert the signal by tapping the checkbox.

5 (Blood Pressure only) Calibrate the blood pressure equipment by tapping **Calibrate**, see "Calibrating the blood pressure device" on the facing page.

6 Settings are applied immediately. Tap the **Physiology** tab or anywhere on the control panel to close the Physiology panel.

Connecting the blood pressure equipment

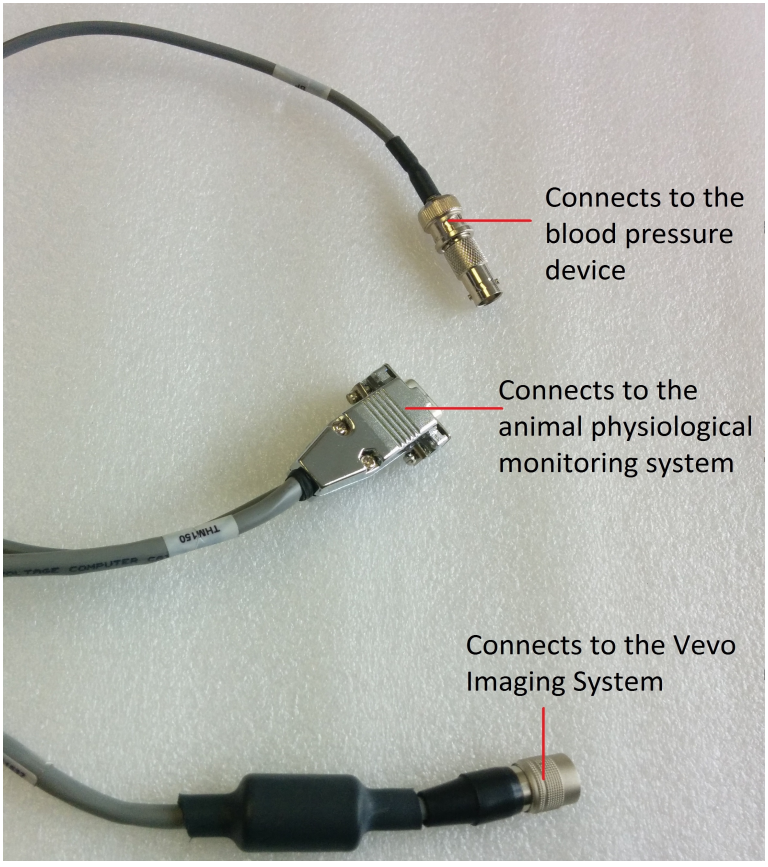
The Vevo Imaging System provides a BNC connection as part of its animal physiological monitoring system.

To connect the blood pressure equipment

1 Connect the BNC cable to the back of the Vevo Imaging System.

2 Connect the other connector to the blood pressure monitoring device.

3 Connect the other end of the cable to the animal physiological monitoring system.



Calibrating the blood pressure device

As a best practice, calibrate the Vevo Imaging System software for your blood pressure monitoring device before you begin to acquire blood pressure data.

You can run the calibration procedure at any time even when you are reviewing image data, as long as the blood pressure monitoring device is

connected to the system. This only affects the physiological live display values, not the blood pressure values that are already acquired.

The following manual and import calibration procedures assume that your blood pressure monitoring system includes a built-in calibration function.

Blood pressure calibration options

Use the Calibration button in the Blood Pressure section of the Monitor tab in the Live Monitoring section of the physiology panel to set your preferences for calibrating your pressure scale using either:

a. Manual Calibration. Select this option if the Vevo Imaging System does not support your blood pressure instrument.

b. Import Calibration. Select this option if the Vevo Imaging System supports your blood pressure instrument.

The Vevo Imaging System includes pre-configured calibration settings for the following blood pressure instruments:

- Data Sciences International R11CPA analog adapter
- Millar PCU2000 Pressure Control

Calibrating a Vevo-supported blood pressure instrument (import calibration)

To calibrate a Vevo supported blood pressure instrument

1 Connect the blood pressure instrument to the animal physiological monitoring system and ensure the unit is connected to the Physio Data

connector on the Vevo Imaging System. Ensure all three systems are powered on.

2 Begin acquiring data on the system, or open an image for review from the **Study Browser**.

3 Tap the physiology tab to open the physiology panel

4 Tap the **Calibration** button in the Blood Pressure section of the **Monitor** tab in the Live Monitoring section of the physiology panel.

5 Tap the **Import Calibration** tab.

6 In the drop-down list, select your device.

7 Tap **Calibrate**. The system calibrates the pressure scale and retains the calibration setting between imaging sessions.

Note: You only need to repeat the calibration if you connect a different blood pressure monitor or if you think there might be a problem with the calibration accuracy.

8 Tap **Done** to return to the Live Monitoring controls.

Calibrating any blood pressure instrument (manual calibration)

To calibrate any blood pressure instrument

1 Connect the blood pressure instrument to the animal physiological monitoring system and ensure the unit is connected to the Physio Data connector on the Vevo Imaging System. Ensure all three systems are powered on.

2 Begin acquiring data on the system, or open an image for review from the **Study Browser**.

3 Tap the physiology tab to open the physiology panel

4 Tap the **Calibration** button in the Blood Pressure section of the **Monitor** tab in the Live Monitoring section of the Physiology panel.

5 Tap the **Manual Calibration** tab.

6 Follow the step by step instructions on the panel.

7 Tap **Calibrate**. The system calibrates the pressure scale and retains the calibration setting between imaging sessions.

Note: You only need to repeat the calibration if you connect a different blood pressure monitor or if you think there might be a problem with the calibration accuracy.

8 Tap **Done** to return to the Live Monitoring controls.

Physiology Alarms

To activate or deactivate alarms for any of the physiology signals, open the Live Monitoring panel and set the values in the Alarm section.

Use the checkbox to toggle the alarm on or off, and slide the picker control to set the high and low limits for the alarm.

When the value for the selected input is outside the selected range, the live numerical display for that input will blink at the bottom of the Image Display.

Respiration Gating

Respiration gating is a tool you can use to effectively suppress the artifacts coming from respiratory movement.

When you are acquiring image data along with physiological data, the physical movement of the subject's chest cavity may move the region of interest you want to study. This can cause artificial variations in measurements. Respiration gating suppresses this effect.

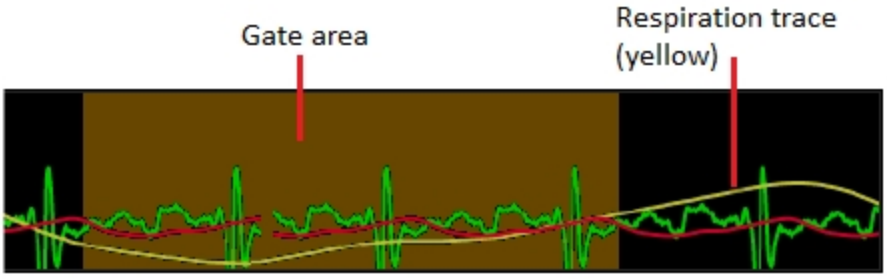
Respiration gating is only available for frame-based modes—B-Mode, Color Doppler Mode, Power Doppler Mode, Nonlinear Contrast Mode, PA-Mode and EKV.

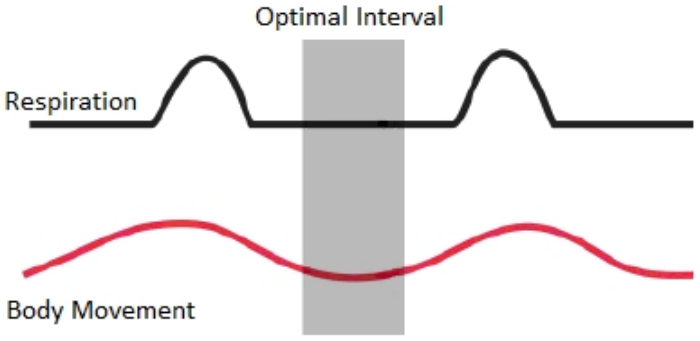
How Respiration Gating Works

To suppress the effect of respiration on your image data, you can use the Respiration Gating tools within the Physiology panel to select the period of time between breaths when the body is least affected by the breathing

motion. This brief period of time is called the respiration gate. The system records image data only during the respiration gate period.

When respiration gating is on, a dark yellow area will appear on the physiological trace window on the image display. This area is the gate period where data will be collected.





Before you begin:

- Your animal must be connected to the animal physiological monitoring system.

- In the Monitor tab in the Live Monitoring section of the Physiology panel, the checkbox in the Respiration section must be selected.
- You can only activate and control respiration gating while you are acquiring data. You cannot access these options when you review an image.

Activating respiration gating

To activate respiration gating

1 Begin acquiring data.

2 Tap the Physiology tab to open the Physiology panel. In the Live Monitoring section, adjust the Respiration range and offset so that the trace line is:

- short enough that the peaks and valleys do not extent above or below the window.
- tall enough that you can clearly define those peaks and valleys.

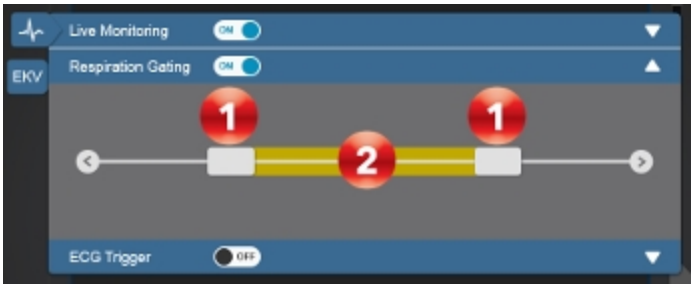
3 Tap the On/Off toggle on the Respiration Gating heading to turn on Respiration Gating and show the controls. The status of Respiration Gating will be displayed on the Mode settings panel on the Image Display under Acquistion as either On or Off.

4 While looking at the respiration signal on the image display, adjust the size and position of the window using the control on the Respiration Gating panel, if necessary.

Change the size of the gate by dragging either the left or right handle (see 

below); set the size of the gate to capture the period of time between breaths.

Change the position of the gate by dragging the gate window (see 2 below), or tap the arrows to make small adjustments; adjust the position of the gate window to the start of the gate period (after the waveform has returned to the baseline).



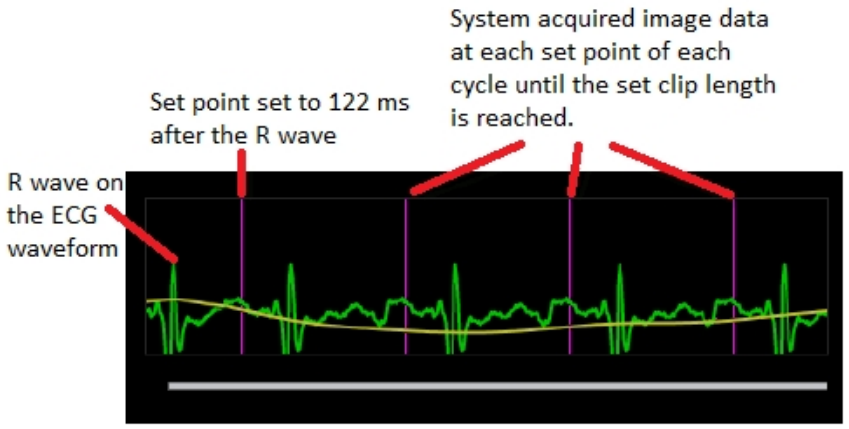
5 Tap the Physiology tab or anywhere outside the Physiology panel to return to imaging.

ECG Trigger

ECG Triggering is available only for frame-based imaging modes (excluding PA-Mode and EKV acquisitions), and effectively suppresses the effect of the physical movement of the heart during the heart cycle.

Overview

ECG triggering acquires one single frame of image data during each cardiac cycle, at precisely the same time point after the R wave peak. The result of this triggering is a clip of a remarkably static heart. It can also be used to acquire two frames at two specific time points after the R wave.



Before you begin:

- Your animal must be connected to the animal physiological monitoring system.
- In the Monitor tab in the Live Monitoring section of the Physiology panel, the checkbox in the ECG section must be selected.
- You can only activate and control ECG trigger while you are acquiring data. You cannot access these options when you review an image.

Activating ECG triggering

To activate ECG triggering

1 Begin acquiring data.

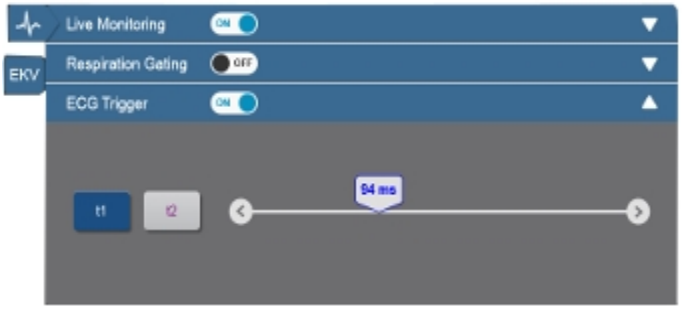
2 Tap the **Physiology** tab to open the Physiology panel. In the Live Monitoring section, adjust the ECG range and offset so that the trace line is:

- short enough that the peaks and valleys do not extent above or below the window.
- tall enough that the peak of the R wave is clearly defined.

3 (Optional) You may want to temporarily turn off the other physiology signals while setting up ECG triggering, to make it easier to view. This can be done in the Live Monitoring section of the Physiology panel.

4 Tap the On/Off toggle on the ECG trigger heading to turn on ECG trigger and show the controls. The status of ECG trigger will be displayed on the Mode settings panel on the Image Display under Acquisition as either On or Off.

5 Tap the **t1** button to activate the systole time slider control.



6 Watch the B-Mode image as you adjust the slider until you find the image within the cardiac cycle that displays the tissue characteristics that you want to study. The system sets the time point after the R wave where it will continue to acquire one single frame of image data during each cardiac cycle.

7 (Optional) If you want to study the diastole time point within the cardiac cycle, select the **t2** button and follow the same procedure to place a second trigger.

8 Tap the **Physiology** tab or anywhere outside the Physiology panel to return to imaging.

Settings

You can customize your system and set your user preferences through the System Settings panel.

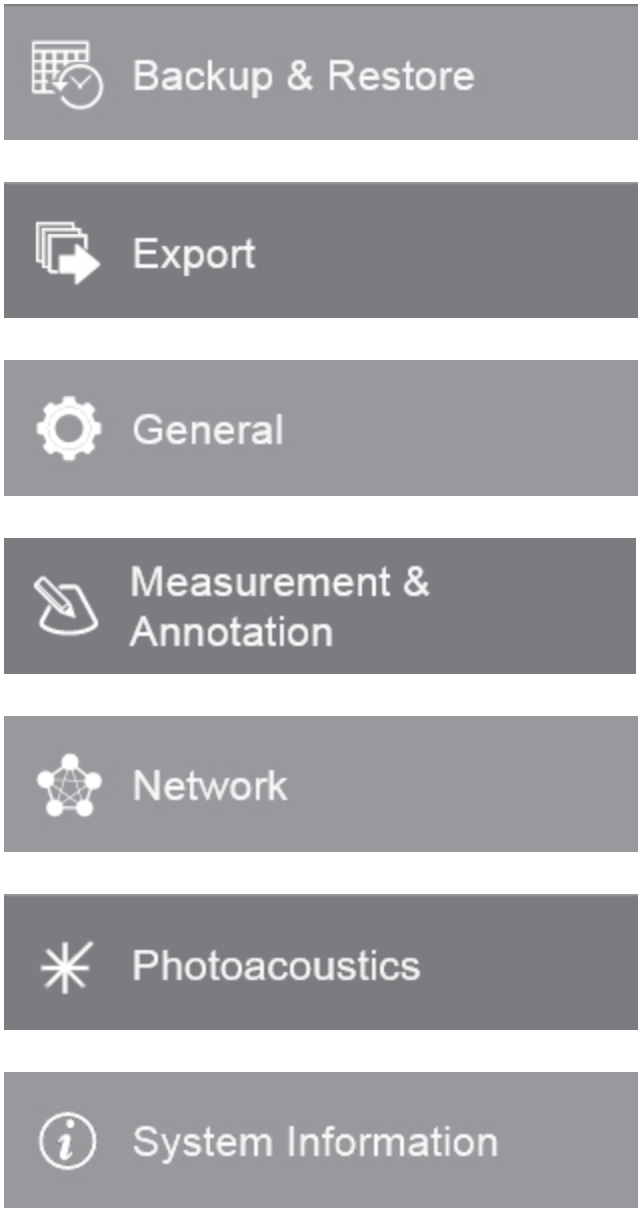
Note: Some system settings are only available to system users with Administrator status. Additionally, not all system settings are available if you log in to the system as a Guest. See "Logging on for the first time" on page 207.

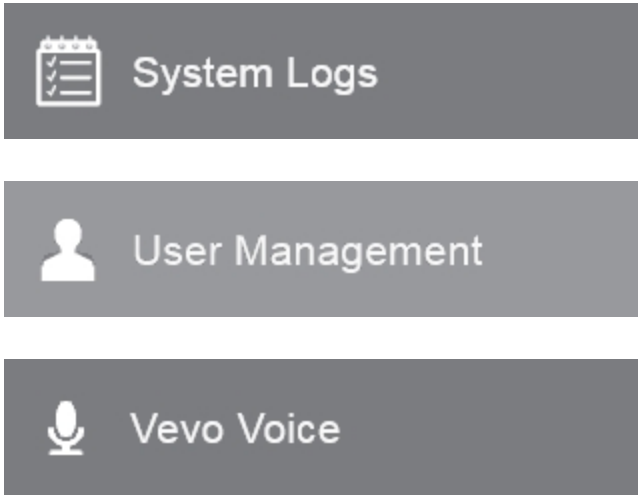
To display the System Settings page

- Tap MORE, and then tap System Settings.

Tapping a settings tab displays its available settings on the right side. The active selection is highlighted.

Tap a System Settings control below to learn more:


Backup & Restore
Export
General
Measurement & Annotation
Network
Photoacoustics
System Information


System Logs
User Management
Vevo Voice

Applications and Presets

Applications & Presets contains the settings for viewing and configuring imaging presets. Use the options here to change a default transducer application or to change a default mode preset.

To display the Applications & Presets page

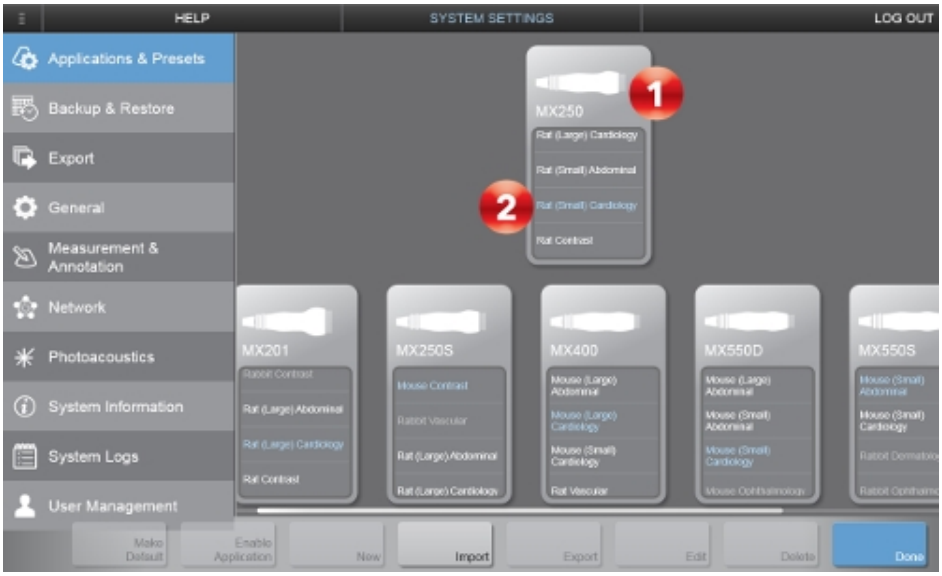
1 Tap **MORE**, and then tap **System Settings**.

2 Tap **Applications & Presets**.

Applications

An application contains the imaging mode presets you can use to instantly optimize your image during an acquisition session.

Applications & Presets lists the transducers that the Vevo 3100 Imaging System and Vevo LAZR-X Imaging System supports. Select the transducer you are planning to use to acquire image data.



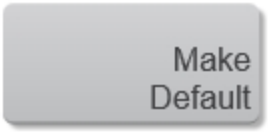
1	The transducer displayed at the top of the display is the one that is currently connected to the system.
2	The application displayed in blue on each transducer panel is the current default application for that transducer.

See "Transducers" on page 57 for a list of transducers compatible with the Vevo 3100 Imaging System and Vevo LAZR-X Imaging System.

To specify the default application for a transducer

1 On the Applications & Presets page, select a transducer, then tap the application that you want to be the default from the displayed options.

2 Then tap **Make Default**.



3 Click **Done**.

Creating a custom application

Factory default applications are defined for each transducer which contain the imaging mode presets you can use to instantly optimize your image during an acquisition session.

You cannot modify factory default applications, except to add custom presets. However, you can create custom applications based on existing applications.

Creating a custom application from within the Applications & Presets page allows you to copy all of the presets associated with that application. You can delete factory defined presets only from custom applications.

You can also save an application during imaging using the **Save Application** button. See "Customizing controls" on page 388.This allows you to save your current configuration of controls and presets for all of the modes.

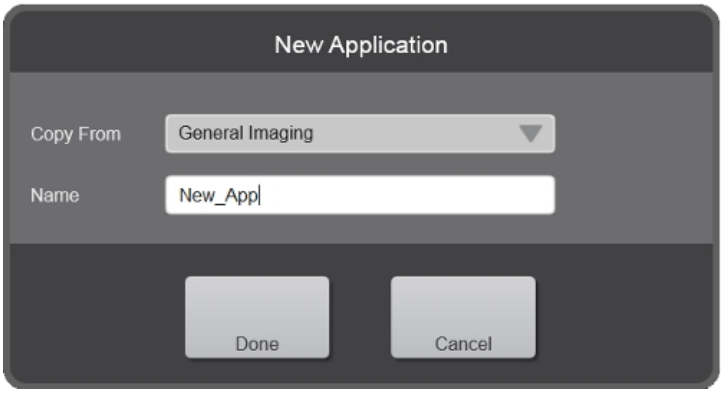
To create a custom application

1 On the Applications & Presets page, tap the transducer for which you want to create the application.

2 Click **New**.

3 Select an existing application that contains the Mode presets that are similar to what you want to create.

4 Enter a name for your custom application.



5 Click **Done**.

The new application appears in the Applications list of the selected transducer.

Note: Custom Applications and Presets are user specific.

Importing, exporting, disabling, and deleting applications

You can import and export all of the mode settings of the selected application from the Applications & Presets page.

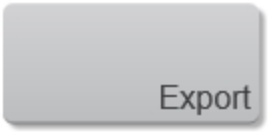
Note: When exporting an application, only the custom presets are exported, not the factory default presets.

To export an application

1 Select a transducer from the list.

2 In the Applications list, tap to highlight the application you want to export.

3 Tap **Export**.



4 In the Export Application page, browse to and select the folder that you want to export the application presets.

5 (Optional) To add a subfolder, tap **New Folder**, name the folder and then click **Done**.

6 Tap **Export**. The system exports the application.

Note: When exporting an application, only the custom presets are exported, not the factory default presets.

7 Tap **Done** to close the settings page.

To import an application

1 Tap **Import**.

2 In the Import Application page, browse to the folder that contains the application and then select it. Application files appear with the FUJIFILM VisualSonics symbol.

3 Tap **Import**.

4 Tap **Yes** to confirm the import operation.

Note: The imported files will overwrite the files in their current location if the application being imported already exists for the selected transducer.

The application you imported appears in the selected transducer Applications list, in alphabetical order.

5 Tap **Done** to close the settings page.

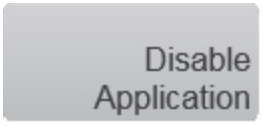
To disable an application

When you disable an application, it will be removed from the Applications list for that transducer.

1 Select the transducer from the list.

2 Tap to highlight the application you want to disable.

3 Tap **Disable Application**.



The application is grayed out, indicating that it has been disabled. To enable the application, select a disabled application and tap **Enable Application**. The application is enabled.

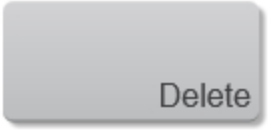
To delete a custom application

1 Select the transducer from the list.

2 Tap to highlight the application you want to delete.

Note: You cannot delete the factory default applications.

3 Tap **Delete** and confirm you want to delete the application.



4 Tap **Done** to close the settings page.

Presets

Presets allow you to save a set of acquisition parameters that you have customized and then apply as required. You can create presets with mode settings while scanning.

Applications & Presets allows you to manage how you work with the existing presets. Use this section to:

- set the default preset for an imaging mode.
- enable and disable existing presets for a mode.
- create auto-selected groups of presets across modes.
- view the parameters associated with a mode preset.

Setting the default preset for a mode

A default preset for a mode is the set of saved acquisition parameters that is applied to image data when a user begins scanning in that mode.

Note: The default preset is indicated in bold for each mode.

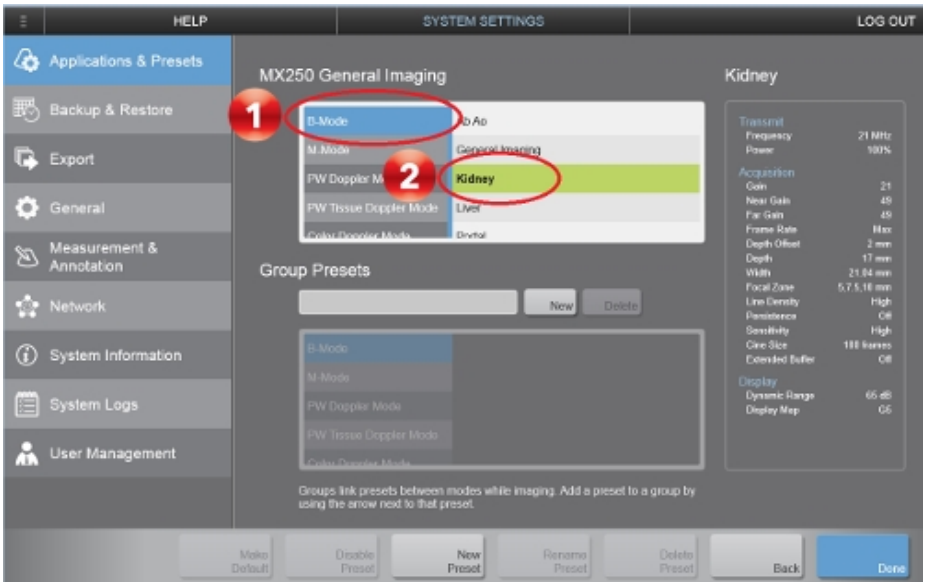
To set the default preset for a mode

Note: At any time during your edits, tap the **Back** button to save you changes and return to the Applications & Presets page.

1 On the Applications & Presets page, tap an application on the transducer.

2 Tap **Edit** to access the presets page for that application.

3 In the mode list, select the mode for which you want to set the default preset (see 1 below). The system populates the mode presets list for that mode.



4 Select a preset (see 2 above) and tap **Make Default**.

5 Repeat this selection process for the each mode that is available for the selected transducer application.

6 Tap **Done** to save the new default settings.

Enabling and disabling existing presets

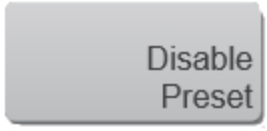
When a preset is enabled, it will appear in the list of available presets when you tap the **Mode Presets** control while scanning.

To disable an existing preset

1 In the mode list, select the mode for which you want to disable a preset; the system populates the mode presets list for that mode.

2 Tap the preset you would like to disable. The preset will be highlighted.

3 Tap **Disable Preset**.



The preset is grayed out, indicating that it has been disabled.

To enable a disabled preset

- Select a disabled preset and tap **Enable Preset**. The preset is enabled.

Creating a preset

Every transducer application includes factory presets for each imaging mode. You can create custom presets that store your own settings.

Creating a custom preset from within the system settings allows you to add that preset to multiple groups, see "Creating group presets" on page 149. You can also create a preset while scanning, see "To create a custom preset during scanning" on the facing page.

Note: Custom presets are transducer, mode, and user specific.

To create a custom preset from Applications & Presets

Note: At any time during your edits, tap the **Back** button to save your changes and return to the Applications & Presets page.

1 On the Applications & Presets page, tap the application on the transducer for which you want to create the preset.

2 Tap **Edit**.

3 In the Mode list, select the mode for which you want to create the preset.

4 Select the preset from the list that you want to copy.

5 Tap the **New Preset** button.

6 In the dialog, type the name for the preset. You also have the option of changing the preset you are copying.

7 Tap **Done** to save the preset.

To create a custom preset during scanning

The Save Mode Preset button is used to save the mode specific parameters being used in the current mode. This allows you to apply these exact parameters again later using the Mode Presets button.

1 Begin scanning in the desired mode.

2 Adjust the controls to optimize your image.

3 Tap **Save Mode Preset** to save the current settings as a preset.

4 Enter the name of your preset in the displayed field and tap **Done** to save the setting.

The new preset appears in the mode-specific flyout when you use the Mode Presets control.

Create your B-Mode presets first. B-Mode includes the largest number of controls that can be saved. Many other modes are based on B-Mode, including Color Doppler Mode, Nonlinear Contrast Mode and PA-Mode. These modes include fewer available settings. If your study protocol requires any of these B-Mode based modes you will still be able to use your B-Mode presets.

Deleting a preset

Users are only allowed to delete custom presets. You also can't delete a preset if it is the last remaining preset in a mode.

Note: The **Delete Preset** button is disabled until you select a preset that can be deleted.

To delete a mode settings preset

1 In the Mode list, select the mode that contains the preset you want to delete.

2 In the Mode Presets list, tap the name of the preset you want to delete.

3 Tap **Delete** then tap **Yes** at the confirmation prompt.

4 Tap **Delete Preset**.

5 Tap **Done** to save and apply the settings.

Creating group presets

A group preset is a way to set your system to automatically apply selected presets in multiple-mode image acquisition sessions.

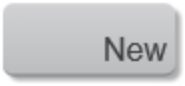
You create a group preset on the Applications & Presets page. When creating the group preset, note the following:

- Name and apply the group to each mode in a particular multiple mode session sequence such as you would follow in a protocol SOP.
- You can assign a particular preset to only one group. If you need to use a preset in a second preset group, create a copy of that preset using the **New Preset** button and then add that preset to the new group.
- You can assign only one preset per mode to the same group.
- You can activate a preset group during an acquisition session.

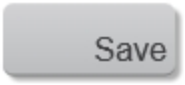
To create a group preset

Note: At any time during your edits, tap the **Back** button to save you changes and return to the Applications & Presets page.

1 While editing an application, in the Group Presets section of the window, tap **New** and enter a name for your new preset group.



2 Tap **Save**.



3 From the Mode list, displayed at the top of the window, select the mode from which you want to select a preset.

4 In the Mode Presets list select the preset to add to the group. Tap the down arrow. The system populates the corresponding Mode, within your group, with the selected preset.

The name of the group is displayed in the Mode Presets list.

Note: A preset can be used in only one group. If you create another group and add a preset already used in a group, it will be removed from its existing group.

5 Select the next mode in the Group Presets and select the required preset from the available options for the corresponding Mode Presets list from the top of the window.

6 (Optional) Change the preset in a group. Tap the preset to be replaced and tap the "X" to remove it, then replace it by selecting a preset from the available options for the corresponding Mode Presets list from the top of the window.

7 Tap **Done** to save and apply the settings.

Backup and Restore

Backup and Restore provides the tools to create and manage the backup of:

- system users.
- custom applications and presets.
- custom measurement packages.
- the state of configurable preferences.
- the active usage log mode state (enabled/disabled).

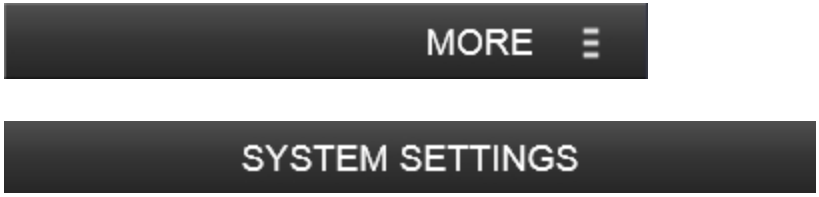
> **Note:** This backup does not store studies. See "Exporting images from the Study Browser" on page 253.

When backing up and restoring data, be aware of the following user access permissions and conditions:

- Only an administrator can restore, import, export or delete a backup.
- A Guest user cannot perform a system backup.

To display the Backup & Restore page

1 Tap **MORE**, and then tap **System Settings**.

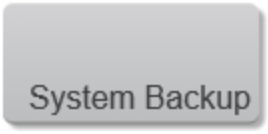


2 Tap the **Backup & Restore** tab.

System Backup

To create a backup file

1 On the Backup & Restore page, tap **System Backup**.



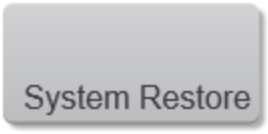
The system creates a time-stamped backup file.

2 Tap **Done** to close the settings page.

System Restore

To restore from a backup file

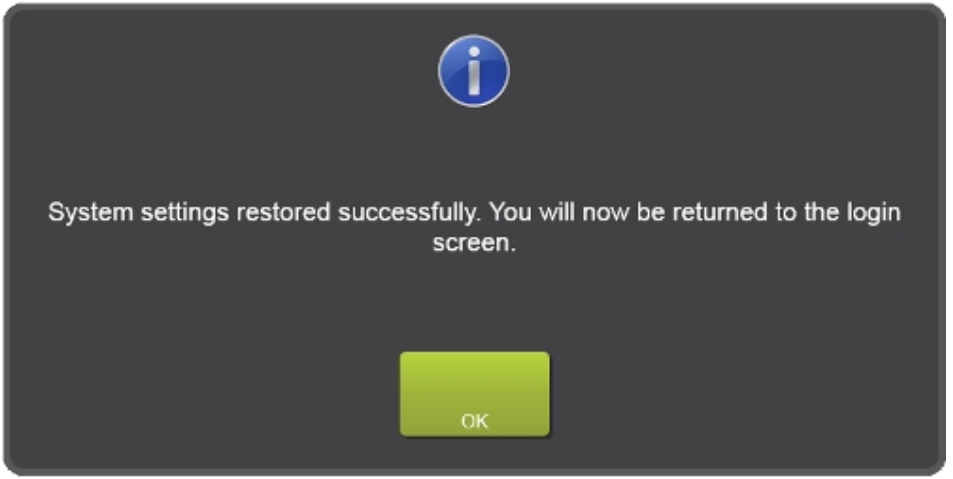
1 On the Backup & Restore page, select the backup file you want to restore. Tap **System Restore**.



2 Confirm the system restore by tapping **Restore**.

The system first completes an automatic backup of the current settings and then completes the restore.

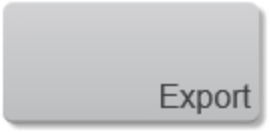
Tap **OK** on the confirmation dialog to return to the login page.



Importing, exporting and deleting backup files

To export a backup file

1 Select a backup file and then tap **Export**.



2 In the Export System Settings Backup page, browse and select the folder to which you want to export the file.

3 (Optional) To add a subfolder, tap **New Folder**, name the folder and then click **Done**.

4 Tap **Export**.

5 Tap **Done** to close the settings page.

To import a backup file

1 On the Backup & Restore page, tap **Import**.

2 In the Import System Settings Backup page, browse to the folder that contains the file and then select it. Backup files appear with the FUJIFILM VisualSonics symbol.

3 Tap **Import**.

4 Tap **Yes** to confirm the import operation.

Note: The imported files will overwrite the files in their current location

5 Tap **Done** to close the settings page.

To delete a backup file

1 Select one or more backup files from the list.

2 Tap **Delete** and confirm you want to delete the file(s).

3 Tap **Done** to close the settings page.

Export

Export allows you to define the content of your exported image files.

You can also select to enable the option for "Export" above.

To display the Export page

1 Tap **MORE**, and then tap **System Settings**.

2 Tap the **Export** tab.

Export Options

To define export options

1 Select one more of the following export options.

Option	Description
Hide measurements and annotations on exported images	Select this option to hide any measurements and annotations that have been added to the image on all exported images. The measurements and annotations are not deleted, just hidden from view on the exported image(s).
Hide physiology on exported images	Select this option to hide the physiology data on all exported images. The physiology data are not deleted, just hidden from display on the exported image(s).
Maintain data hierarchy	Select this option to maintain the tree structure of the exported data. If this option is not selected, files are exported to a single folder with all sub-directories removed.

2 Select the clip format.

Option	Description
Uncompressed AVI (*.avi)	Largest file size, provides the original image quality.
Animated GIF (*.gif)	Medium file size, provides fair image quality.
MPEG (*.mp4)	Smaller file size, provides good image quality.
Windows Media Video (*.wmv)	Smallest file size, provides good image quality.

3 Select the frame format as one of TIFF or BMP file format in either full screen or only the image area.

Option	Description
TIFF Full Screen (*.tif) BMP Full Screen (*.bmp)	
TIFF Image Area (*.tif) BMP Image Area (*.bmp)	

4 Select the compression level for your DICOM export file.

Option (*.dcm)	Description
Implicit VR Little Endian	Image pixel data are not compressed. The Tag type is determined by the context.
Explicit VR Little Endian	Image pixel data are not compressed. The Tag type is explicitly defined in the file.

Option (*.dcm)	Description
JPEG Baseline	An image created using the JPEG compression algorithm that starts displaying the image as the data are made available, line by line.
RLE Lossless	Run Length Encoding. A lossless compression algorithm that provides decent compression ratios in specific types of image file types such as TIFF and PDF.

5 Select the Report options.

Option	Description
Export Measurements	Export measurements in all reports.

6 Select the export options for the RAW/RF Data. See "RF Mode image export" on page 687 for details of the available options.

7 Tap **Done** to close the settings page.

Background Data Transfer

Background Data Transfer transfers studies, series and images automatically in the background to a designated location.

Please note the following:

- Target Locations will be remembered for each user—except for Guest (Background Data Transfer is not available for a Guest user).
- Changing the target location will not affect already submitted jobs. If the target location is changed, the pending or transferring jobs will continue to go to the original target location—any new jobs submitted for transfer will use the new target location.
- The Status column in the Study Browser will remain blank for data if the software used to acquire it was an older version that did not contain the Background Data Transfer feature or if a user stops data transfer.

  Note: The Status column will only be displayed if the user has Background Data Transfer enabled.

- The Data Transfer status flyout will display the meaning of each icon and an explanation for any data transfer failures.
- If a series is in the progress of transferring data or in a pending state, the study that the series belongs to cannot be modified.
- The system will not overwrite any images that exist in the target folder, and if an image is deleted from the system, it will not be removed from the target folder when and if the study or series is resubmitted for transfer.
- If a data transfer has failed, the system will keep it in queue and retry for up to 7 days. If after 7 days the data transfer has still failed, the system will abort transfer and remove it from the job queue. The Data Transfer Status icon will be displayed as an error.

To enable Background Data Transfer

1 Tap **MORE**, and then tap **System Settings**.

2 Tap the **Export** tab.

3 Tap the **OFF** button to turn **ON** and enable Background Data Transfer.

4 Once Background Data Transfer is turned **ON**, the Target Location browser is displayed.

5 Tap **Browse** and select a target location.

6 (Optional) Create a new folder.

7 Tap **Done**.

Important: When Background Data Transfer is turned ON, any previously closed studies or series will be not be transferred–older studies or series will need to be manually transferred.

Studies or series closed after Background Data Transfer is enabled, will be automatically transferred to the selected target location.

To disable Background Data Transfer

Important: When Background Data Transfer is turned OFF, all pending data transfer jobs will be canceled for the current user.

1 Tap MORE, and then tap System Settings.

2 Tap the Export tab.

3 Tap the ON button to turn OFF and disable Background Data Transfer.

4 Once Background Data Transfer is turned **OFF**, the Target Location browser is no longer displayed.

5 Tap **Done**.

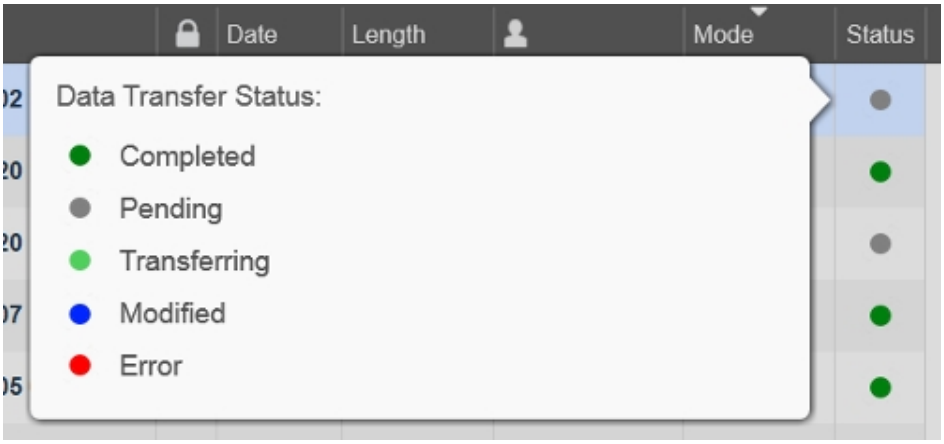
To use Background Data Transfer

Transfer of data will happen only when the study or series is closed.

Check the status of data transfer by looking at the Status column in the Study Browser.

Tapping the Status column icon for any study, series or image will display a legend for the status column icons and additional information.

The Data Transfer Status icons displayed are as follows:

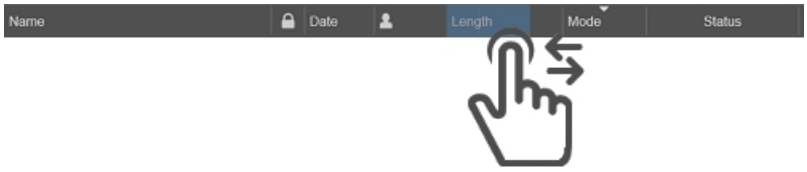


Data Transfer Status	Meaning
Completed	Data has been successfully transferred.
Pending	Data is waiting in queue for transfer. The name of the user who initiated the transfer is displayed.
Transferring	Data is in the process of transferring. The name of the user who initiated the transfer is displayed.

Data Transfer Status	Meaning
Modified	Status will only be displayed if you modify an image, series or study after transfer is complete and only if Background Data Transfer has be used at least once already. Status will remain until you resubmit the data for transfer, delete the data from the Study Browser or delete the data from the destination folder. If all modified images are deleted, the series and studies that the images belong to will return to their previous state. If an image is modified, the series and study will also display the modified status; If the series information is modified, the study will also display the modified status; If the study information is modified, only that study will display the modified status.
Error	Status will only be displayed when the system stops attempting to transfer the data after the data has been waiting for more than 7 days to transfer.

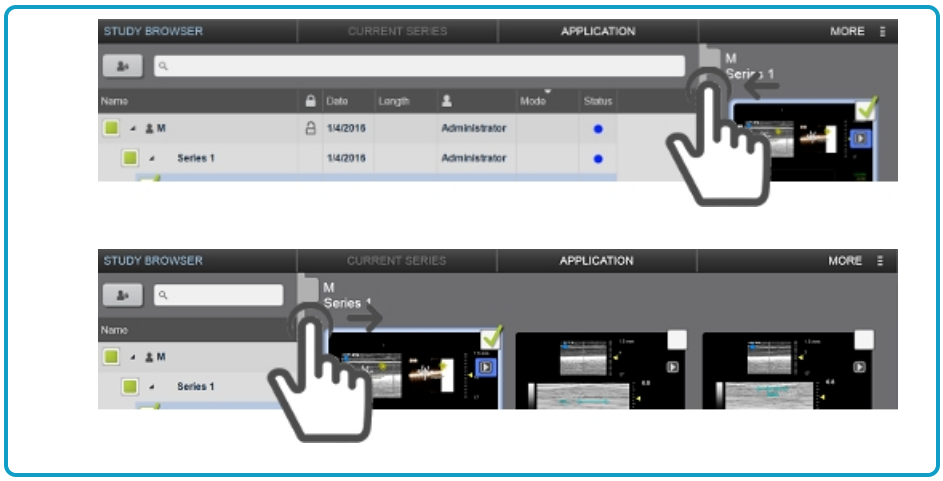
Important: To view the Status column for Background Data Transfer, you may need to adjust the columns in the Study Browser.

- Arrange the order of the columns by tapping and dragging a column heading to a different location. The column heading will turn blue to indicate that it is active.



- Resize the width of a column by tapping and dragging a column divider.

- Resize the study browser or thumbnail gallery view by dragging the divider tab.



To stop Background Data Transfer

Once the Background Data Transfer is enabled, any studies or series that are closed will be transferred to your selected target location, however, the data transfer can be stopped manually.

When the data transfer is stopped manually, the Data Transfer status icons return to their state before transfer—data that was already transferred successfully will display a completed status icon.

1 Go to the Study Browser.

2 Select a study, series or image that has a status of either *Pending* or *Transferring*.

3 Tap **More**.

4 Tap **Stop Transfer**.

Note: Only an Administrator and the user who submitted the image, study or series for transfer will be able to stop the transfer; other users will only be able to see the status of the transfer and who submitted it.

To manually transfer data

You can manually transfer an image, series or study from the Study Browser.

Use this feature if you have modified an image, series or study that has already been transferred to your target location; modified data is indicated by a blue dot icon.

Important: If you transfer modified data to the same location as a previous transfer, data will NOT be transferred. Create a new subfolder in the same location and transfer again. FUJIFILM VisualSonics does not allow transfer of modified data to the same location to prevent data from being corrupted due to data that may have already been modified in the destination location.

1 Go to the Study Browser.

2 Select a study, series or image that has no status defined (blank).

3 Tap **More**.

4 Tap **Queue For Transfer**.

General

Use the General preferences to describe your facility and set basic system settings—Institution, Startup screen, Date and Time, System Sounds, Display Brightness, Heart Rate Detection and Foot Pedal Configuration.

Note: Swipe upwards anywhere on the General page to see the settings on the lower part of the page.

To display the General page

1 Tap **MORE**, and then tap **System Settings**.

2 Tap the **General** tab.

Institution

To set your Institution

Once set, the system displays the institution name in Reports and Image Area exports.

1 Tap the Institution text box and type the name of your institution.

2 Tap **Done** to save and apply the settings.

Startup

To set your Startup preference

Specify what system state you prefer when you log in to the system.

1 Select either Home Screen, Study Browser, or Scanning.

2 Tap **Done** to save and apply the settings.

Date and Time

To set the Date and Time

1 Enter the date and select your preferred format: DD\MM\YYYY, MM\DD\YYY or YYYY\MM\DD.

2 Enter the time and time zone values as required.

3 (Optional) Tap to uncheck (disable) automatic updates for Daylight Saving Time. By default, the system updates the internal clock automatically for daylight saving time.

4 (Optional) Tap to check (enable) the 24 hour time format.

Note: Date and time settings can only be changed by an Administrator.

5 Tap **Done** to save and apply the settings.

System Sounds

To set System Sounds

Important: Changing the system sounds will not affect PW Doppler Mode sounds. To edit PW Doppler Mode sounds, use the **Volume** button in the PW Doppler Mode controls by tapping **More Controls**.

1 Adjust the volume of system sounds by tapping and dragging the sliders.

- Keyboard Tones. Enable if you want to hear a tone when the keyboard keys are tapped.

  Note: You will hear the keyboard tone at the selected volume after your selection has been made.

- Saving Tones. Enable if you want to hear a tone when saving images.

  Note: You will hear the saving tone at the selected volume after your selection has been made.

2 (Optional) Mute the system sounds by tapping the speaker icons;  to  to mute sounds, tap again to enable sounds.

3 Tap **Done** to save and apply the settings.

Display Brightness

To set the Display Brightness

You can adjust the brightness of the image display or the control panel to compensate for the level of light in the room in which the system is located.

1 Drag the upper slider for the image display.

2 Drag the lower slider for the control panel.

3 Tap **Done** to save and apply the settings.

Heart Rate Detection

To set the Heart Rate Detection

1 Select the heart rate detection option that is appropriate for the type of animals being imaged.

a. Low Heart Rate (large animals, less than 200 BPM)—not supported in EKV and 4D-Mode.

b. High Heart Rate (small animals, more than 200 BPM).

2 Tap **Done** to save and apply the settings.

Foot Pedal Configuration

To set the Foot Pedal Configuration

If you have a foot pedal, you can define the operation for each of the three pedals.

1 Tap the drop down to select the operation to assign to the selected pedal. Repeat this step for each foot pedal. The options include:

- B-Mode
- Name Image

- New Series
- Next Mode
- Next Preset
- Reset Preset
- Save Clip
- Save Frame
- Scan/Freeze
- Start/Stop
- Vevo Voice

2 Tap **Done** to save and apply the settings.

Note: Using Next Mode will switch to the next mode that is listed above the current mode according to the Scanning Mode buttons order on the left of the control panel.

When switching to a spectrum based mode (M-Mode, PW Doppler Mode, PW Tissue Doppler Mode) or PA-Mode, using Next Mode once will evoke the mode" Start" state—to begin scanning you must use Next Mode again.

Measurement & Annotation

Measurement & Annotation allows you to specify various default settings for the measurements and annotations used on acquired and saved images.

To display the Measurement & Annotation page

1 Tap **MORE**, and then tap **System Settings**.

2 Tap the **Measurement & Annotation** tab.

Display options

To specify measurement display options

♦ In the Measurement & Annotation page, select the desired default font size using the drop down. This value will be used for measurements and annotations that are added to your images.

Note: You can also define whether or not to show physiology data by default on measurements. This can be changed per measurement later, by changing the properties of a measurement.

Calculation options

To specify calculation options

1 When viewing graph data, specify how you want the histogram calculated. Select one of the following:

a. Raw data – Calculates the histogram from the original image data acquired by the transducer

Note: In Power Doppler Mode, the system applies the Image data preference at all times, even when you select Raw data.

b. Image data – Calculates the histogram from a combination of the original image data plus any modification you make after you process the image. For example, if you modify the brightness value, the system creates the histogram based on the original image data plus the modified brightness.

2 For M-Mode LV trace measurements, specify which heart rate values should be used for calculation:

a. Measurement – Uses the heart rate derived from the LV measurement.

b. Acquired physiological data – Uses the heart rate acquired directly from the animal.

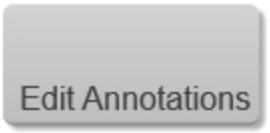
3 Tap **Done**.

Edit Annotations

To edit annotations

You can customize the available annotation labels that can be placed on an acquired image.

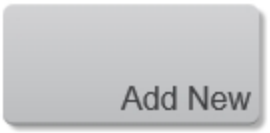
1 In the Measurement & Annotation page, tap **Edit Annotations**.



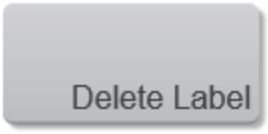
2 To edit a label, tap a custom label and update it as required. Custom labels are denoted with a small pencil icon.

Note: You cannot edit the default labels.

3 To add a new annotation, tap **Add New** and add the text of the new label.



4 To delete a label, tap to select the label, and tap **Delete Label**.



Note: You cannot delete the default labels.

5 Tap **Done** to close the page and return to your imaging session.

Network

On the Network page, you can specify the network connectivity settings.

Note: Swipe upwards anywhere on the Network page to see the settings on the lower part of the page.

To display the Network page

1 Tap **MORE**, and then tap **System Settings**.

2 Tap the **Network** tab.

Note: All of the tasks listed below can only be completed by a user with administrator status on the system.

Computer Name

To change the Computer Name

The Computer Name is set by default but can be changed.

1 On the Network settings page, tap the **Computer Name** field and enter the computer name.

2 Tap **Done** to close the page and restart the system.

Workgroup

To change the Workgroup

1 On the Network page, tap the **Workgoup** field and enter the workgroup name.

2 Tap **Done** to close the page and restart the system.

IP address

To change the IP address

1 On the Network page, do one of the following:

a. Tap **Obtain IP Address Automatically**. This is the default setting.

b. Tap **Use the following IP Address** and then enter the IP Address, the Subnet Mask and Default Gateway.

2 Tap **Done** to close the page and restart the system.

DNS settings

Note: You will not be allowed to tap **Done** until you enter valid DNS settings.

To change the DNS settings

1 On the Network page, do one of the following:

a. Tap **Obtain DNS server address automatically**. This is the default setting.

b. Tap **Use the following DNS Server Address** and then enter the IP address of the Preferred DNS Server and the Alternate Server.

2 Tap **Done** to close the page and restart the system.

Mapping network drives

Use the Network Maps section to connect to external drives on your organization's network.

A network drive is a file folder located on a remote system that has been configured for sharing over a network. It functions as a shortcut link to the remote location.

When you map a remote location, it appears as a lettered drive on your system, just like your C: drive or D: drive. Your mapped drive can only connect to the remote location when your system is connected to the network.

Note: This task can only be completed by a user with administrator status on the system.

To map a network drive to your system

1 On the Network page, in the Network Maps section, tap **Map Drive**. The Add Network Map page appears and loads the network structure into the network directory list.

2 Select the network location you want to map and do one of the following:

a. In the **Add Network Map** page, on the left side, in the Explorer area, expand the network and select the folder or drive you want to map.

b. Enter the Network Location in the text field. You must enter this name exactly.

3 In the **Specify the drive letter for the new network map** drop-down menu, select the letter you want to assign to the mapped location.

Note: The drive will be available to all users.

4 (Optional) Specify the behavior for the connection to the mapped drive.

By default, the system clears the Network maps each time you log off. Choosing **Permanently map the network drive** attempts to reconnect any mapped drives the next time you log on. If you do not want this to happen (for example, if you want the mapped drive to be active only for your current session), clear the checkbox.

Important: If you have to enter credentials to connect to the drive, you also must select the 'remember' checkbox on the Windows credentials panel to permanently map the drive. If you do not select the 'remember' checkbox, you may have to delete the drive and map the drive again.

Note: If you need to enter network credentials to connect to the selected drive, you will require a physical keyboard. Connect the keyboard via a USB port.

5 Tap OK. The mapped drive appears on the Network preferences tab in the Network Maps list.

To delete a mapped network drive

1 On the Network page, scroll to the bottom of the page. In the Network Maps list, select the mapping that you want to delete and tap Delete Drive.

2 Tap Done to close the page and return to your imaging session.

Photoacoustics

Use the Photoacoustics settings to define PA-Mode acquisition settings for PA-Mode (Single) and PA (Spectro).

To display the Photoacoustics page

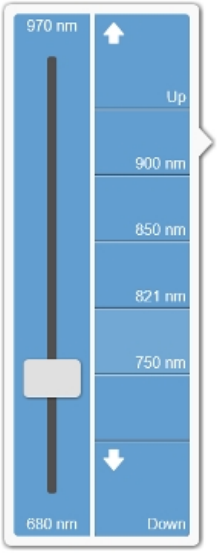
1 Tap **MORE**, and then tap **System Settings**.

2 Tap the Photoacoustics tab.

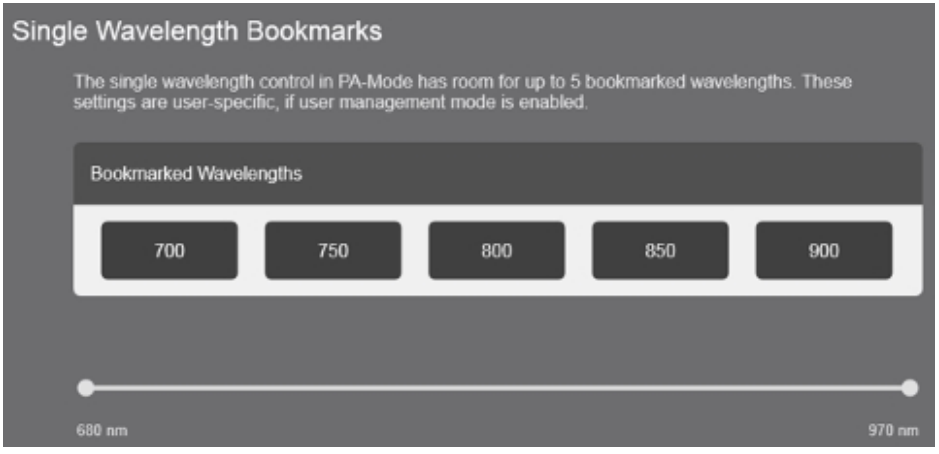
Single Wavelength Bookmarks

The single wavelength control for PA-Mode (Single) allows for five bookmarked wavelengths. These bookmarks are specific to each user.

Note: When switching between the fiber ports, the bookmarks will be disabled if they fall outside the current wavelength range.



PA-Mode (Single) wavelength flyout from the mode window.



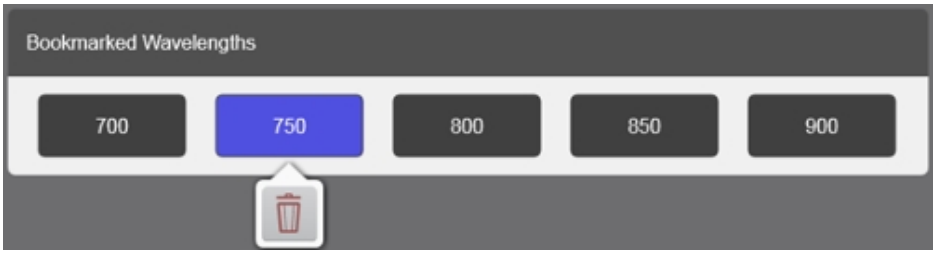
PA-Mode (Single) wavelength bookmarks from System Settings.

To delete a bookmarked wavelength

Note: If you switch from the Signal port (680-970 nm) that had five bookmarks to the Idler port (1200-2000 nm) and you want to add a bookmark, you must delete an existing bookmark first.

1 Go to the Photoacoustics page in System Settings.

2 Tap the bookmarked wavelength you want to delete.



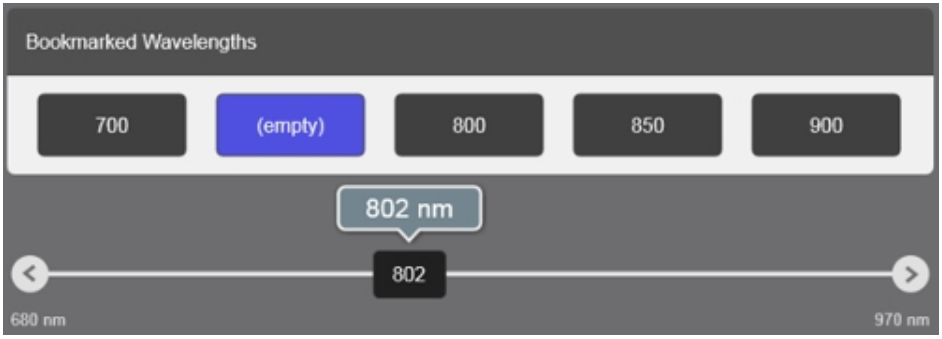
3 Tap the garbage icon.

The wavelength is removed from the bookmarked wavelengths list and the button is marked as empty.

To add or modify a bookmarked wavelength

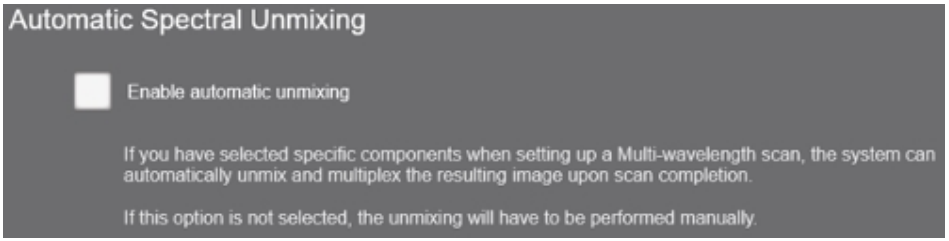
1 Tap a button listed in the bookmarked wavelengths list. A control on the wavelength range will become active.

2 Use the control to slide along the wavelength range and remove your finger when you have selected the new wavelength. The empty button will now be replaced with your selected wavelength and will be available on the single wavelength button in the mode window.



Automatic Spectral Unmixing

Enable Automatic Spectral Unmixing to unmix components automatically once a PA-Mode (Spectro) scan is complete. The system software will unmix components that you have selected automatically and will create layers for each component so you can select/deselect when viewing the image in review.

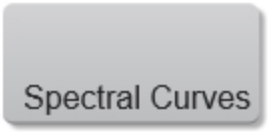


Note: If you do not enable the Automatic Spectral Unmixing option, the unmixing will need to be done by you manually.

Note: If the Automatic Spectral Unmixing section is not displayed, then it is not enabled on your license for the system software. Contact FUJIFILM VisualSonics to acquire this feature.

Spectral Curves

Tap the Spectral Curves button to display the PA Spectral Curves window.



This is where you will manage components used for spectral unmixing. The component name, sensitivity, and default display map for multiplexing can be changed. Components can also be exported, imported or deleted.

See "Vevo Spectral Unmixing" on page 563 for more information.

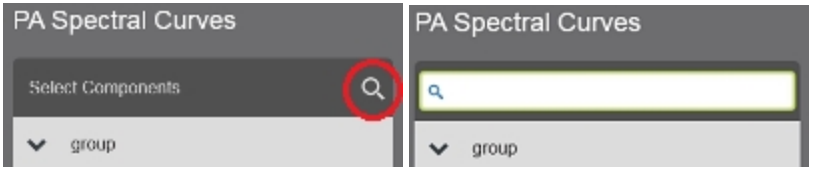
To export a PA Spectral Curve

Note: If exporting the same spectral curve to Vevo LAB, the Vevo LAB software may or may not overwrite the existing curve—the software will use the spectral curve that has the most recent edits, if any.

1 If you are signed in as an Administrator, select a user from the drop down list.

Spectral Curves are user specific. An Administrator will be able to select any user from the User drop down menu; a non-Admin will not see this drop down menu and will only see their own custom components.

2 Tap to select up to nine components to include from the Select Components list on the left. A search option is available, tap the search icon and then type text using the onscreen keyboard.

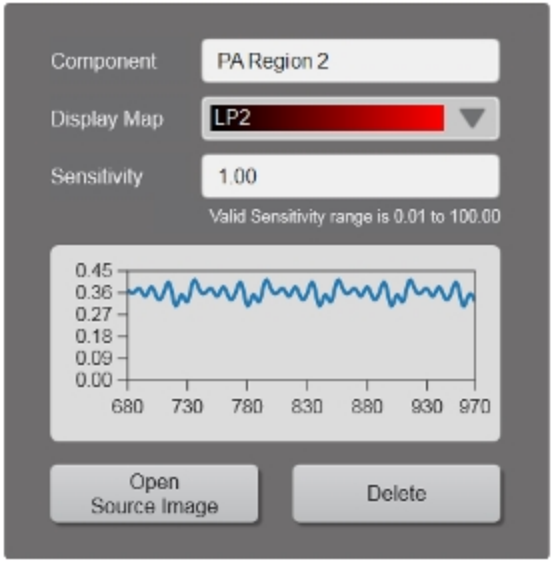


Once a component is selected, the component will be displayed on the graph to the right.

3 (Optional) Edit the component settings. When you tap a custom component, a settings icon will be displayed for that component.

Tap the settings icon to display a panel that provides the following options:

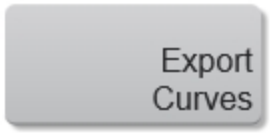
- Component - Edit the component name by tapping in the text box and using the available keyboard.
- Display Map - Select a different display map for the component when used in a multiplexed image.
- Sensitivity - Sensitivity enables you to give one component more visual weight over the other. Enter a sensitivity between 0.01 to 100.00.
- Open Source Image - Tap this button to open the source image that the component was used to acquire.
- Delete - Tap this button to remove the component from the Select Components list.



4 (Optional) Normalize Graph. Tap to enable graph normalization which will adjust the Y axis values to a notionally common scale.

5 (Optional) Remove components from the graph. To remove selected components from the graph, tap the component from the top of the graph; a delete icon will be displayed. When the delete icon is tapped, the component is removed from the graph.

6 Tap **Export Curves**.



7 A flyout with two export options will be displayed. Select one according to the following:

a. Export Selected - Export only the curves that you have selected.

> **Note:** Export Selected button will be disabled if there are no components selected or if only the VsiSystem default components are selected.

b. Export All - Exports all of the available curves, regardless if they are selected or not.

> **Note:** Both export options only apply to user or custom created curves.

8 Within the export window, tap to select the location for the exported file.

9 (Optional) Create a new folder.

10 (Optional) Enter a new name other than the system generated default name for your exported curve in the text box.

11 Tap **Export**. The system exports the curve as a *.cxml file and includes the file date and time of export.

To import a PA Spectral Curve

Note: If importing the same spectral curve from Vevo LAB, the system software may or may not overwrite the existing curve—the software will use the spectral curve that has the most recent edits, if any.

1 From the PA Spectral Curves window, tap **Import Curves**. The Import Spectral Curves window will be displayed.

2 Go to and tap to select the curve file.

3 Tap Import.

4 The imported curve will be added to the Select Components list.

To create custom PA Spectral Curves

User or custom PA Spectral Curves are created from the PA Region graph on a PA-Mode (Spectro) image.

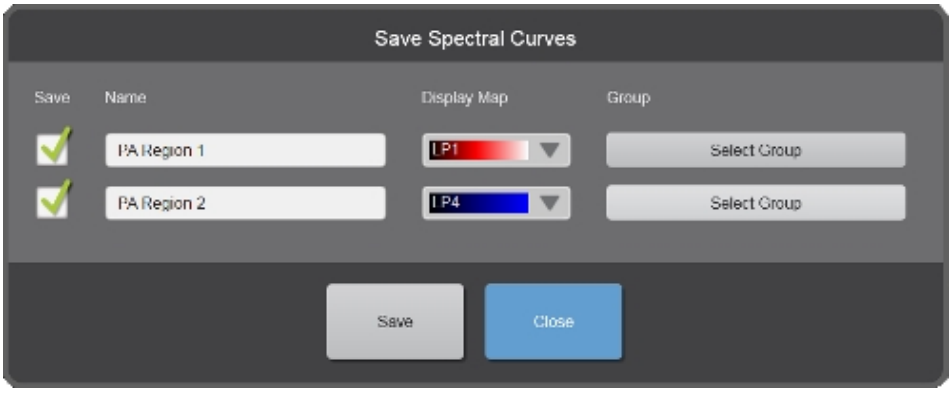
1 Acquire or load a PA-Mode (Spectro) image into review.

2 Place a PA Region measurement.

3 Select the graph option for the PA Region measurement from the Measurement panel. The PA Region Analysis window is displayed.

4 (Optional) Edit the Display Options and PA Regions from the panel on the left.

5 In the PA Regions section, tap **Save Spectral Curves**. The Save Spectral Curves panel is displayed.



6 Tap **Save**. The Spectral Curve will now be available in the PA Spectral Curves list on the Photoacoustics page in System Settings and also within the Unmixing and Multi-wavelength panels.

System Information

The System Information page displays system hardware and software versions and licensed features information.

On this page you can upgrade the system and update your license.

Note: Drag upwards anywhere on the System Information page to see the settings on the lower part of the page.

To display the System Information page

1 Tap **MORE**, and then tap **System Settings**.

2 Tap the **System Information** tab.

System Upgrade

To upgrade your system

Before upgrading your system, ensure any imaging files are saved.

Note: Only a user with administrator privileges can upgrade the system.

Note: The installation and restart process could continue for up to 30 minutes.

The following is required to perform a system software upgrade:

- Vevo 3100 Imaging System Software Upgrade Instructions (this document).
- Download the zip file named 'Vevo 3100 Imaging System Software VX.X.X.zip' from the FUJIFILM VisualSonics Customer Site. Unzip the downloaded file onto the root of a USB storage device.

  Note: Sign in at www.visualsonics.com and go to the Customer Site. On the Vevo 3100 tab, click the **Update Vevo 3100 Software** button, fill out the required information and then click **Download**.

  If you do not have a Customer Site account go to www.visualsonics.com/user/register and FUJIFILM VisualSonics will create one for you.

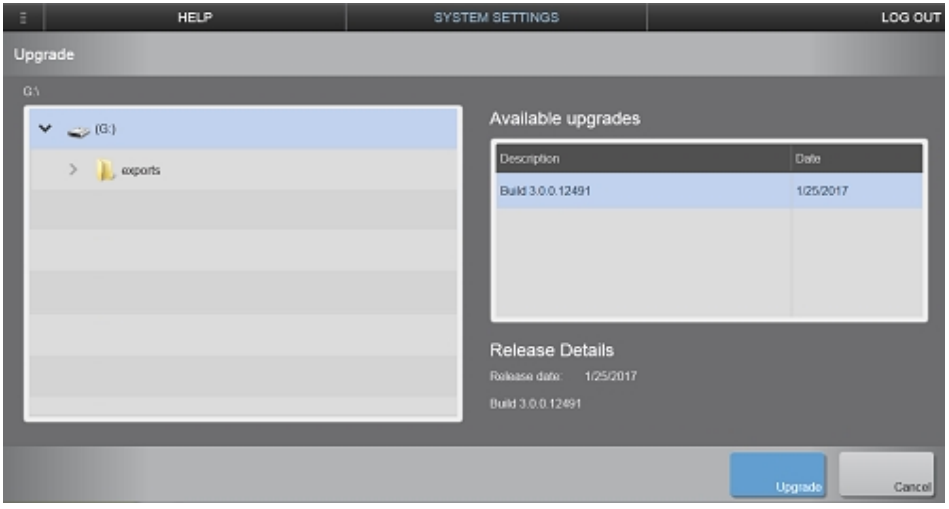
Important: Before upgrading, power down the system via the power button on the top right, then power off the complete system by using the main power switch at the back of the Vevo 3100 Imaging System.

Power up and restart the system.

1 Insert the USB storage device containing the Vevo 3100 Imaging System Software VX.X.X into the USB port on the right side or back of the system.

2 From the top menu, tap **More**, **System Settings**, then the **System Information** tab.

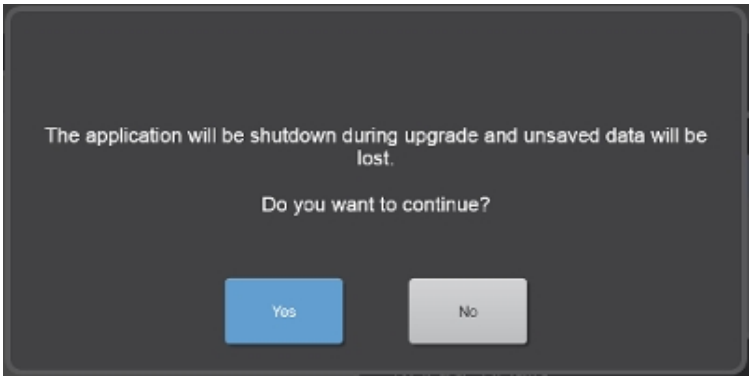
3 n the **System Information** page tap the **System Upgrade** button. The Upgrade window appears.



4 In the file browsing panel on the left, click on the USB drive letter.

5 Select the upgrade from the Available upgrades list and tap **Upgrade**.

6 The upgrade prompt appears.



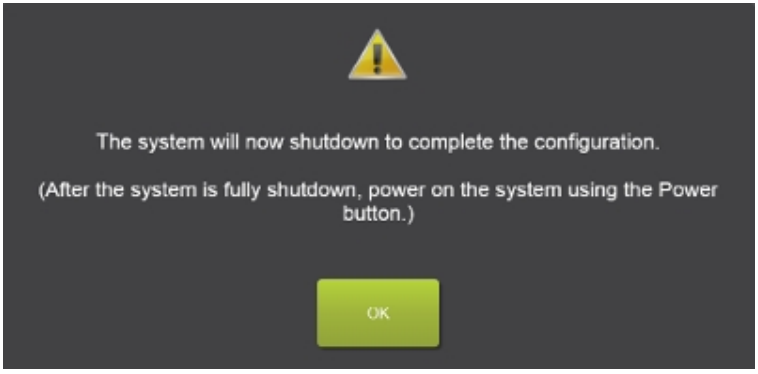
7 From this upgrade prompt, choose an option:

a. Click **Yes** to continue the installation.

> **Important:** It may take up to one minute before the screen starts showing the installation progress. Please DO NOT start any acquisition sessions during the upgrade process.

b. Click **No** to cancel the installation.

8 The following upgrade prompt will appear.



9 Click OK to continue the installation.

10 Once the system has fully shutdown, power on the system by pressing the power button on the top right.

11 Installation will continue—follow the on-screen instructions.

Note: DO NOT manually reboot the system while the system is upgrading.

12 Restart the system and verify the installed version on the System Information page.

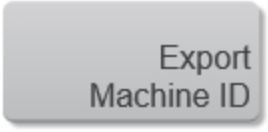
13 Remove the USB storage device from the USB port on the system

License Update

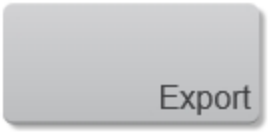
To update your license

Your system license and the enabled features are mapped to your specific machine as identified by the machine ID. In order to update your license and enable new features, you will need to provide the machine ID to Technical Support.

1 From the System Information settings page tap **Export Machine ID** .

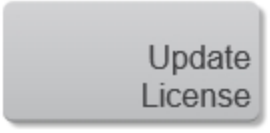


2 Select the location for the export and tap **Export**. The ID is saved to a text file that can be sent to Technical Support.



Once you have the license file on a USB you can perform the update.

3 Tap **Update License**.



4 In the file browsing panel on the left, navigate to the appropriate location.

5 Select the update file and then tap **Update**. The Update progress appears.

6 Tap **Done** to close the settings page.

System Logs

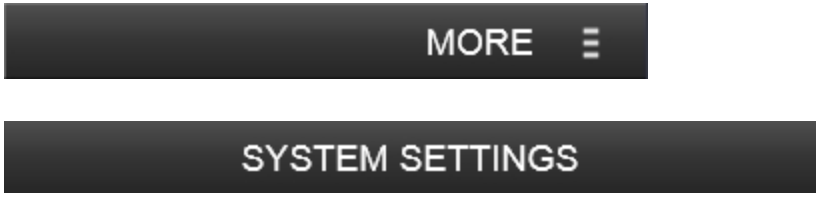
On the System Logs page, you can view the following logs:

- All – Displays every type of log file.
- Error – Logs that are usually generated when a system error occurs (Error logs include a dump file).
- Exit – Logs that contain all the information for an acquisition session, including when the system is powered on to when the system is powered off.
- Terminate – Logs that are usually generated when a critical system error occurs (Terminate logs include a dump file).

The log files are text files that you can open in a text-editing application (for example, Notepad). You can export the logs to a USB memory stick or network drive.

To display the System Logs page

1 Tap **MORE**, and then tap **System Settings**.



2 Tap the **System Logs** tab.

Export system logs

To export log files

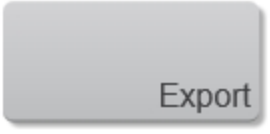
Caution: To avoid losing data from or damaging the USB memory stick, do not remove the USB memory stick or turn off the ultrasound system while exporting. In addition, do not bump or apply pressure to the USB memory stick while it is connected to the system as the system connector could break.

1 Select the type of log files to export.

2 Connect a USB memory stick.

3 On the System Logs page, select the specific files to export.

4 Tap **Export**.



5 In the Export System Log page, browse to and select the folder to which you want to export the file.

6 (Optional) To add a subfolder, tap **New Folder** and name the folder.

7 Tap **Done**.

You can safely remove the USB memory stick.

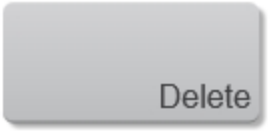
Delete log files

Note: Only a user with administrative privileges can delete log files.

To delete a log file

1 On the System Logs page, select the log file that you want to delete.

2 Tap **Delete** to delete the selected files.



3 Tap **Yes** to confirm the deletion.

4 Tap **Done** to close the settings page.

User Management

The User Management page is used to configure and customize each user profile on the system. You can configure the placement of controls on the control panel for each user, as well as applications and presets, and other system settings. See "Customizing controls" on page 388. Each user should have their own account in order to take advantage of this customization and to manage studies more efficiently.

There are three components to user management:

1. Create an Administrator password – The first time you log on to the system, you are prompted to create an administrator password. See "User Management" above.
2. Create User accounts – After creating the initial administrator account, the administrator can add more user accounts. See "User Management" above.
3. Ability to use Usage Log – Upon adding user accounts, you can use the Usage Log feature (if licensed). See "User Management" above.

Note: Only an administrative user can add new user accounts.

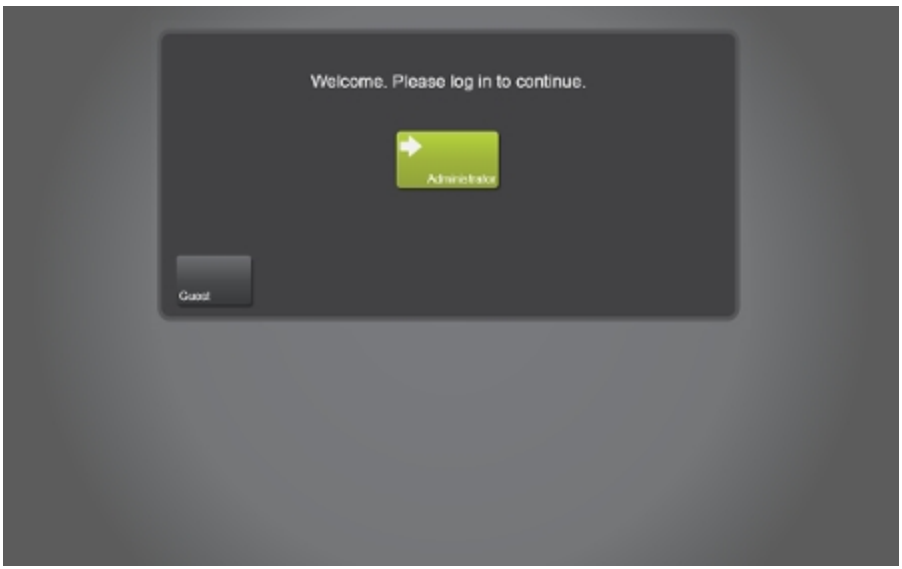
To open the User Management settings page

1 Tap **MORE**, and then tap **System Settings**.

2 Tap the **User Management** tab.

Logging on for the first time

The first time you turn on the system, you will see the log in screen with two buttons.



The **Administrator** button allows you to log on as an administrator with all of the associated administrative privileges.

The **Guest** button allows you to begin imaging immediately; however, any saved data is not associated with a unique user account and some system settings are blocked.

To configure the administrator account

1 Tap the **Administrator** button on the login screen. The system directs you to the **User Management** settings panel.

2 (Optional) Change the name of the currently logged in user in the **Name** field.

3 Set and confirm the password for the current user; this user will be the Administrator for the system.

Note: This password is for future use. You will need it to log in for subsequent sessions.

4 Tap **Done** to create the account.

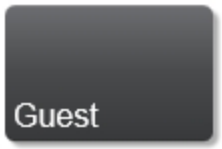
5 The system updates the name of the logged in administrator user, if the name was changed. You are then directed to the User List page.

Note: You must create a password for the Administrator account the first time you log in, if you don't you can only use the system as Guest with limited access to system settings.

Managing user accounts

There are three types of user accounts available on the system:

- Guest – The Guest account does not require a password and has access to all of the imaging and review functionality. Any user can access the Guest account using the **Guest** button on the login screen.



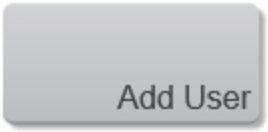
- Standard user – When you are creating a new user account, you can optionally select administrative privileges for the account. User accounts that are not defined as administrators have access to all of the imaging and review functionality and can take advantage of the customization and data privacy features of the system. Features, such as creating new user accounts, configuring network settings, and some other system settings are not accessible to an account without administrative privileges.
- Administrator – A user account with administrative privileges has access to all system features, such as creating new users, changing access permission of studies, upgrading the system software, etc. Users with an administrative account can also view all of the data on the system, regardless of the other user's privacy settings.

To create a new user account

Note: Only a user with administrative privileges can add a new user to the system.

1 Open the **User Management** page from the System Settings.

2 Tap **Add User**.



3 Tap the **Name** field and enter the user name.

4 (Optional) Check the **Administrator** checkbox to add administrative privileges to this account.

5 Enter and confirm the password for the user. This can be changed by the user or an administrative user at any time. See "User Management" on page 206.

6 (Optional) Choose another user account from which to copy the settings. This includes control placement as well as custom applications and application presets.

7 (Optional) Assign the user to a group. If a group has been defined, select the group from the list, If you want to create a new group, tap New and enter the group name.

Note: You can assign users to groups at any time using the user settings. See "User Management" on page 206.

8 Set the sharing option for study data. When a user creates a study, they have three options for how they can share their data. See "Working with studies" on page 230 . The option can be changed for each study at the time of creation.

9 Tap **Done** to create the user account. You are then directed to the User List page.

To assign users to a group

Groups allow you to manage user accounts more efficiently. You can assign permissions or access to a group of user accounts rather than having to update each user account individually.

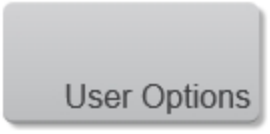
Note: The Guest account cannot be assigned to a group.

Note: Only a user with administrative privileges can create groups and assign user accounts to groups.

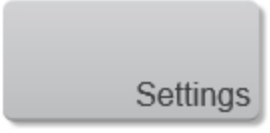
1 Open the User Management page.

2 In the User List, select the user you want to assign to a group.

3 Tap **User Options**.



4 Tap **Settings**.



5 Select a previously created group from the Group list or tap **New** to create a new group.

6 Tap **Done** to add the user account to the group.

7 Repeat for each user you want to assign to a group.

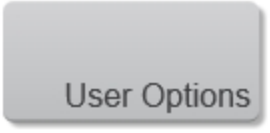
To delete a user account

Note: Only a user with administrative privileges can delete user accounts; Administrators cannot delete their own account while they are logged in and they cannot delete the Guest account.

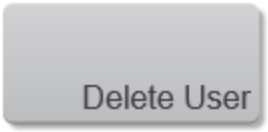
1 Open the User Management page.

2 In the User List, select the user you want to delete.

3 Tap **User Options**.



4 Tap **Delete User**.



5 Enter your password to confirm deletion of the user account. The user account is deleted and you are returned to the User List.

To modify a user's settings

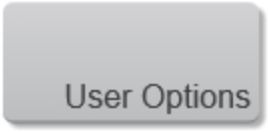
Note: A user with administrative privileges cannot remove their own administrator status while they are using the account.

Note: Only a user with administrative privileges can modify user accounts. Users without administrative privileges (standard user account) can change the default sharing setting for their own account.

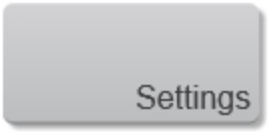
1 Open the User Management page.

2 In the User List, select the user you want to modify.

3 Tap **User Options**.



4 Tap **Settings**.



5 From this page you can:

- change the group.
- change the default sharing for new studies.
- change the administrator status of a user.
- disable a user so they cannot log in.

6 After making the desired changes, tap **Done** to update the user account.

To restore a user

Restores both the user and the user's button configuration.

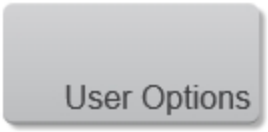
Note: Restore User affects button placement and any user specific system settings. Data and custom presets are not affected when restoring a user's account settings.

Note: Users without administrative privileges (i.e standard user account) can only restore their own settings.

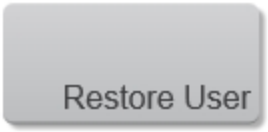
1 Open the User Management page.

2 In the User List, select the user account for which you want to restore the settings.

3 Tap **User Options**.



4 Tap **Restore User**. A confirmation dialog is displayed.



5 Tap **Restore**. A message is displayed confirming the settings have been restored, and you are returned to the login page.

To restore buttons

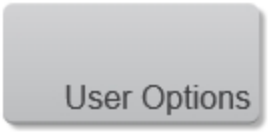
Restores the original default button configuration for any selected user.

Note: Only users with administrative privileges can restore buttons.

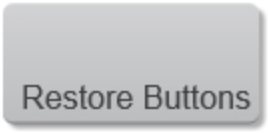
1 Open the User Management page.

2 In the User List, select the user account for which you want to restore buttons.

3 Tap **User Options**.



4 Tap **Restore Buttons**. A confirmation dialog is displayed.



5 Tap **Restore**. A message is displayed confirming the buttons have been restored, and you are returned to the log in page.

To change a user account's password

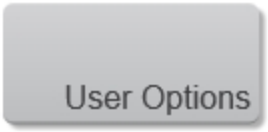
Users without administrative privileges (standard user account) can only change their own password.

Note: If you are an administrative user and are changing another user's password, you must enter your own password, not the password of the other user.

1 Open the User Management page.

2 In the User List, select the user account for which you want change the password.

3 Tap **User Options**.



4 Tap **Change Password**.

5 Enter your current password, and then enter and confirm your new password.

6 Tap **Done** to change the password.

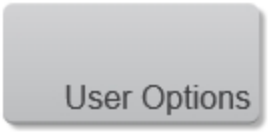
To export a user account

Note: Users without administrative privileges (standard user account) can only export their own settings.

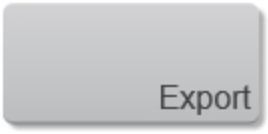
1 Open the User Management page.

2 In the User List, select the user account to export.

3 Tap **User Options**.



4 Tap **Export**.



5 Complete the export from the Export User page.

To import a user account

1 Open the User Management page and tap **Import**.

2 On the Import User page, navigate to the location and select the User file.

3 Tap **Import**.

4 The user account is added to the User List.

Note: If you import a user with the same name as an existing user account, you have the option to overwrite the current settings.

To enable or disable the Guest account

Note: Only a user with administrative privileges can enable or disable the Guest account.

1 Open the User Management page and uncheck/check the **Enable Guest Account** option below the User List to disable/enable the Guest account.

2 Tap **Done**. The next time you view the log in page, the **Guest** button will be displayed if enabled, and not if it is disabled, .

Usage Log

The Usage Log is an optional feature that allows you to record the usage of each user account. Any user account with administrative privileges can view data for all users. A standard user or guest can only view data for their own sessions.

To view the Usage Log

1 Open the User Management page and tap **View Usage Log**.

2 (Optional) Sort the log using any of the table headers; sort in either descending or ascending order.

To enable or disable the Usage Log

- On the Usage Log page, toggle the checkbox below the Usage Log table.

Note: You can still view, purge, and export the logs, but new logs will not be saved when Usage Log is disabled.

To purge the Usage Log

Note: Only a user with administrative privileges can purge the Usage Log.

1 On the Usage Log page, tap the **Purge Log** button. The Purge Usage Log panel is displayed.

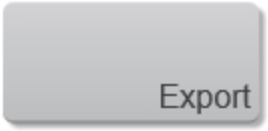
2 Enter the Start Date and End Date for the logs you want to purge.

3 Tap the **Purge** button. When the purge is complete, the panel closes and a confirmation message is displayed.

To export the Usage Log

Note: Users without administrative privileges (standard or guest user account) can only export their own logs.

1 On the Usage Log page, tap the **Export** button.



2 Enter the Start Date and End Date for the logs you want to export.

3 (Optional) Change the file name for the exported file.

4 Select the location you would like to export to.

5 (Optional) Create a new folder using the **New Folder** button.

6 Tap **Export**. When the purge is complete, the panel closes and a confirmation message is displayed.

7 (Administrator only) Exported items show a check mark next to the row in the Usage Log table.

Vevo Voice

The Vevo Voice page is used to set your voice options and to perform voice training.

The Vevo Imaging System supports voice activated commands to scan, acquire, save and review images.

You can decide whether or not to have Vevo Voice constantly on or user controlled.

You can also program the foot pedal for Vevo Voice, see "Foot Pedal Configuration" on page 175 (General page in System Settings).

To display the Vevo Voice page

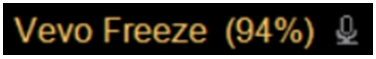
1 Tap **MORE**, and then tap **System Settings**.

2 Tap the **Vevo Voice** tab.

Voice Options

1. Show recognized voice commands and confidence levels.

   Enable this option to display text on the image display when a valid voice command is recognized. An overall percent confidence is also shown.



2. Select either constantly on or user controlled.

    a. Constantly on (stays on)

    Enable this option to have the microphone constantly listening for voice commands. If you want to disable this option during scanning, you do not have to go back to the Vevo Voice page in System Settings, you can disable this option from the Vevo Voice button on the General page in More Controls.

    Note: When Vevo Voice is constantly on, you must say 'Vevo' before saying any commands. See "Vevo Voice commands" on page 400.

    b. User controlled (off after a command is recognized)

    Enable this option to have control as to when the system software listens to your commands. You must tap the Vevo Voice button on the General page in More Controls or press a foot pedal (if configured, see "Foot Pedal Configuration" on page 175) in order for Vevo Voice to listen to your command. Once your command has been recognized, Vevo Voice will be disabled again—as well as the Vevo Voice button or foot pedal.

Off On

Voice Training

Vevo Voice requires time to 'train' the software to recognize users voices. The estimated time varies for each user.

Using the voice training will increase the accuracy and efficiency of Vevo Voice.

If you need to stop voice training once you have begun, you can continue from where you left off when you return to the Vevo Voice page—the Start Training button will be displayed as Continue Training.

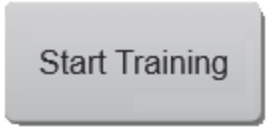
Note: Each user should complete training for themselves by logging in under their own name. If multiple people train Vevo Voice using the same user login, Vevo Voice may not be as accurate.

To start Voice Training

Note: If no microphone is detected the Voice Training title will be displayed as 'Voice Training (Microphone not detected)' and all controls under Voice Training will be disabled. Check your microphone connections and try again.

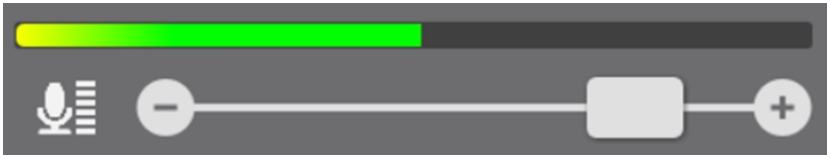
1 Tap the **Start Training** button.

Once training has begun, the **Start Training** button changes to **Stop Training**—use this button to stop training at any time.



2 Adjust the volume. As you adjust the volume, the level is displayed on the microphone icon.

Adjust the volume such that the level meter reads within the green area. The level meter is located just below the training phrase text box and displays the level of sound that your microphone detects.



3 Read the text displayed in the Training Phrase text box.

When the system software recognizes the phrase, another phrase will be automatically shown. This process will continue until all training phrases have been read (about 10 in each set).

When the first set of voice training commands is complete, the **Start Training** button will change to **Continue Training**. Tap **Continue Training** to begin additional voice training on a different set of commands. Once all of the voice training sets are complete, the **Continue Training** button will return to **Start Training**.

To start Voice Testing

Test the confidence level of any voice command to determine which words are interpreted at a higher confidence level and which words need to be

more clearly enunciated.

Some voice commands have options, for example you can say Save Frame or Frame Store for the same result—use the voice command that results in a higher confidence level when using Vevo Voice.

1 Tap **Start Testing.**

Once training has begun, the **Start Testing** button changes to **Stop Testing**—use this button to stop testing at any time.

2 Say any Vevo Voice command. See "Vevo Voice commands" on page 400.

The system software interprets your voice command and displays what it thinks you said in the Recognition Results text box. If the results are poor, begin Voice Training again.

Data Management

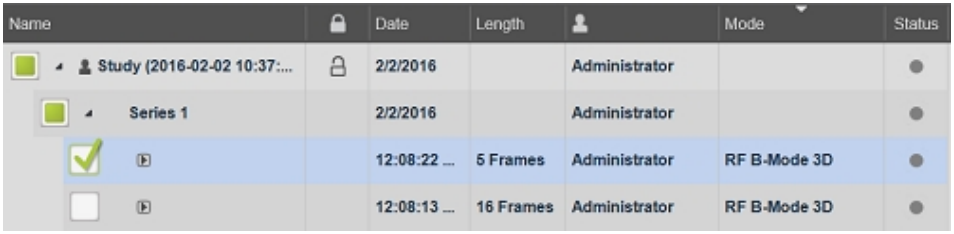
Studies on the Vevo Imaging System are like studies in a paper-based system; they work like a file directory and hold the collection of images.

When you acquire and save an image, the image is listed in the Study Browser. This section shows you how to use the Study Browser when you want to work with your saved images.

The Study Browser organizes your work into studies, series and images and displays them in the following hierarchy:

- Study – Contains one or more grouped image sets called a series.
    - Series – This is the group of one or more images that you acquire during an acquisition session. A series is a sub-folder of the parent study folder.
        - Image – This is a clip that contains multiple frames, a single frame, a 3D or 4D-Mode image, or a time period of a spectrum based mode.

The following illustration shows the hierarchy of a Study, Series and Image.



Interacting with the Study Browser

There are many actions that you can take from within the Study Browser such as opening images for review, creating new studies or series, viewing or changing information for studies or series, exporting data, deleting data, and generating reports. These actions are detailed in the following topics. Some of the most commonly used actions include:

- Navigating through previous studies and series by tapping on rows and dragging to scroll the list.
- Opening an image for review by tapping a thumbnail, or double tapping an image row.
- Creating a new study, series or adding a new image using the **New** button.
- Exporting data by selecting items using the checkboxes, and then using the **Export** button.
- Creating an analysis report by selecting items, and then using the **Report** button found under the **More** button.
- Starting a scan using the **Scan** button.

> **Note:** Scanning will start in the last acquisition mode or if it is a new study or new series, then scanning will start in B-Mode. If the transducer has not been initialized, the system will display the Application screen.

Filtering the list of studies in the Study Browser

To filter the list of studies in the Study Browser

An icon is shown next to each study in the Study Browser list which shows if the study is private, shared with the group, or shared with everyone.

1 Tap the privacy icon in the upper left corner of the Study Browser.

2 A list appears with three options.

Note: If you have installed the Vevo Brain Neuroanatomical Atlas to use with the Vevo Brain Stereotactic Frame, you will have a fourth option—Reference Studies.

3 Choose an option to filter the list of studies in the study browser. The choices relate to the privacy settings of each study.

- My Studies – You will see only the studies you are the owner of.
- Group Studies – You will see any studies from users in the same group as you; users will have set the privacy to 'share with group'.
- All Studies – You will see any studies that users have set the privacy to 'share with everyone', as well as group studies and your own studies.

Working with studies

Studies are the largest grouping you can work with in the Study Browser. Studies contain your images; these images are grouped into series which list all the images you create during an acquisition session.

You can organize your studies the way you want based on the type of study you are working on. Sometimes you will create a study that tracks a specific set of images of one animal over a period of time, other times you will create a study that tracks a specific set of images of a series of animals at one time.

You can create a study by acquiring image data or from within the Study Browser.

Creating a study

When you begin imaging in a mode, the system automatically creates a new system-named study and series. This is typically the fastest way to create a study.

To create a study by acquiring image data

1 After you start the system, choose an application.

2 The system creates a study. The system-generated study name and series name are displayed on the image display.

3 Add images to your series using **Save Frame** or **Save Clip**.

4 Tap the **Study Browser**.

5 Tap **More**.

6 Tap the **Information** button in the flyout. The Study Information page is shown.

7 Complete the desired fields as needed and tap **Done**.

8 (Optional) Tap **Close Series** to close the series. You can reopen a series later and add more images by tapping **New** and then selecting **New Images**.

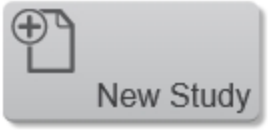
Note: When you close a series that contains no images, the system deletes the series.

To create a new study from within the Study Browser

1 Tap the **Study Browser**. The Study Information window appears.

2 Tap **New**.

3 Tap **New Study**.

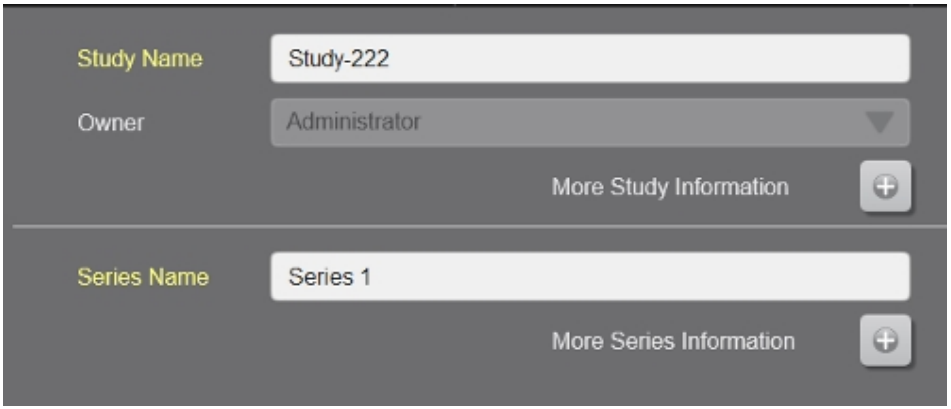


4 In the New Study window, the following information is already provided:

- The name of the current user appears in the **Owner** field as well as the **Acquired By** field.
- The **Series Name** defaults to Series 1.

5 Tap the expand icon to see more study information.

6 Enter a name in the **Study Name** field.



7 (Optional) Tap the **More Study Information** expand icon and add the following additional information:

- Institution – Enter the name of your institution.
- Study Notes – Enter specific notes related to this study.
- Privacy – Select the option that is appropriate for this study:

Privacy Setting	Icon	Description
Keep Private		Provides study access to you and administrators.
Share with Group		Provides study access to you, to all users in your group, and to administrators.
Share with Everyone		Provides study access to everyone.

8 (Optional) Enter a name in the **Series Name** field.

9 (Optional) Enter applicable Series information.

Note: A series is automatically created during the creation of a new study.

10 Tap **Done** to create the study. The system creates the study and series and begins acquiring in B-Mode.

11 Add images to your series as required.

Editing a study

You can update the information and settings for an existing study as long as you are the owner, have the required permissions and if the study is not locked.

To edit a study

1 In the Study Browser, select the study you want to edit and tap the **More** button.

2 Tap the **Information** button in the flyout.

3 Edit the information as described above.

4 Tap **Done** to save your changes and return to the Study Browser.

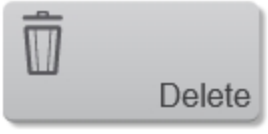
Deleting a study

You can delete a study as long as you are the owner, have the required permissions and if the study is not locked.

Note: You must unlock a study before you can delete a study, series or image.

To delete a study

1 In the Study Browser, select the study or studies you want to delete and tap the **Delete** button.



2 A message displays the study to be deleted and asks you to confirm the deletion.

Warning: When you delete items from the Study Browser, the system completely removes the data from your system. You cannot retrieve it.

3 Tap the **Delete Items** button to permanently remove the study and its contents.

Locking and unlocking a study

Studies can be locked to prevent unauthorized changes. Only the owner of a study or the administrator can lock or unlock the study. When a study is locked, it cannot be deleted or edited. The contents of the study can still be viewed and exported.

Note: You must unlock a study before you can delete a study, series or image.

To lock or unlock a study

- Tap the lock icon. The icon will toggle between the locked state  , and the unlocked state  .

Searching in the Study Browser

When you need to find a specific study, series, or image, use the Study Browser's search box or sorting features.

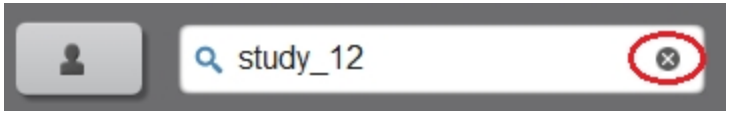
To search the Study Browser

1 Tap **Study Browser**.

2 Type your search phrase in the Search box.

3 Select your study from the returned list. If there are no matching results, then tap the search window and update the search criteria.

4 Tap the "x" to clear the search field and display the current list of studies.



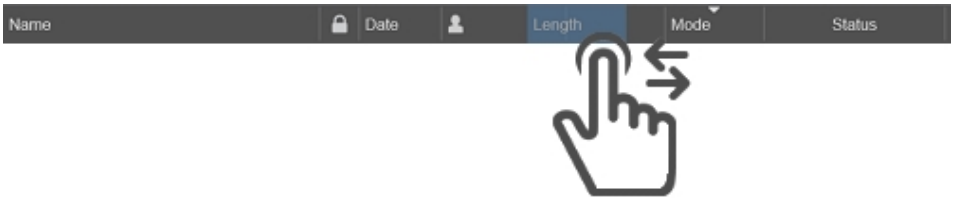
If you do not know the name of the study, you can try searching for any other identifying information, such as study name, owner name, study notes, or other parameters.

Editing and sorting the Study Browser

To edit and sort the Study Browser

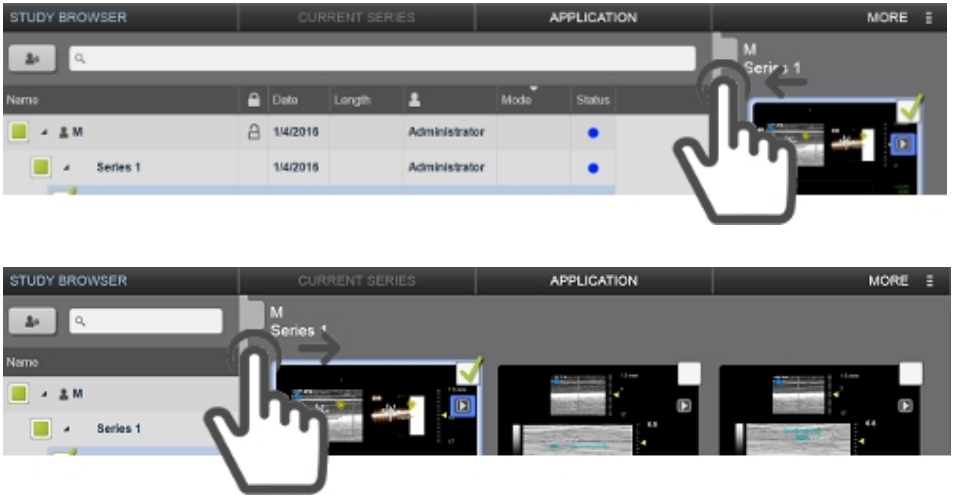
1 Tap **Study Browser**.

2 Edit the order of the columns by tapping and dragging any column heading to a new location—the active column header will turn blue.



3 Edit a column width by tapping and dragging a column divider—the active column divider will turn red.

4 Edit the size of the study browser or thumbnail gallery view by dragging the divider tab.



5 Tap any column heading to sort the list of studies. Toggle the column heading to switch from an ascending order to descending order.

- Tap Name column to display the list in alphanumeric order based on the study name.
- Tap the Lock icon column heading to display the locked studies first. Tap the heading again to display the unlocked studies first.
- Click the Date column heading to display the list in chronological order.
- Tap the Study Owner icon to display the list in alphabetical order based on the name of the study owner.

6 Scroll through the list to find the study of interest.

Working with series

Series are sub-groupings within studies that contain all the images you created during acquisition. Use series to create useful image groupings within your study.

Whenever you create a new study in the Study Browser, the system automatically creates the first series.

Let's say your study tracks a specific set of images of one animal over a period of time. Create a new series each time you reach a point in the study when you need to acquire images and take measurements. Add all your images for that animal to a series.

If your study tracks a specific set of images of a series of animals at specific times, create a new series at each time point and add your images for each animal to that series.

Creating a new series

You can create a new series by performing either of the following:

- Creating a new study (the system automatically creates the first series in the study).
- Adding a new series to an existing study from the Study Browser.
- Adding a new series to an existing study while imaging.

To add a new series to an existing study from the Study Browser

1 In the Study Browser, select the study that will contain the new series.

2 Tap **New**.

3 Tap **New Series**. The New Series window appears.

4 Expand the More Series Information section via  and enter the series parameters as required.

Parameter	Description
Series Name	(Required) Enter a name or use the default setting.
Date of Birth	(Optional) Click the calendar icon or the three spinners and select the date that the animal was born.
Sex	(Optional) Select the sex of your animal; if you select Female, the system displays the Pregnant option.
Pregnant	(Optional) Tap to select the checkbox. The system displays optional Date Mated and Date Plugged fields; if you want to add that data, tap the field and select the date.
All Other Fields	(Optional) Enter your information, as required.

Important: If you want to add embryology measurements to any image in the series you must select the Pregnant checkbox. Embryology measurements are only available in Vevo LAB. You can edit the series information later while in Vevo LAB.

5 Tap **Done** to create the series in the selected study. The system starts acquiring image data in B-Mode.

To simplify the addition of subsequent series in a study

1 In the Study Browser, select a study or series, tap **New**.

2 Tap **New Series**. The New Series window appears.

3 Tap the **Previous Information** button. The system copies the series information for nearly all the fields from the previous series in the study (Series Name and Acquired By information is not copied).

Note: When copying previous series information, you can choose from up to 5 of the previous series in the same study.

To add a new series to an existing study while imaging

1 In the General controls, tap **New Series**. The New Series window appears.

Note: If the New Series button is not on the control panel, open the More Controls panel and go to the General tab. See "Customizing controls" on page 388.

2 Enter the series parameters as required or copy the information from the previous series, as outlined above.

3 Tap **Done** to create the series in the selected study. The system starts acquiring image data in B-Mode.

Editing a series

You can edit the information for an existing series as long as you are the owner or have the required permissions, and the study is unlocked.

To edit a series

1 In the Study Browser, select the series you want to edit and tap **More**.

2 Tap **Information**.

3 Expand the **More Series Information** field and edit the information.

4 Tap **Done** to save your changes and return to the Study Browser.

Moving a series

You can move a closed series from one study to another.

To move a series

1 From the Study Browser select the series you want to move.

2 Tap the **More** .

3 Tap the **Move** button in the pop up menu.

4 In the target window, select the study to which you want to move the series and tap the **Move** button.

Closing a series

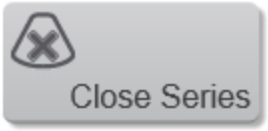
When you are in an acquisition session adding images to your study, the series you are working with is the active series.

Note: The closed series can be re-opened at any time to add or edit images

Note: When you close a series that contains no images, the system deletes the series.

To close a series

- Tap the **Close Series** button.



Re-opening a series

To re-open a series

1 Select the series in the Study Browser.

2 Tap **New**.

3 Tap **New Images**.

4 The system begins acquiring in B-Mode. Any saved images or clips are added to the selected series.

Deleting a series

Any user, other than Guest, can delete a series as long as you can see it and it isn't locked.

To delete a series

1 In the Study Browser, select one or more series that you want to delete and tap the **Delete** button.

2 A message displays the series to be deleted and asks you to confirm the deletion.

Warning: When you delete items from the Study Browser, the system completely removes the data from your system. You cannot retrieve it.

3 Tap the **Delete Items** button to permanently remove the series and its contents.

Current series

You can view the currently active series using the **Current Series** option at top of the control panel.

All of the controls for managing series are also available from this window. However, you cannot create a new series from this location. For more information on the controls, see "Working with series" on page 239 and "Exporting from the Study Browser" on page 252.

To access the thumbnail images

1 Tap on a thumbnail to open that image for review.

2 Use the checkboxes on the upper right corners of the thumbnails to select multiple images for actions such as exporting or deleting.

3 (Optional) Tap **Scan** to resume scanning.

Working with images

Images are saved clips and image frames that are listed within a series.

To open an image

1 In the **Study Browser**, expand the study and series that contain the image you want to open.

2 Select the image you want to open, by either double tapping the image row or tapping the image thumbnail.

The system opens the image in review mode in the mode window.

Naming an image

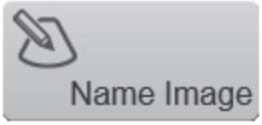
To name an image from the Study Browser

You can name a saved image from the Study Browser.

1 In the Study Browser, expand the study and series that contain the image you want to name.

2 Select the image you want to name and tap the **More** button.

3 Tap the **Name Image** button in the pop up menu.



Note: The Name Image button will not be available if more than one image is selected.

4 Enter the name for the selected image and tap **Done** to update the name.

Modifying a stored image

Image processing tools for modifying images that have already been acquired are available in the Controls bar while reviewing the image.

The tools vary depending on the imaging mode. For information on the available image processing tools for a mode, see the Acquisition and Display subsections in the mode settings topic for each imaging mode.

Note: Changes made in the Image Processing panel do not change the outcome for data quantification.

Storing an image

You can store a clip or individual frame while you are acquiring image data or reviewing image data.

To store a clip

1 Begin acquiring data or load a stored clip from the Study Browser into review.

2 Tap Save Clip. The system saves the clip as a single image item and lists the image in the Study Browser.

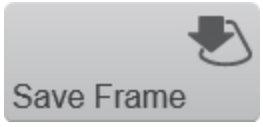
To store a single-frame image

You can use Save Frame for a single-frame image in B-Mode, EKV, PA-Mode, Color Doppler Mode, Power Doppler Mode and Nonlinear Contrast Mode.

For M-Mode, AM-Mode, PW Doppler Mode and PW Tissue Doppler Mode, this button stores the complete clip.

1 Begin acquiring data or load a stored clip from the Study Browser into review.

2 Tap **Save Frame**. The system saves the frame and lists the image in the Study Browser.



Note: When you store a frame from a previously stored clip, the frame includes the same image label as the original clip.

Deleting an image

You can delete an image as long as you are the owner or have the required permissions, the study is unlocked and the study is not in pending or in the process of being transferred.

To delete an Image

1 In the Study Browser, select one or more images that you want to delete and tap the **Delete** button.

2 A message displays the images to be deleted and asks you to confirm the deletion.

Warning: When you delete items from the Study Browser, the system completely removes the data from your system. You cannot retrieve it.

3 Tap the **Delete Items** button to permanently remove the images.

Exporting from the Study Browser

The Export function translates your images from the proprietary Vevo Imaging System file format into industry-standard formats that you can work with on another computer.

Export also transfers the translated files to a network location or an external storage device connected to the USB ports on the Vevo Imaging System. See "System connections" on page 46.

You can also enable Background Data Transfer. Background Data Transfer transfers studies, series and images automatically in the background to a designated location. See "Background Data Transfer" on page 161.

Note: You do not need to eject a connected USB device before removing.

Before you begin, ensure that the Vevo Imaging System is connected to a data storage location on your network, or to an external storage device through the appropriate ports on the system.

Exporting images from the Study Browser

When you select a series or a study that includes clips as well as image frames, the system exports the last frame of any clip as an image frame.

Note: Select only clips if you want to export the entire clip.

If you have selected a clip that includes a measurement, the system exports the frame where the last measurement was placed, or the frame that was displayed when it was last saved.

To export images from the Study Browser

1 Tap **Study Browser**.

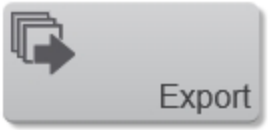
2 Select the clips or frames that you want to export.

a. If you want to export a single clip or frame, expand the study and series that contains the image and tap to select it.

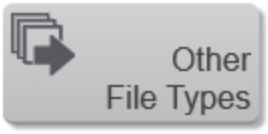
b. If you want to export multiple clips or frames, expand and select the study rows or series rows that contain the images you want to export.

Note: You cannot export 3D Mode images as a clip.

3 Tap the **Export** button.



4 Tap the **Other Files Types** button from the flyout.



5 The Export page appears. Do one of the following:

a. Browse to and select the destination folder.

b. Manually enter the destination folder in the field located above the Export Type options.

Note: The **Export** button will be disabled if the destination selected does not have enough available space.

6 (Optional) Tap **New Folder** to add a sub-folder. Enter a name for the folder and then tap **Done**.

7 In the Export Type section select the appropriate format:

a. Clips – If the images are all multi-frame clips.

b. Frame – If the selected files are single-frame images.

8 (Optional) Type a new file name.

In the field located above the Export Type options, the system displays the system-defined date and time stamp file name. You can change the file name for any export.

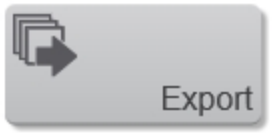
Note: To identify and group these files more easily in your export folder, enter a new file name other than the default. When exporting multiple clips or frames, the text entered will be the start of each of the exported files.

9 Tap **Export**. The system exports the images to the destination folder and then displays an export report.

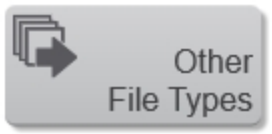
To export physiological data from the Study Browser

1 In the Study Browser, select the clips and/or image frames that contain the physiological data you want to export.

2 Tap the **Export**.



3 **Other Files Types** from the flyout menu.



4 On the Export page, browse to or manually enter the destination folder.

5 In the Export Type section select the Physiological Data option.

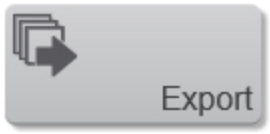
6 Tap **Export**. The system exports the images to the destination folder. The file name ends with the extension physio.csv.

To export images to DICOM from the Study Browser

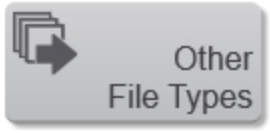
You can export saved clip and frame images as DCM files that you can import into a DICOM compatible workstation. You can export your saved images from the Study Browser or while you are reviewing them in the Mode window.

1 In the Study Browser, select the images you want to export.

2 Tap the **Export**.



3 Tap **Other Files Types** from the flyout menu.



4 On the Export page, browse to or manually enter the destination folder.

5 In the Export Type section select the DICOM option. See "Export" on page 158 for DICOM export options.

6 Tap **Export**. The system exports the images to the folder you selected. The file name ends with the extension .dcm.

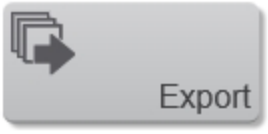
To export Study Browser list view to a text file

The export table feature exports the Study Browser window content as it appears, as a .txt file that you can open in any standard text editor.

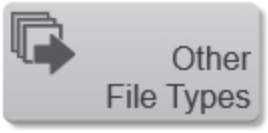
For example if your Study Browser includes 50 studies and you expand only the sixth study and its series and images, your export will include all the listing information for the one study that you expanded completely, and include only the study rows for the other 49 studies.

1 In the Study Browser, expand the study rows and series rows as required to create the precise view you want to export

2 Tap the **Export**.



3 Tap **Other Files Types** from the flyout menu.



4 In the Export Image window, browse to or manually enter the destination folder.

5 In the Export Type section select the **Study browser inventory table** option.

6 Tap **Export**. The system exports the Study Browser list view as a .txt file to the folder you selected.

Exporting studies to Vevo LAB

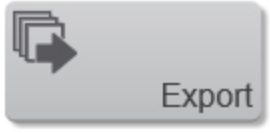
You can export studies from the Study Browser to the Vevo LAB for further analysis or processing.

To export images to Vevo LAB

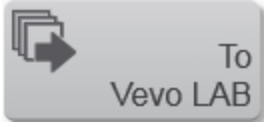
1 In the Study Browser, select the study or studies you would like to export.

Note: You have the option to export individual series or images to Vevo LAB; however, this is not recommended as it may interfere with future data management.

2 Tap **Export**.



3 Tap **To Vevo LAB** from the flyout menu.



4 On the Export page, browse to or manually enter the destination folder.

5 Tap **Export**. The system exports the selected images to the destination folder.

Exporting from other locations

You can export from other locations within the software:

- Applications and Presets system settings
- Report window
- System Logs system settings
- User Management system settings
- Mode window

Exporting from the mode window

The export function translates your images from the proprietary Vevo Imaging System file format into industry-standard formats that you can work with on another computer.

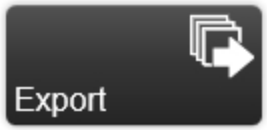
Export also transfers the translated files to a network location or an external storage device connected to the USB ports on the Vevo Imaging System. See "System connections" on page 46.

Note: You do not need to eject a connected USB device before removing.

Before you begin, ensure that the Vevo Imaging System is connected to a data storage location on your network, or to an external storage device through the appropriate ports on the system.

To export images from the mode window

1 From the Mode window, tap **Export**.



2 The Export page appears. Browse to or manually enter the destination folder.

Note: The **Export** button will be disabled if the destination selected does not have enough available space.

3 (Optional) Tap **New Folder** to add a sub-folder. Enter a name for the folder and then tap **Done**.

4 In the Export Type section select the appropriate format:

a. Select Clips if the image is a multi-frame clip.

b. Select Frame if the selected image is a single-frame image.

5 (Optional) Type a new file name.

In the field located above the Export Type options, the system displays the system-defined date and time stamp file name. You can change the file name for any export.

Note: To identify and group these files more easily in your export folder, enter a new file name other than the default. When exporting multiple clips or frames, the text entered will be the start of each of the exported files.

6 Tap **Export**. The system exports the images to the destination folder and then displays an export report.

Important: The Study browser inventory table is the only option that is not available when exporting from the Mode window.

Reports

A report is the collection of measurements, calculations and graphs for a collection of series or studies.

When you are creating reports consider the following:

- You can create reports for studies or individual series.
- You cannot create a report for measurements of an individual image; the system builds a report for the entire series that includes that one image.
- When you select a study for a report, the report includes all measurements for all the series in the study.
- When you select multiple studies for a report, the report includes all measurements in all the studies you selected.

Creating a report

To create a report

1 Open the Study Browser and select the images, series or studies that contain the measurements you want to compile into a report. See "Searching in the Study Browser" on page 236.

You can also create a report for the current series from the "Current series" on page 247 page or the report button located in the general controls during scanning or while reviewing an image.

2 Tap the **More** button and then tap the **Report** button in the flyout menu. The system compiles your selections into a single report and displays the report in the Report page.

3 If your selected series contains a saved graph, the graph will be displayed in the report. Tap the **Graph Size** control to select the size for the graph in the report (100%, 50%, 25%).

Interacting with your report

Once your report is created, it will show the study and series information for each study and series selected.

You can tap a measurement row to show the thumbnail of the image the measurement was placed on. Tapping on the image will open that image for review.

You can also create a contrast graph from within the report if you have placed contrast region measurements within the imaged selected. See "Contrast Region measurement" on page 297.

Exporting a report

The system exports your report as a CSV file which you can load into third party applications such as spreadsheet software to allow for additional statistical analysis.

The system supports four ways to export your report:

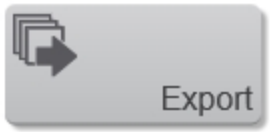
- From the Study Browser
- From the Report page

- From the Mode window
- From the Current Series page

To export a report

1 Create the report as outlined in "Creating a report" on page 262.

2 Tap the **Export** button.



3 The Export Image window appears. Browse to or manually enter the destination folder.

4 (Optional) Tap **New Folder** to add a sub-folder. Enter a name for the folder and then tap **Done**.

5 Tap **Export**.

6 The report is exported and the status is displayed when the export operation completes. Tap **Done** to close the Export page.

Annotations

Annotations are text labels that you can add to any image.

When you store an annotated frame or clip, the system stores the annotations along with the image. This topic describes how to work with annotations when you are analyzing an acquired image.

Predefined Annotations

When placing an annotation on an image, you will see the annotations panel which contains predefined labels. The system comes loaded with a set of predefined labels.

You can also create and save custom predefined labels in the System Settings. See "Measurement & Annotation" on page 177.

Adding Annotations

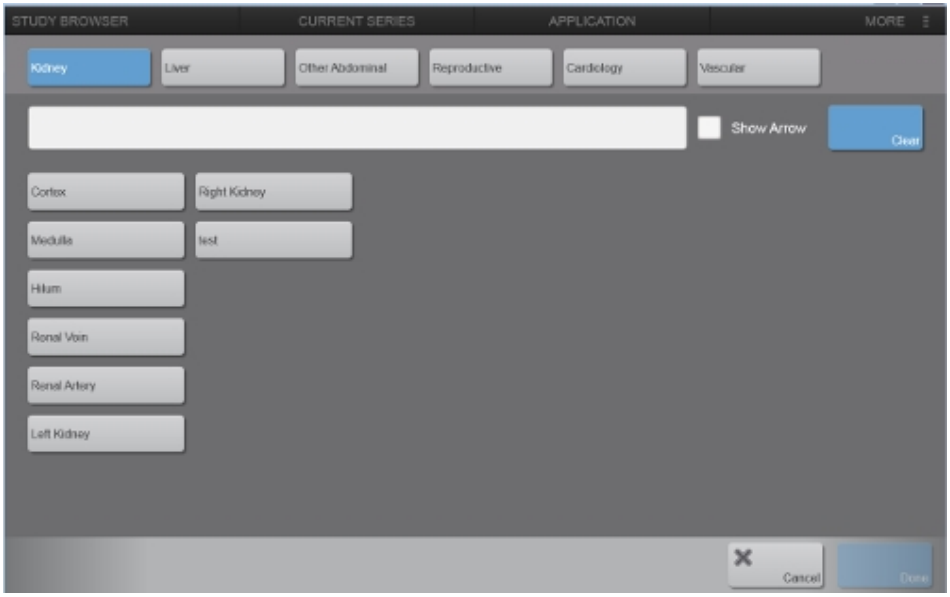
To add an annotation

1 Select the image you want to annotate. Either acquire an image with the **Freeze** button, or load an image from the **Study Browser**.

2 In the imaging controls, tap the **Annotation** button.

The annotation page is displayed.

Note: When placing annotations on M-Mode, AM-Mode, PW Doppler Mode, or PW Tissue Doppler Mode images, you can place annotations on either the mode data window or the B-Mode scout window. To place an annotation on either location, tap on the desired window on the control panel, and then tap the **Annotation** button for that mode. You can also do this by opening **More Controls**, selecting the mode tab, and then tapping the **Annotation** button for that mode.



3 You can select a predefined annotation, or enter custom text.

a. Tap the text entry area to show the onscreen keyboard. Enter the text you want to add as a one time custom annotation.

b. Select the category from the top of the page, and then the predefined label you want to add.

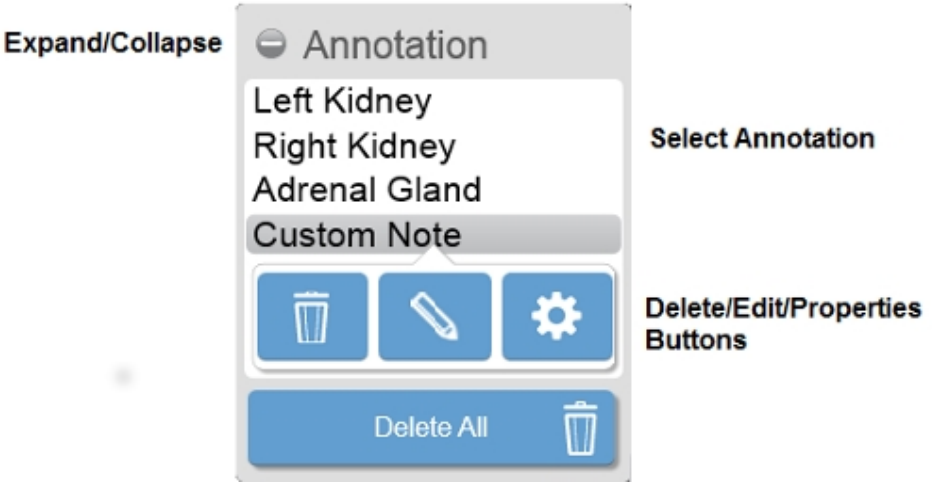
4 (Optional) Tap the **Show Arrow** checkbox to show an arrow when the annotation is dragged.

5 Tap **Done** to add the annotation. The annotation is placed on the image. You can then interact with the annotation using the control panel.

Note: While you are placing the annotation, a magnified view of the placement area is displayed on the image display to help with a more accurate placement.

6 Drag the annotation to the desired location on the image.

7 Annotations on the image will be shown on the Annotation panel on the left of the control panel. Use the Annotation panel to edit the annotations.



To change the annotation's properties

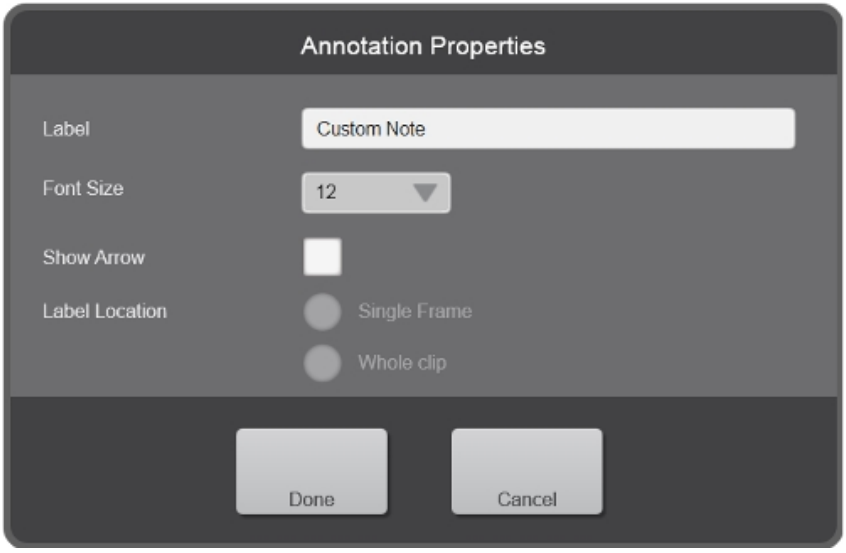
Each annotation has its own set of properties that you can modify.

1 Tap the annotation that you want to modify in the Annotation panel.

2 Tap the **Properties** button.

The Annotation Properties screen is displayed.

- Label – Tap the text box and modify the existing label as required.
- Font Size – Tap the Font Size and select the preferred size – range is from 6 to 48. The default font size is set in the system settings. See "Measurement & Annotation" on page 177.
- Show Arrow – Select whether or not to show an arrow from the text to a location on the image.
- Label Location – Specify whether you want to show the annotations on the current frame of a clip or on each frame of the clip. This option is only available for frame-based modes.



To delete an annotation

1 On the Annotation panel, tap the measurement you want to delete.

2 Tap the **Delete** button displayed below the selected annotation. The annotation will be immediately deleted.

3 If you want to delete all of the annotations on the selected image, tap **Delete All**. located at the bottom of the Annotation panel. You will be prompted to confirm the deletion of all annotations.

The annotation(s) are deleted from the image and the Annotation panel.

To edit an annotation

Once an annotation is placed, you can edit the text. The image is saved automatically after you edit an annotation.

1 Tap the annotation on the image or on the Annotation panel.

2 Tap the **Edit** button and edit the text or select another predefined annotation.

To move an annotation

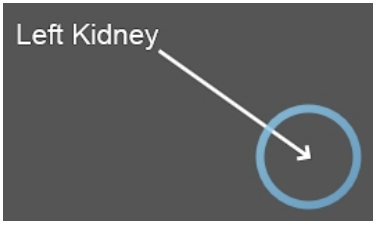
Once an annotation is placed, you can move it to a different location on the image.

The image is saved automatically after you move an annotation.

1 Tap the annotation on the image or on the Annotation panel. The annotation will change color.

2 Drag the annotation to the desired location. If an arrow is part of the annotation, the head of the arrow stays at the location on the image while you move the text. You can drag the arrow head separately, if required.

The following example shows the arrow head selected for editing.



3 When the move is complete, lift your finger to commit the change.

Measurements

The Vevo Imaging System offers several types of generic measurements. These are the measurements you can apply to any image acquired in a specific imaging mode.

This section lists all of the available generic measurements and describes how to add each one.

When adding generic measurements, please note the following:

- Measurements will be displayed on the image display and the control panel.
- Measurements can be placed on a saved image loaded into review, any image that has been acquired during an acquisition session and an image that is in the zoom state.
- Placing or editing a measurement will automatically save the image.
- If the unit value includes more than four digits before the decimal point, the unit of measure changes so that the value will have less than four digits displayed.

Note: Protocol measurements are only available on Vevo LAB.

Frame-based imaging mode measurements

Measurement	B-Mode/EKV	Color/ Power	Nonlinear Contrast	PA-Mode	3D Mode	4D-Mode
Angle	✓	✓	✓	✓		
Area	✓	✓	✓	✓		
Ellipse	✓	✓	✓	✓		
Linear	✓	✓	✓	✓	✓	✓
Distance	✓	✓	✓	✓		
LV Area Long	✓					
LV Area Short	✓					
Contrast Region			✓			
PA Region				✓		

Time-based imaging mode measurements

Measurement	PW/Tissue Doppler	M-Mode/ AM-Mode
Acceleration	✓	
Auto Trace	✓	
Heart Rate	✓	✓
Time	✓	✓
Velocity	✓	✓
Point	✓	
VTI	✓	
LV 2 Wall		✓
LV 4 Wall		✓
Depth		✓

Using the Measurement Panel

The Measurement panel provides tools for editing measurements on an image and the ability to change what measurement properties are displayed.

The Measurement panel is only displayed once the first measurement is placed on an acquired or saved image. The panel is not available in acquisition. When playing back a clip with measurements, you cannot interact with the panel until the clip is paused.

> **Important:** You must pause a clip before you can place a new measurement or interact with previously saved measurements.

Viewing available generic measurements

To view available generic measurements for an image

1 Load/acquire an image into review by doing one of the following:

a. If you are in the Study Browser open a saved image. If the image is a clip then pause the clip at the frame you want to work with.

b. If you are acquiring image data, tap **Freeze** on the control panel.

2 View the available measurements by tapping the **Measurements** button. Only the available measurements for the active mode will be available.

Placing measurements

To place a measurement on an image

1 Tap **Measurements**.

2 Tap a measurement from the list.

3 The measurement will be placed on the image. Interact with the measurement using the control panel.

While you are placing the measurement, a magnified view of the placement area is displayed on the image display. The default magnification factor is 4x; change the magnification factor by tapping the **Magnify Scale** button and using the **Increase** or **Decrease** button.

A measurement label will be displayed next to the measurement on the image. It will display the measurement label, number, and values associated with the type of measurement placed.

4 Measurements on the image will be shown in the Measurement panel on the left of the control panel. Use the Measurement panel to edit the measurements.

Expand or collapse the Measurement panel to view your list of measurements and to delete, edit or change properties.

Note: Measurements can be placed, modified and saved on an image in review that has zoom applied. The zoom factor can be changed during the placement of a measurement. Changing the zoom factor will affect the image and measurements, however the measurement value, parameter(s) value(s) and font size will not be affected.

Modifying measurement properties

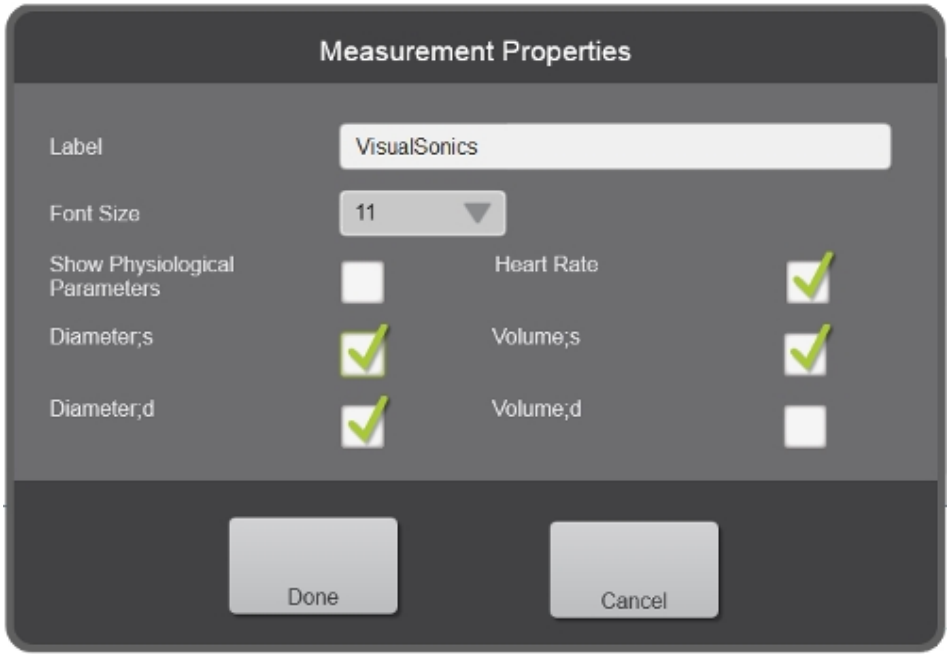
To modify measurement properties

Each measurement has its own set of measurement properties that you can modify.

1 Tap a measurement in the Measurement panel

2 Tap the **Properties** button.

The Measurement Properties panel is displayed.



- Label – Tap the text box and modify the existing label as required.
- Font Size – Tap the Font Size and select the preferred size; range is from 6 to 48.
- Parameters – Select the measurement parameters to be displayed on both the Measurement Label and in the Measurement panel.

Tap the parameters that you want to display. The number and type of items displayed changes depending on the type of measurement that is selected.

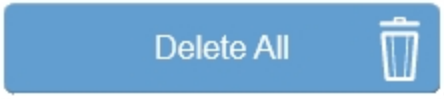
Deleting measurements

To delete a measurement

1 On the Measurement panel, tap the measurement you want to delete.

2 Tap the **Delete** button displayed below the selected measurement. The measurement will be immediately deleted.

3 (Optional) Tap **Delete All**, to delete all of the measurements on the selected image.



Delete All is located at the bottom of the Measurement panel. You will be prompted to confirm the deletion of all measurements. The measurement(s) are deleted from the image and the Measurement panel.

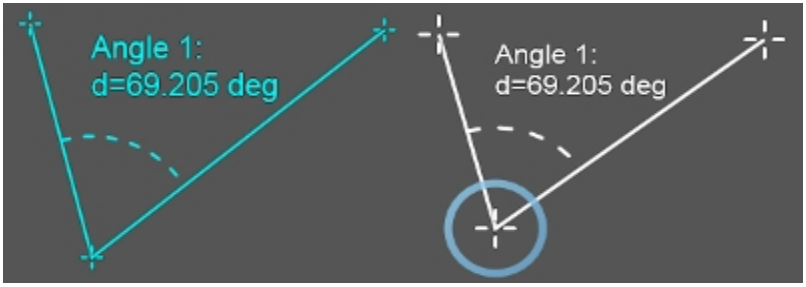
Editing measurements

To edit a measurement

Once a measurement is placed, you can edit individual anchor points along the measurement. After you edit a measurement, the system software automatically saves the image.

Note: Not all measurements can be modified after being placed. In this case, delete the measurement and add it again.

1 Tap the measurement on the image or on the Measurement panel. The measurement will change color—from cyan (left) to white (right).



2 Tap and drag one of the measurement anchor points to the desired position. The measurement parameters will update on the Measurement panel.

Note: Moving a measurement anchor point for a depth or time measurement will also allow you to change the location of the measurement at the same time.

Moving measurements

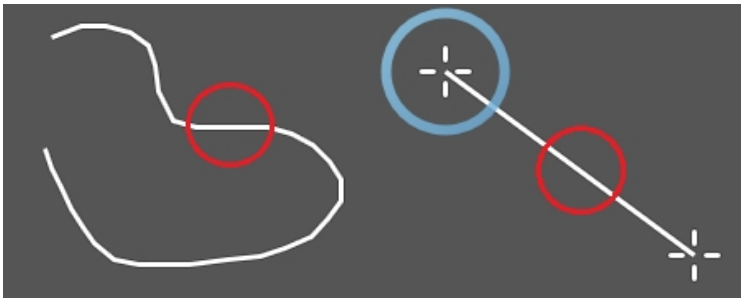
To move a measurement

Once a measurement is placed, you can move the entire measurement to a different location on the image, while maintaining its original measurement value. The image is saved automatically after you have moved your measurement.

1 Tap the measurement on the image or on the Measurement panel. When the measurement is active it will change color (from green to white).

2 Tap the center of the measurement, if there is a center anchor point. If there is no center point then drag the measurement line.

The following examples show the center point for Distance and Linear measurements.



3 When the move is complete, lift your finger and tap anywhere outside of the measurement area to commit the measurement.

Acceleration measurement

Use an acceleration measurement to determine the acceleration of tissue movement.

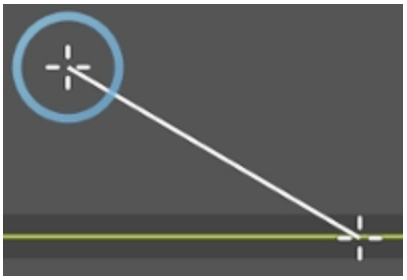
Acceleration measurements are available in PW Doppler Mode and PW Tissue Doppler Mode.

To add an acceleration measurement

1 Tap the **Measurements** button.

2 Tap the **Acceleration** button.

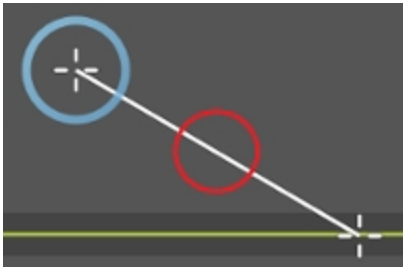
The measurement is placed on the spectral display.



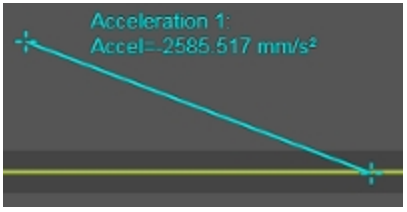
3 Tap and drag one of the anchor points to the desired location on the image. The anchor points must always be on the same side of the baseline.

As you move the anchor point, the parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.

4 Tap and drag the measurement line to move the measurement. The measurement line can only be moved horizontally.



5 The measurement and image are automatically saved as the measurement is adjusted.



Angle measurement

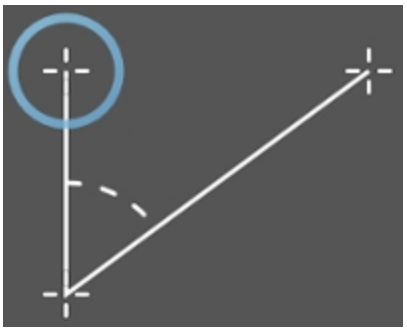
The angle measurement is available in B-Mode, PA-Mode, Color Doppler Mode, Power Doppler Mode, Nonlinear Contrast Mode, and EKV.

To add an angle measurement

1 Tap the **Measurements** button.

2 Tap the **Angle** button.

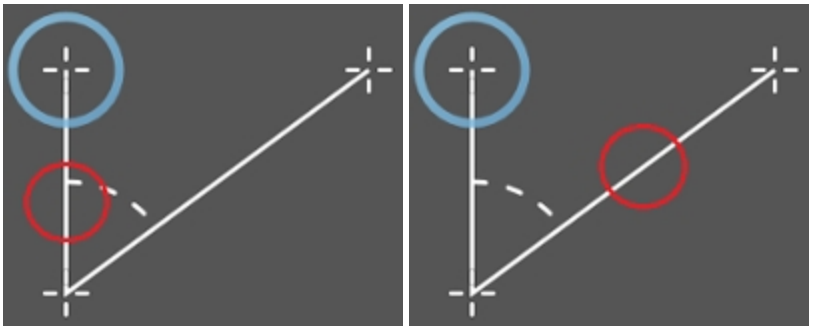
The measurement is placed on the image.



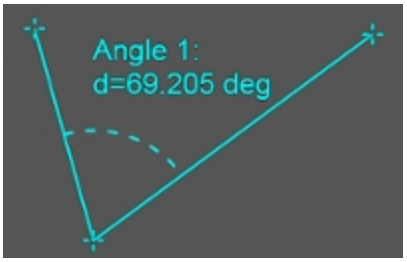
3 You can select any of the 3 anchor points for editing. Tap and drag an anchor anywhere on the image.

As you move the anchor points, the parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.

4 Tap and drag either one of the two measurement lines to move the whole measurement.



5 The measurement and image are automatically saved as the measurement is adjusted.



Area measurement

Area measurements are available in B-Mode, PA-Mode, Color Doppler Mode, Power Doppler Mode, Nonlinear Contrast Mode, and EKV.

To add an area measurement

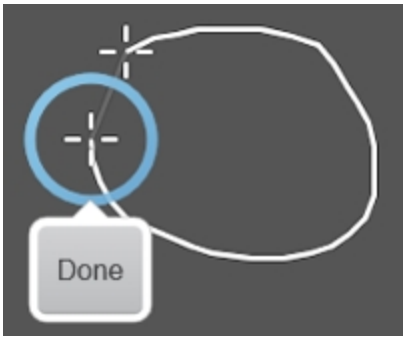
1 Tap the **Measurements** button.

2 Tap the **Area** button.

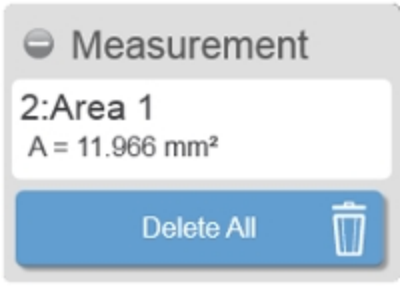
An active anchor is placed on the image.

3 Tap and drag the active anchor to the desired location on the image. When you have placed the anchor in the desired starting position, tap **Set**.

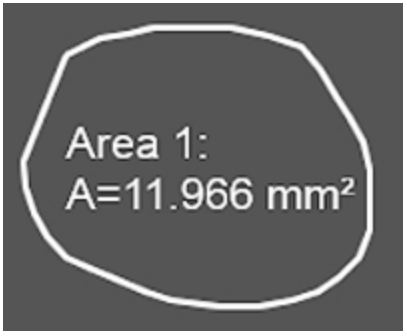
4 Tap and drag the handle to draw the measurement within the image area.



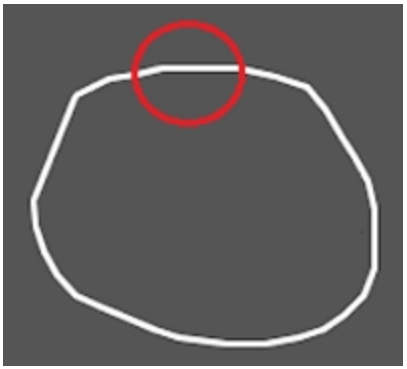
As you draw the area, the parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



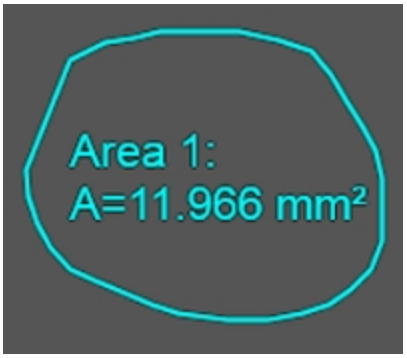
5 When you are finished drawing your measurement, lift your finger from the control panel and tap **Done**.



6 (Optional) Tap and drag the line of the area to move the entire measurement while maintaining the area.



7 The measurement and image are automatically saved after the measurement is moved.



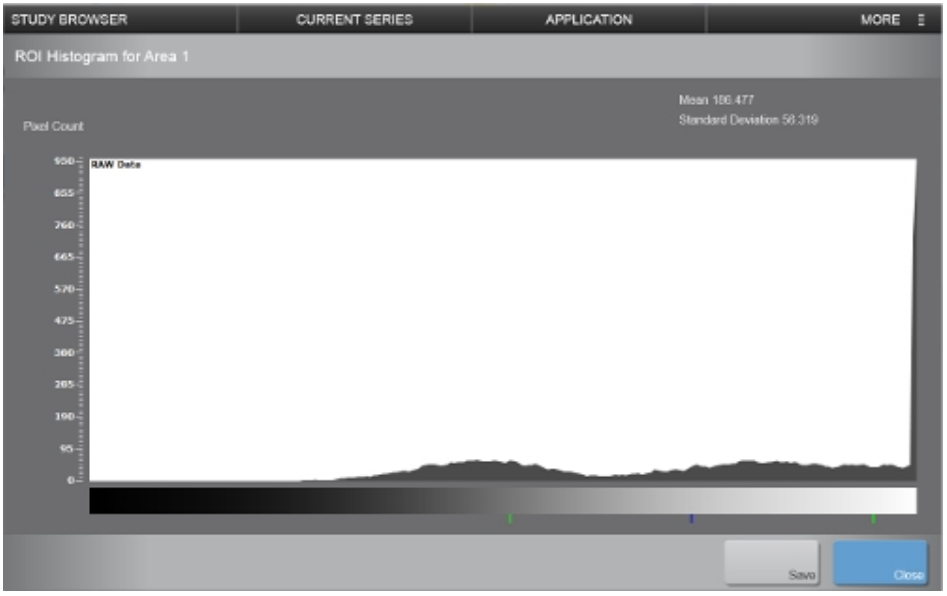
To create a histogram for the area

Note: Histogram is not available for Color Doppler Mode images.

1 Tap the measurement from the Measurement panel for which you want to create the histogram. See "Using the Measurement Panel" on page 274.

2 Tap the Graph icon for the selected measurement.

The histogram is displayed on the control panel. The histogram contains a pixel count scale of the RAW data, the mean, and the standard deviation.



3 Tap Save to save the histogram to the report.

4 Tap **Close** to return to the image.

To view your saved histogram

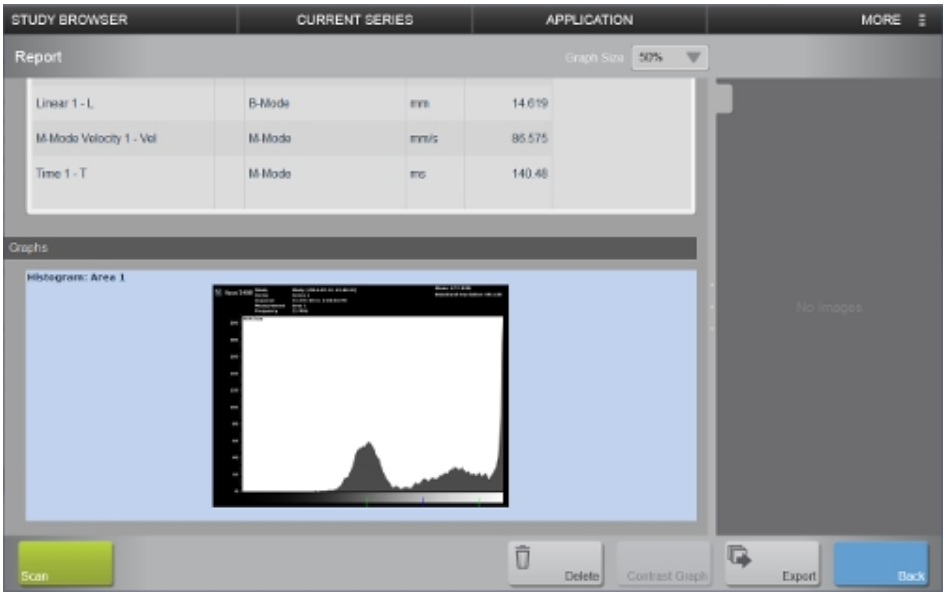
1 Navigate to the Study Browser. Select the image that you performed the measurement on, or select the series containing that image. Tap **More** and select **Report**.

2 The Report window is displayed containing the saved histogram.

Within the Report screen, you can perform the following actions:

- Change Graph Size – Select either 100%, 50% or 25% from the drop down list.
- Delete – Tap this button to delete the graph from the report.
- Export – Tap this button to export the report with the graph data.

Note: The graph image will not be exported, only the numerical data, which can be used to recreate the graph.



Auto Trace

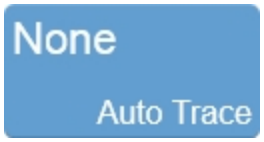
You can set the system to apply a range of peak and mean frequency traces to your PW Doppler Mode spectral data.

The automatic frequency trace feature instantly plots the anchor points on the frequency waveform before you apply the Velocity Time Integral (VTI) measurement. Use a VTI measurement when you want to measure Velocity Time Integrals over a series of cycles. See "VTI measurement" on page 366.

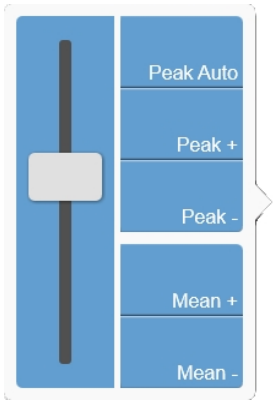
Auto Trace is available in PW Doppler Mode, and PW Tissue Doppler Mode.

To add an auto trace to your data

1 Tap the **Auto Trace** button. The state of the Auto Trace is displayed on the button. The default state is "None".



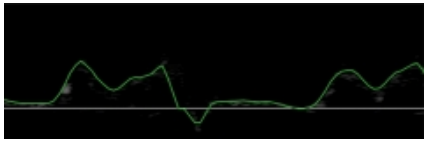
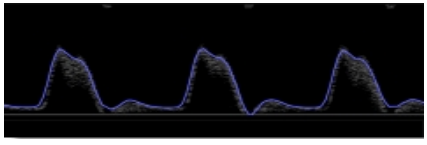
The Auto Trace Selection controls are displayed.

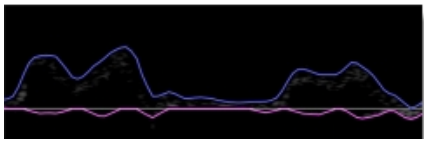
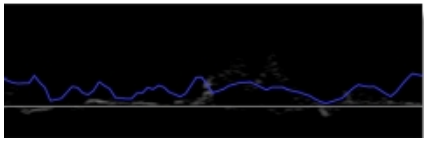


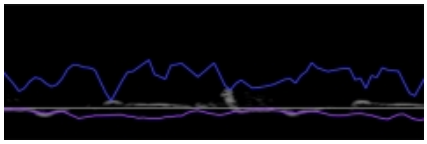
2 Adjust the VTI threshold for the trace by tapping and dragging the sensitivity slider up or down.

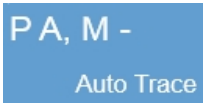
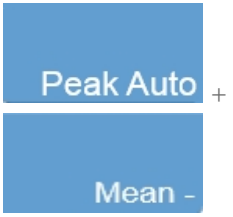
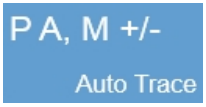
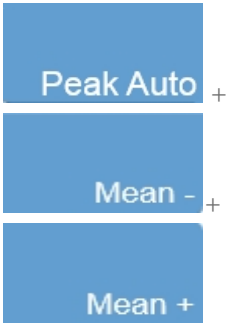
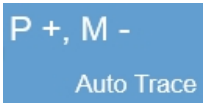
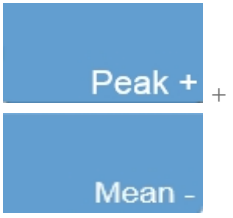
3 Select the best auto trace option for either peak or mean frequency, or both. Tap a button to enable the trace. Tap again to turn the trace Off.

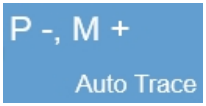
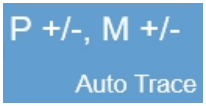
Button	Expected Result	Tap the following buttons on the Auto Trace flyout to enable this feature.
None Auto Trace	No auto trace will be displayed.	

Button	Expected Result	Tap the following buttons on the Auto Trace flyout to enable this feature.
Peak Auto Auto Trace	Applies a green trace to the largest velocity values, positive and negative, along the entire clip. 	Peak Auto
Peak + Auto Trace	Applies a purple trace to all positive peak frequency signal traces (flow moving toward the transducer face) along the entire clip. 	Peak +
Peak - Auto Trace	Applies a pink trace to all negative peak frequency signal traces along the entire clip. 	Peak -

Button	Expected Result	Tap the following buttons on the Auto Trace flyout to enable this feature.
Peak +/- Auto Trace	Applies a blue and pink trace to all positive and negative frequency signal traces along the entire clip. 	Peak + + Peak -
Mean + Auto Trace	Applies a blue trace to all positive mean frequency signal traces along the entire clip. 	Mean +
Mean - Auto Trace	Applies a magenta trace to all negative mean frequency signal traces along the entire clip. 	Mean -

Button	Expected Result	Tap the following buttons on the Auto Trace flyout to enable this feature.
Mean +/- Auto Trace	Applies a blue and magenta trace to all positive and negative mean frequency signal traces along the entire clip. 	Mean - + Mean +
Combinations of Peak and Mean		
Button	Expected Result	Tap the following buttons on the Auto Trace flyout to enable this feature.
P A, M + Auto Trace	Applies a green trace to the largest velocity values, positive and negative, along the entire clip. Applies a blue trace to all positive mean frequency signal traces along the entire clip.	Peak Auto + Mean +

Button	Expected Result	Tap the following buttons on the Auto Trace flyout to enable this feature.
	Applies a green trace to the largest velocity values, positive and negative, along the entire clip. Applies a magenta trace to all negative mean frequency signal traces along the entire clip.	
	Applies a green trace to the largest velocity values, positive and negative, along the entire clip. Applies a blue and magenta trace to all positive and negative mean frequency signal traces along the entire clip.	
	Applies a purple trace to all positive peak frequency signal traces (flow moving toward the transducer face) along the entire clip. Applies a magenta trace to all negative mean frequency signal traces along the entire clip.	

Button	Expected Result	Tap the following buttons on the Auto Trace flyout to enable this feature.
	Applies a pink trace to all negative peak frequency signal traces along the entire clip. Applies a blue trace to all positive mean frequency signal traces along the entire clip.	
	Applies a purple and pink trace to all positive and negative frequency signal traces along the entire clip. Applies a blue and magenta trace to all positive and negative mean frequency signal traces along the entire clip.	

4 If you want to add a VTI measurement, tap the **VTI** button. See "VTI measurement" on page 366.

Contrast Region measurement

Contrast Region Measurements are available in Nonlinear Contrast Mode only.

Once the measurement is complete, the system measures the total area of the defined contrast region.

To add a contrast region measurement

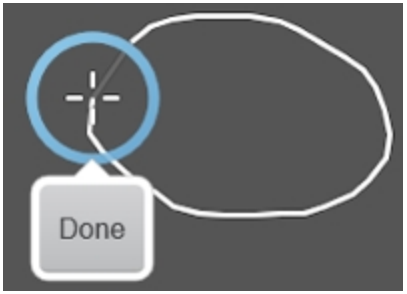
1 Tap the **Measurements** button.

2 Tap the **Contrast Region** button.

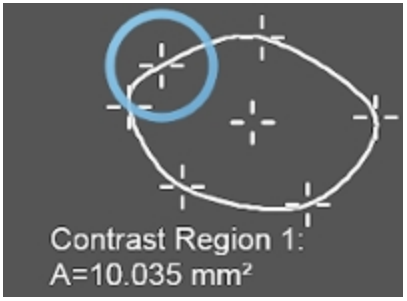
An active anchor point for the measurement will be placed on the image.

3 Drag the anchor point to the desired start point, and then tap **Set**.

4 Tap and drag the anchor point to trace the desired area.

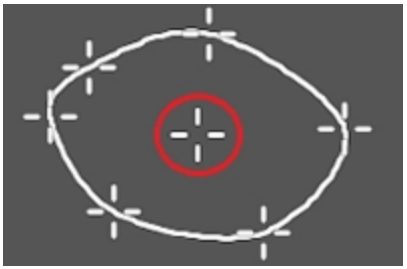


5 When you are done drawing your measurement, lift your finger from the control panel and tap **Done**.



6 (Optional) You can edit any point on the measurement by tapping and dragging the point anywhere on the image.

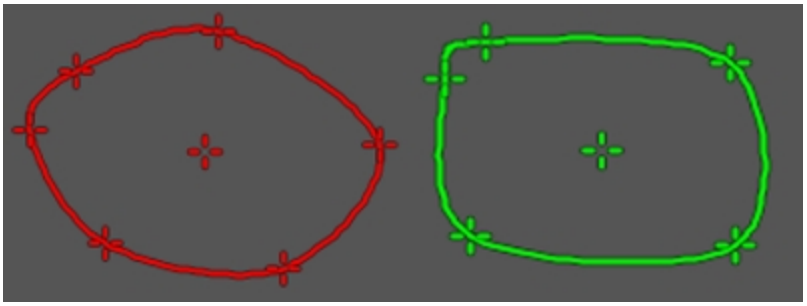
7 (Optional) To move the entire measurement to another location while maintaining the area, tap and drag the center point of the area.



8 Lift your finger after you have completed your edits.

Tap anywhere outside of the measurement area to commit the measurement.

Subsequent contrast measurements placed on the image will be colored differently by the system.



9 Once the Contrast Region is placed, the Measurement panel displays the detailed information. See "Using the Measurement Panel" on page 274.

Copying and pasting Contrast Regions

When copying and pasting Contrast Regions, please keep the following in mind:

- You can copy a Contrast Region measurement from a Nonlinear Contrast Mode image and paste it to a Nonlinear Contrast Mode image or PA-Mode image.
- Pasting a measurement on the destination image will only be allowed if the image area is large enough to fit the copied measurement.
- Copying and pasting a measurement is only available while reviewing an image in the 2D view.
- A total of 5 Contrast Regions are allowed on one image.

To copy and paste a single Contrast Region measurement

1 Tap the Contrast Region contour you wish to copy.

2 Tap **Copy Regions**.

3 Acquire a new image, load an image into review or use the currently loaded image.

4 Tap **Paste Regions**.

5 The copied Contrast Region measurement is placed on the image with its original coordinates.

To copy and paste all Contrast Region measurements

1 Tap **Copy Regions** from the Measurements panel.

2 Acquire a new image, load an image into review or use the currently loaded image.

3 Tap **Paste Regions**.

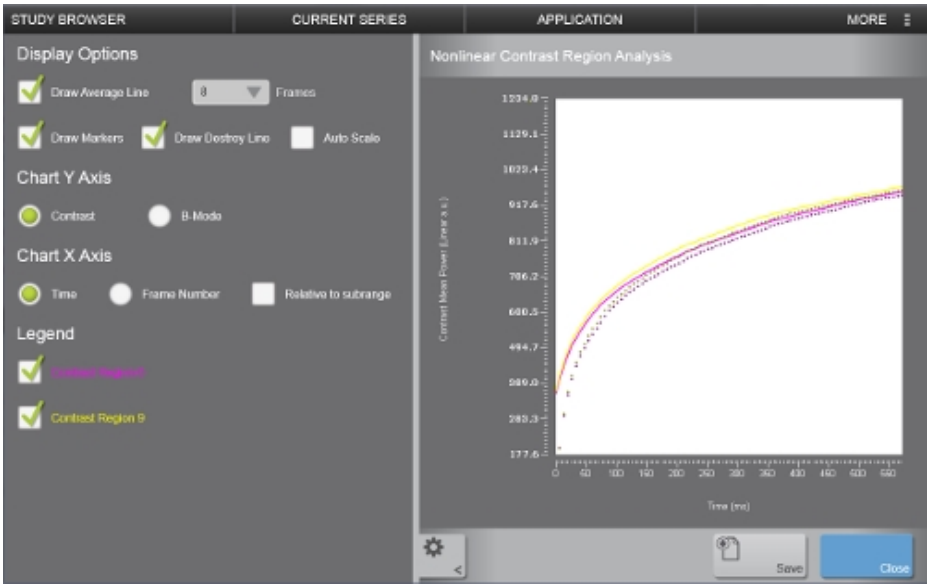
4 The copied Contrast Region measurements are placed on the image, with their original coordinates.

To create Contrast Region graphs

A Contrast Region graph can be populated from any Contrast Region measurement.

1 Select the Contrast Region from the Measurement panel and tap the **Graph** icon for that measurement.

2 The Nonlinear Contrast Region Analysis is displayed.



(Optional) Tap the **Settings** icon to hide the Display Options.

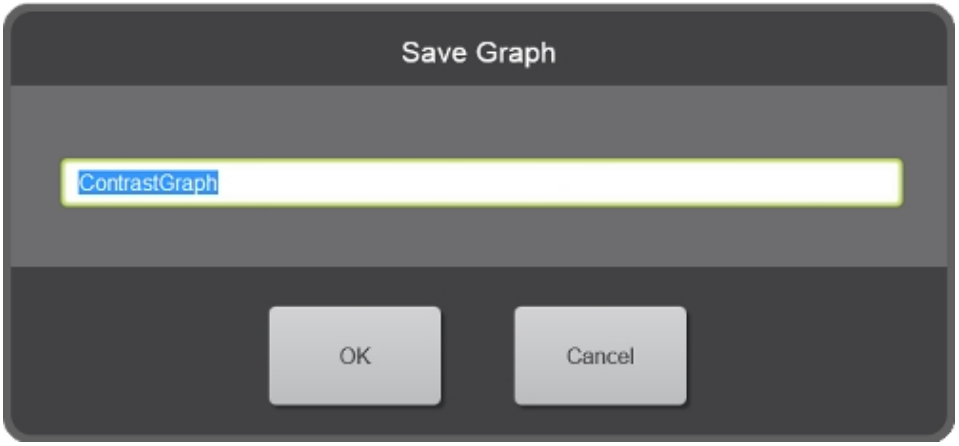
3 You can now edit how the analysis is displayed.

- Display options – You can choose whether or not to draw the Average Line, Markers, or Destroy Line. See Burst, Burst Sequence, and Burst Settings in "Nonlinear Contrast Mode controls" on page 525.
- Chart Y Axis – Select either Contrast or B-Mode data to be displayed.
- Chart X Axis – Select either Time or Frame Marker and if you want the X Axis relative to the subrange (if one was used on the image prior to creating the Report).

- Legend – When displaying multiple regions, you can choose to display one, some, or all on one graph.

4 You can save your edits by tapping **Save**.

5 (Optional) Enter a new name for the graph. Once saved, an image of the graph will be saved to the Report in the Graphs section.



To view your saved Contrast Region graph

1 Navigate to the Study Browser. Select the image that you performed the measurement on, or select the series containing that image. Tap **More** and select **Report**.

You can also view the Report from within the mode window. Go to the General Controls tab from the More Controls button and tap **Report**.

2 The Report window is displayed containing the saved graph.

Within the Report screen, you can perform the following actions:

- Change Graph Size – Select either 100%, 50% or 25% from the drop down list.
- Delete – Tap this button to delete the graph from the report.
- Export – Tap this button to export the report with the graph data.

Note: The graph image will not be exported, only the numerical data.

To create a Contrast Region graph from the report

Once you have created a report, you can combine Contrast Region measurements from multiple images within the same series into one graph.

1 Create your report. See "Reports" on page 262.

2 Use the checkboxes in the measurement rows to select the Contrast Region measurements you would like graphed.

3 Tap the **Contrast Graph** button at the bottom of the Report page.

4 Tap **Save** to save the graph.

To export your saved Contrast Region graph

1 From the Report page, tap **Export**, the export window will be displayed.

2 In the folder browser, browse to the location where you want to export the data and select the folder.

3 (Optional) Tap **New Folder** to create a new folder. Enter a name then tap **Done**.

4 Under Export Type, Measurement report will already be selected.

(Optional) To export all of the images with measurements in the report, enable the option **Include images with measurements** then select from other image options that will become available.

5 (Optional) Rename the report by typing a new name in the text box.

6 Tap **Export**. A progress bar will be displayed and once the export is complete a confirmation message will be displayed.

Depth measurement

A depth measurement is available in M-Mode and AM-Mode.

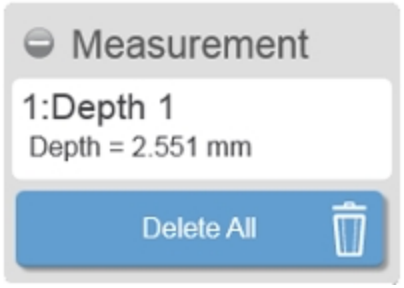
1 Tap the **Measurements** button.

2 Tap the **Depth** button.

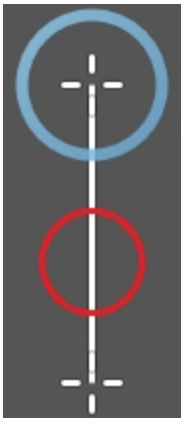
The measurement is placed on the image.

3 Tap and drag one of the end points up or down, to the desired location on the image.

As you move the anchor points, the measurement parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



4 Tap on and drag the measurement line to move the entire measurement.



5 The measurement and image are automatically saved as the measurement is adjusted.

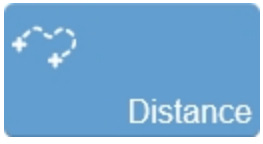
Distance measurement

Distance measurements are available in B-Mode, PA-Mode, Color Doppler Mode, Power Doppler Mode, Nonlinear Contrast Mode, and EKV.

To add a distance measurement

1 Tap the **Measurements** button.

2 Tap the **Distance** button.

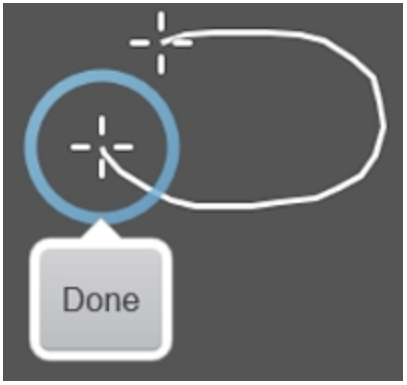


An active anchor for the measurement is placed on the image.

3 Tap and drag the anchor point to the desired location on the image.

4 Tap **Set** when you have placed your anchor at the desired start location.

5 Tap and drag the anchor point to trace the distance on the image area.



6 When you are finished drawing your measurement, lift your finger from the control panel and tap **Done**.

7 The measurement parameters will update on the Measurement panel. See "Using the Measurement Panel" on page 274.

8 (Optional) Tap and drag the line of the measurement to move the measurement to another location on the image.

9 The measurement and image are automatically saved as the measurement is adjusted.

Ellipse measurement

Ellipse measurements are available in B-Mode, PA-Mode, Color Doppler Mode, Power Doppler Mode, Nonlinear Contrast Mode, EKV Mode, 3D Mode (2D view) and 4D-Mode (2D view).

Note: The volume estimate from an ellipse measurement is based on the following:

Volume = 0.52 x width ^{2} x length

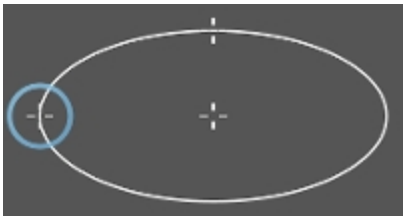
The 'width' component of the formula is the lesser of the two axes of the ellipse measurement, while the 'length' component is the greater.

To add an ellipse measurement

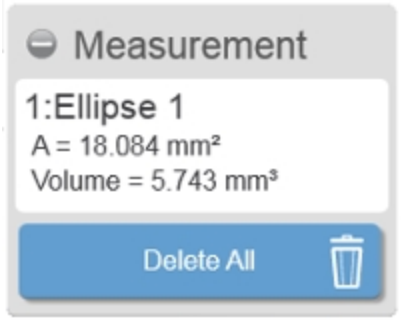
1 Tap the **Measurements** button.

2 Tap the **Ellipse** button.

The ellipse measurement is placed on the image.

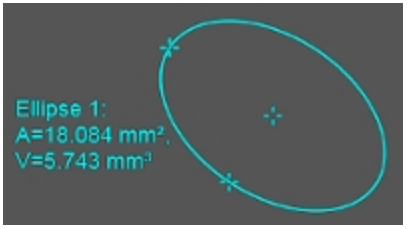


3 Tap and drag one of the line points to the desired location on the image. As you move the point, the measured length is updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



4 (Optional) Tap and drag the center point to move the entire measurement while maintaining the ellipse. The measurement and image are automatically saved as the measurement is adjusted.

5 Remove your finger from the control panel to commit the measurement.



Heart Rate measurement

Use the heart rate measurement tool for measuring the average heart rate of an animal by measuring the distance over time between cardiac cycles.

The Heart Rate measurement is available in PW Doppler Mode, PW Tissue Doppler Mode, M-Mode, and AM-Mode.

To add a heart rate measurement

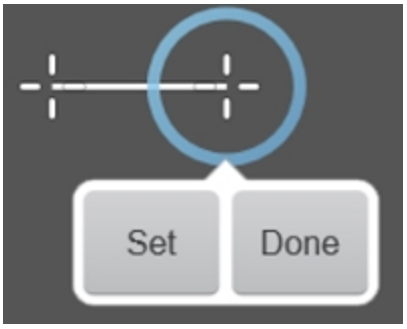
1 Tap the **Measurements** button.

2 Tap the **Heart Rate** button.

The measurement is placed on the image.

3 Tap and drag the active anchor to the start of a cardiac cycle and tap **Set**.

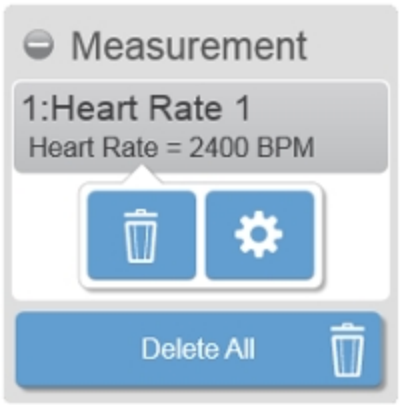
Two buttons are now displayed, **Set** and **Done**.



4 Move the measurement to the same location on the next cardiac cycle and place the next anchor by tapping **Set**.

5 Continue to place anchors on the cardiac cycles using **Set** and tap **Done** when you place the last anchor.

6 As you add anchors, the Measurement Panel is updated. See "Using the Measurement Panel" on page 274.



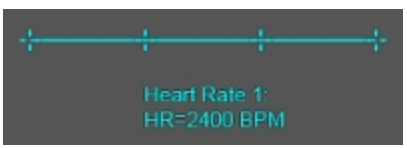
To modify a heart rate measurement

You can modify and move each anchor point even after it has been placed.

1 Tap and drag the measurement line that is located between the anchor points, to another location on the image.

2 Tap and drag any of the anchor points to modify the location of a specific point.

3 The measurement and image are automatically saved as the measurement is adjusted.



Linear measurement

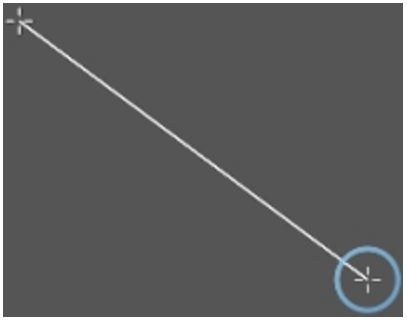
Linear measurements are available in B-Mode, PA-Mode, Color Doppler Mode, Power Doppler Mode, Nonlinear Contrast Mode, EKV Mode, 3D Mode and 4D-Mode.

To add a linear measurement

1 Tap the **Measurements** button.

2 Tap the **Linear** button.

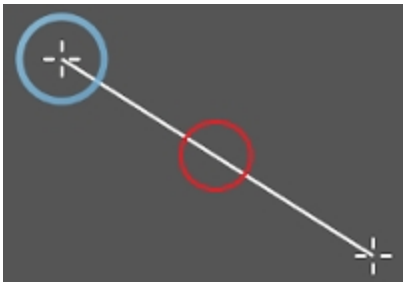
The linear measurement is placed on the image.



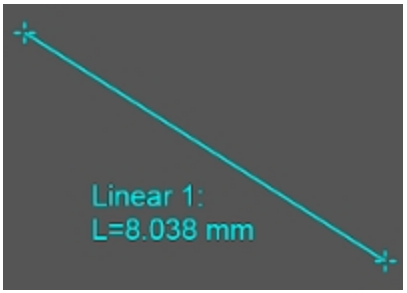
3 Tap and drag one of the end points to the desired location on the image.

As you move the point, the measured length is updated on the Measurement panel. See "Using the Measurement Panel" on page 274.

4 Tap and drag the measurement line to move the entire measurement.



5 The measurement and image are automatically saved as the measurement is adjusted.



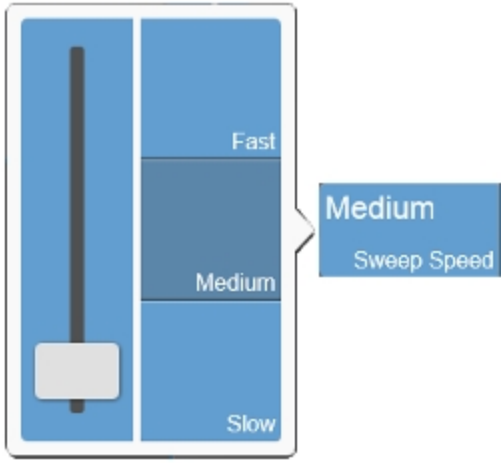
LV 2 Wall measurement

Use the LV 2 Wall measurement to trace the position of the upper and lower inner walls of the ventricle through a heart cycle in order to measure the parameters of the left ventricle inner area.

LV 2 Wall Measurement is available in M-Mode and AM-Mode.

To add an LV 2 Wall measurement

1 Adjust the sweep speed to compress or expand the clip so the heart cycles that will be measured are visible. Decrease the speed to show more cycles, increase the speed to show fewer cycles. See "M-Mode controls" on page 443.



2 Tap the **Measurements** button.

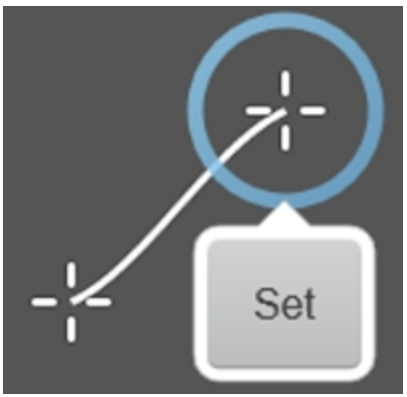
3 Tap the **LV 2 Wall** button.

4 An active anchor for the measurement is placed on the image.

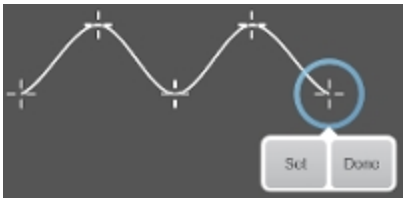
5 Tap and drag the active anchor to a point along the inside of the upper wall at either the diastolic or systolic peak or valley.

6 Tap **Set** to place the first anchor point.

7 Drag the second anchor point to the next peak or valley. Tap **Set**.



8 Repeat this process, drag and **Set**, until the desired number of cycles are traced.

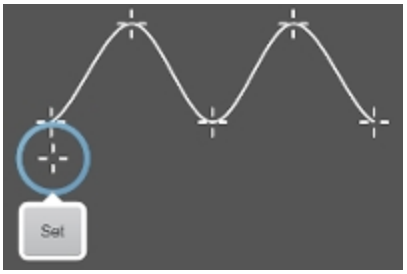


9 Tap **Done** to complete the upper wall trace.

Note: You must place at least four anchor points before completing a wall trace.

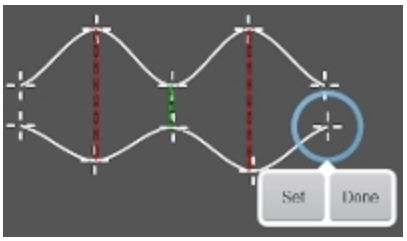
The system will automatically place the first anchor of the next wall.

10 Tap and drag the anchor point to the desired location and tap **Set**.

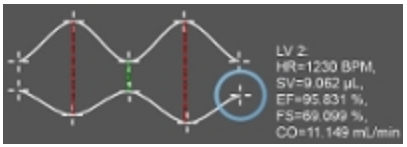


11 Tap and drag the anchor point to the next peak or valley and tap **Set**.

12 On the lower wall, continue to add all the anchor points.

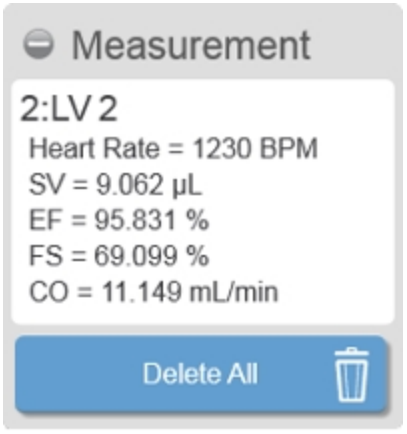


13 Tap **Done** to complete the lower wall trace.



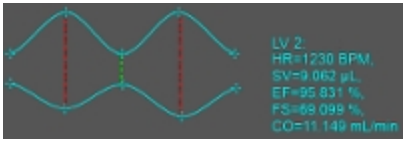
14 Each trace and its anchor points are editable, so modify any of the anchor points, as required.

As you edit the anchor point, the measurement parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



15 The measurement and image are automatically saved as the measurement is adjusted.

Note: As soon as the measurement is placed on the image, the image will be saved. However, the measurement will not be saved until it is complete.



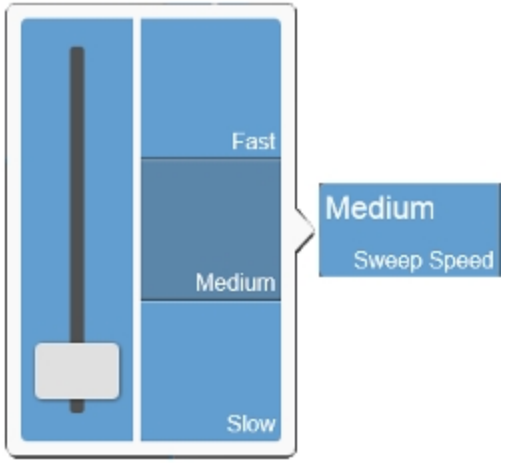
LV 4 Wall measurement

Use the LV 4 Wall measurement to add a trace of the outer walls to the inner walls that you traced so you can measure the parameters of the outer walls of the left ventricle.

LV 4 Wall measurements are available in M-Mode and AM-Mode.

To add an LV 4 Wall measurement

1 Adjust the sweep speed to compress or expand the clip so the heart cycles that you want to measure are visible. Decrease the speed to show more cycles, increase the speed to show fewer cycles. See "M-Mode controls" on page 443.



2 Tap the **Measurements** button.

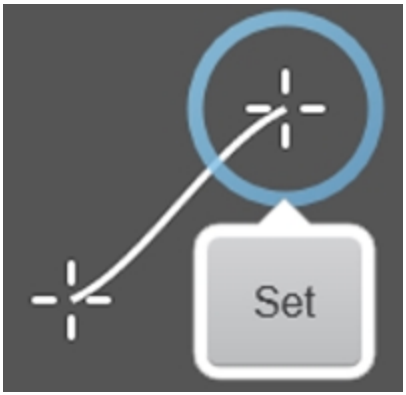
3 Tap the **LV 4 Wall** button.

4 An active anchor for the measurement is placed on the image.

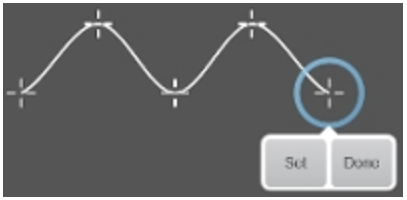
5 Tap and drag the active anchor to a point along the inside of the upper wall at either the diastolic or systolic peak or valley.

6 Tap **Set** to place the first anchor point.

7 Drag the second anchor point to the next peak or valley. Tap **Set**.



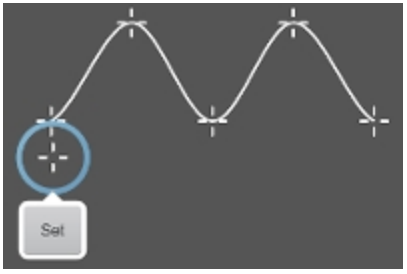
8 Repeat this process, drag and **Set**, until the desired number of cycles are traced.



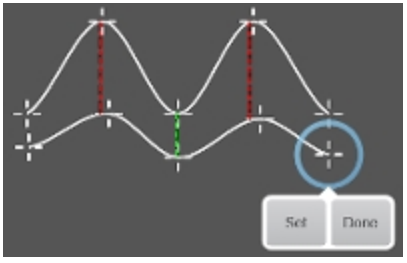
9 Tap **Done** to complete the upper outer wall trace.

The system will automatically place the first anchor of the upper inner wall.

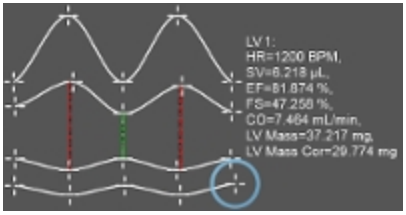
10 Tap and drag the anchor point to the desired location and tap **Set**.



11 Continue to add anchor points along the inner upper wall and tap **Done** when complete.

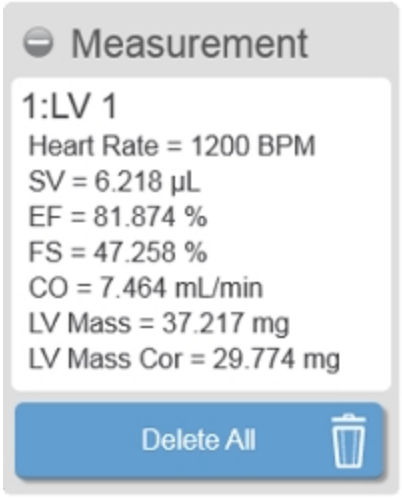


12 Continue to place anchor points for both the lower inner wall and lower outer wall. Tap **Done** when complete.



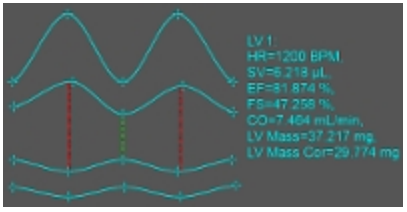
13 The anchor points for each trace are editable, so modify any of the anchor points, as required.

As you edit the anchor point, the measurement parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



14 The measurement and image are automatically saved as the measurement is adjusted.

Note: As soon as the measurement is placed on the image, the image will be saved. However, the measurement will not be saved until it is complete.



LV Area Long measurement

Use the LV Area Long measurement to trace the endocardial wall through multiple cardiac cycles.

LV Area Long measurements are available in B-Mode and EKV.

To add an LV Area Long measurement

1 Tap the **Measurements** button.

2 Tap the **LV Area Long** button.

An active anchor for the measurement is placed on the image.

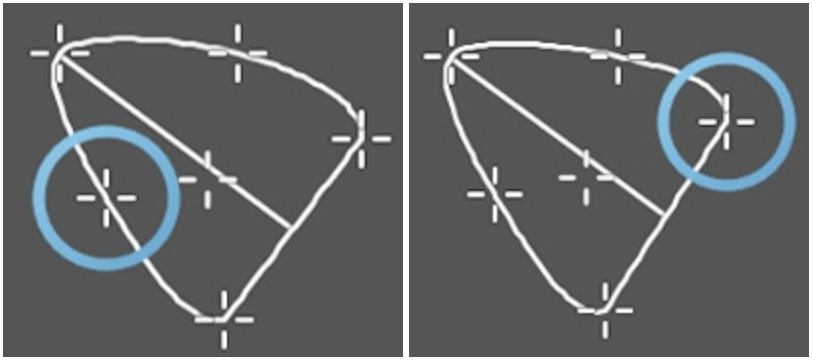
3 Tap and drag the anchor point to either the top or bottom wall of the annulus.

4 Tap **Set** when you have placed the anchor at the desired start point.

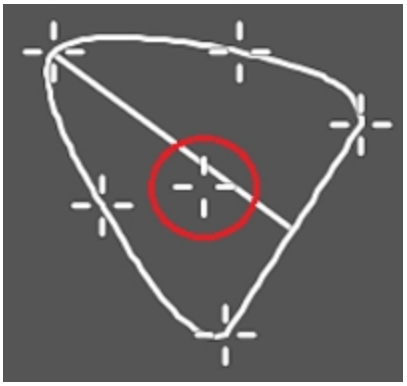
5 Tap and drag the handle to draw the measurement line along the wall to create a contour that traces the area of the wall.

6 When you are finished drawing your measurement, lift your finger from the control panel and tap **Done**.

7 (Optional) Tap and drag any anchor point on the measurement to edit the measurement.

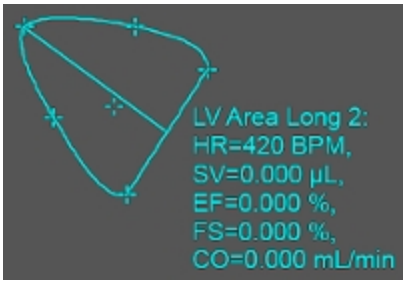


8 (Optional) Tap and drag the center point of the area, to move the entire measurement to another location on the image, while maintaining the current area measurement.



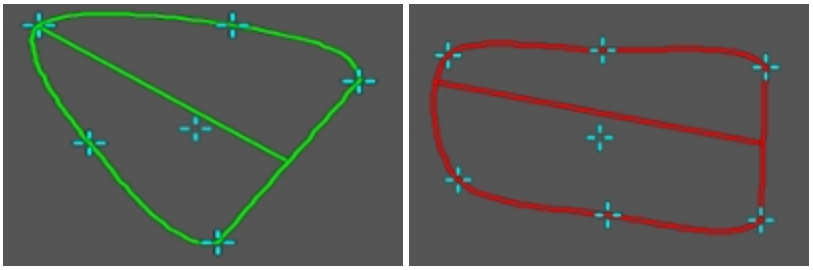
9 The measurement and image are automatically saved as the measurement is adjusted.

Note: As soon as the measurement is placed on the image, the image will be saved. However, the measurement will not be saved until it is complete.

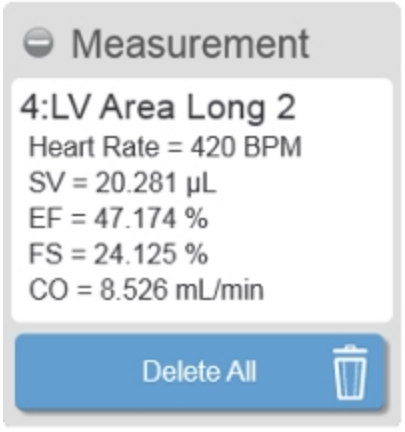


10 Move to another frame in the current clip and place another LV Area Long Measurement by following the above steps.

11 Play back the clip. The system automatically traces the wall forward or backward through the frames. The LV Area contour is displayed in green for the systolic LV and red for the diastolic LV.



12 Once both LV areas are placed, the measurement parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



LV Area Short measurement

Use the LV Area Short measurement to trace the endocardial wall through multiple cardiac cycles.

LV Area Short measurements are available in B-Mode and EKV.

To add an LV Area Short measurement

1 Tap the **Measurements** button.

2 Tap the **LV Area Short** button.

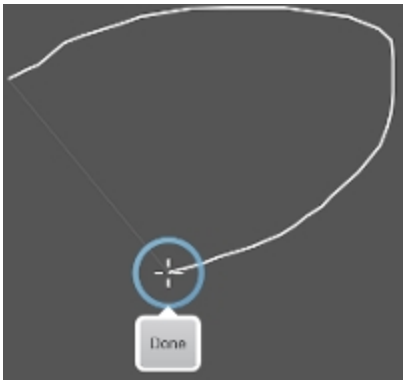
3 An active anchor for the measurement will be placed on the image.

4 Tap and drag the anchor point to a location on the myocardial wall.

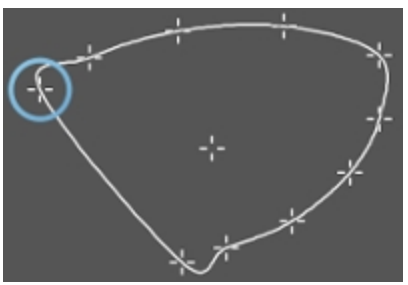
5 Tap **Set** when you have placed the anchor at the desired start point.

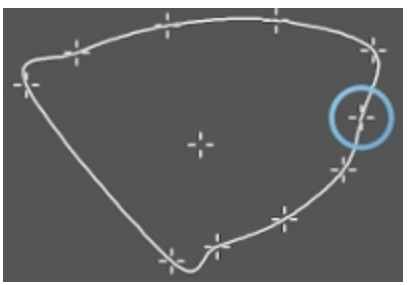
6 Drag the active anchor point to create a contour that traces the area of the wall.

7 When you are finished drawing your measurement, lift your finger from the control panel and tap **Done**.

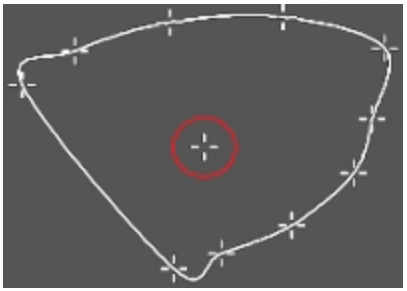


8 (Optional) Tap and drag any anchor point on the measurement to edit the measurement.



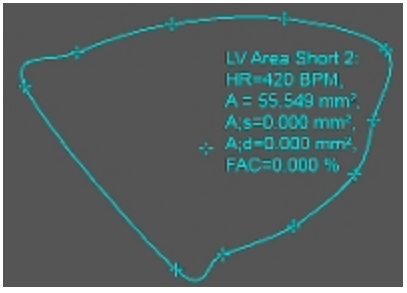


9 (Optional) Tap and drag the center point of the area, to move the entire measurement to another location on the image, while maintaining the current area measurement.



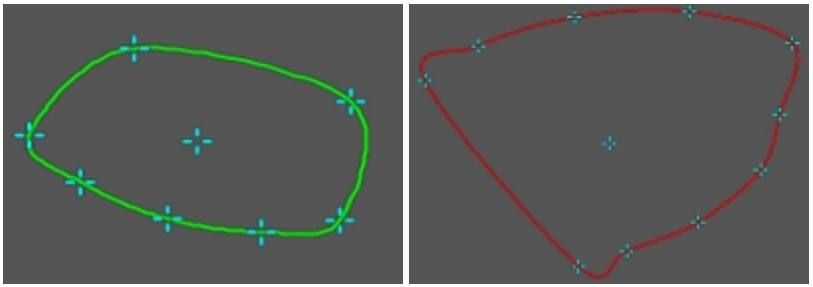
10 The measurement and image are automatically saved as the measurement is adjusted.

Note: As soon as the measurement is placed on the image, the image will be saved. However, the measurement will not be saved until it is complete.

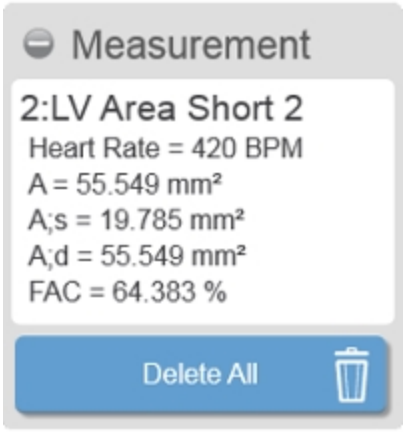


11 Move to another frame in the current clip and place another LV Area Short measurement by following the steps above.

12 Play back the clip. The system automatically traces the wall forward or backward through the frames. The LV Area contour is displayed in green for the systolic LV and red for the diastolic LV.



13 Once both LV Areas are placed, the measurement parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



PA Region measurement

The PA (Photoacoustics) Region measurement traces a region of interest in a PA frame. The software then measures the total area of the defined contrast region.

Quantification is available for the average threshold signal power of each PA Region measurement displayed by the label 'PA Thresh'.

Quantification is also available for the average signal power and the average threshold signal power for Multiplexed PA Region measurements. Displayed by the label 'Avr' and 'Thresh' preceded by the Layer name.

For more details on placing a PA Region measurement on a Multiplexed image, see "To measure signal changes in a PA-Mode (Multi-wavelength) loop" on page 351.

Placing PA Region measurements

Note: When you add a PA Region measurement on a frame in a PA-Mode cine loop, the PA average value changes when you view another frame in the cine loop. This can cause inconsistencies when exporting data. It is recommended to resave the loop on the frame of interest prior to exporting to prevent these inconsistencies.

The Vevo LAZR-X Imaging System allows you to draw up to 20 PA Region measurements on one image.

To place a PA Region measurement

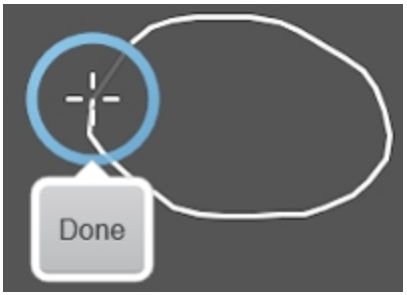
1 Tap **Measurements**.

2 Tap **PA Region**.

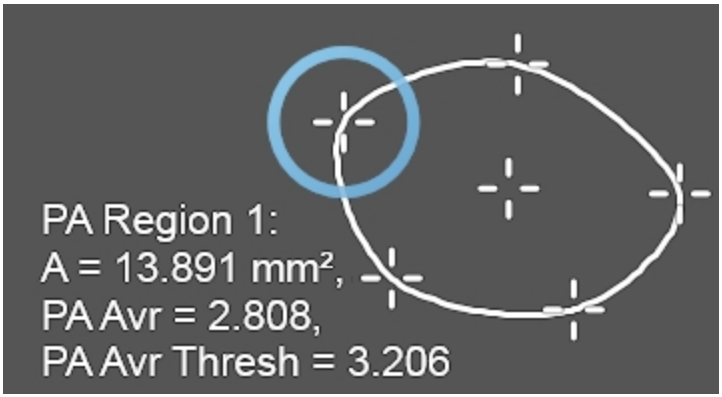
An active anchor point for the measurement will be placed on the image.

3 Drag the anchor point to the desired start point, and then tap **Set**.

4 Tap and drag the anchor point to trace the desired area.

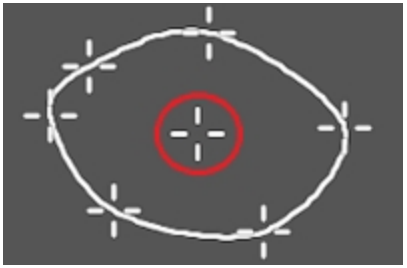


5 When you are done drawing your measurement, lift your finger from the control panel and tap **Done**.



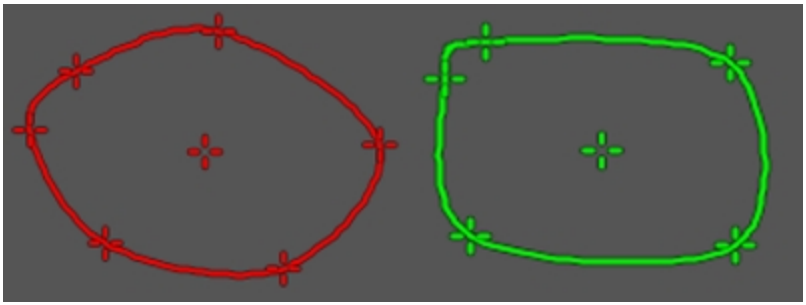
6 (Optional) You can edit any point on the measurement by tapping and dragging the point anywhere on the image.

7 (Optional) To move the entire measurement to another location while maintaining the area, tap and drag the center point of the area.



8 Lift your finger after you have completed your edits. Tap anywhere outside of the measurement area to commit the measurement.

Subsequent PA Region measurements placed on the image will be colored differently by the system.



9 Once the PA Region is placed, the measurement parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.

10 You can also copy a measurement. See "Copying and pasting PA Region measurements" on the next page.

Copying and pasting PA Region measurements

When copying and pasting PA Region measurements, please keep the following in mind:

- You can copy a PA Region measurement from a PA-Mode image and paste it to a another PA-Mode image or a Nonlinear Contrast Mode image.
- Pasting a measurement on the destination image will only be allowed if the image area is large enough to fit the copied measurement.
- Copying and pasting supports one or multiple measurements and is only available while reviewing an image in the 2D view.
- 20 PA Regions are allowed on one PA-Mode image, however only 5 regions are allowed on a Nonlinear Contrast Mode image.

To copy a single PA Region measurement

1 Tap the PA Region measurement you wish to copy.

2 Tap the copy button.

3 Acquire a new image, load an image into review or use the currently loaded image.

4 Tap **Paste Regions**.

5 The copied PA Region measurement is placed on the image, with its original coordinates.

To copy and paste all PA Region measurements

1 Tap **Copy Regions** from the Measurements panel.

2 Acquire a new image, load an image into review or use the currently loaded image.

3 Tap **Paste Regions**.

4 The copied PA Region measurements are placed on the image, with their original coordinates.

Creating PA Region graphs

Use the PA Region Graph to measure and graph the changes in PA-Mode data across wavelengths or frames in a defined region. Define the region of

interest, then generate a graph that measures the signal changes that appear in that region over your PA-Mode cine loop.

Quantification is available for the average threshold signal power of each PA Region measurement. Displayed by the label 'PA Avr Thresh', quantification values represent the average maximum intensity and applies only to the frame on which it appears (expect this value to change from frame to frame within a cine loop). This quantification is available for PA-Mode (Single), PA-Mode (Multi-wavelength), 3D PA-Mode (Multi-wavelength), and PA-Mode (Spectro).

Quantification is also available for the average signal power and the average threshold signal power for Multiplexed PA Region measurements. Displayed by the label 'PA Avr' and 'PA Avr Thresh' preceded by the Layer name, quantification values calculate the average based on calculations described on the multiplexer panel. This quantification is available for PA-Mode (Multi-wavelength), 3D PA-Mode (Multi-wavelength) and PA-Mode (Spectro).

A PA Region graph can be populated from any PA Region measurement.

To create a PA Region graph

1 Select the PA Region from the Measurement panel and tap the Graph icon for that measurement.

2 The PA Region Analysis is displayed.

3 You can now edit how the analysis is displayed. The available settings are different for each PA sub-mode.

PA-Mode (Single)

- Display Options – Auto Scale and PA Average or PA Average Threshold for the Y axis.
- Chart X Axis – Time Scale or Frame Scale
- PA Regions – When displaying multiple regions, you can choose to display one, some, or all on one graph. You can also choose a different color for the data on the chart for each PA Region displayed.

PA-Mode (Spectro)

- Display Options – Auto Scale and PA Average or PA Average Threshold for the Y axis.
- PA Regions – When displaying multiple regions, you can choose to display one, some, or all on one graph. You can also choose a different color for the data on the chart for each PA Region displayed.

  For an unmixed PA-Mode (Spectro) image, you also have a Save Spectral Curves button to save a custom curve.

  Note: The Save Spectral Curves button is only available for Spectro images that have acquired the full wavelength range.

  Note: Your custom curve will be displayed in the Select Components list on the Spectral Curves window found on the Photoacoustics page in System Settings, in the Unmixing panel and the Multi-wavelength setup panel.

PA-Mode (Oxy-Hemo)

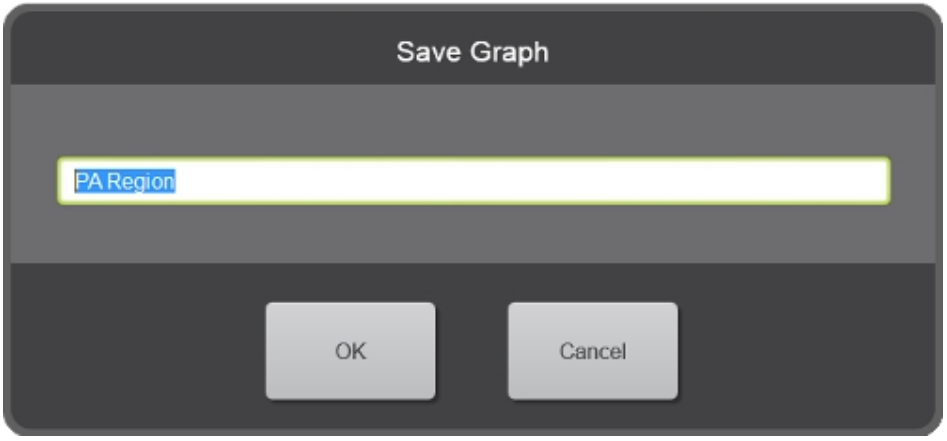
- Display Options – Auto Scale and sO_2 Average, sO_2 Average Total, HbT Average or HbT Average Threshold for the Y axis.
- Chart X Axis – Time Scale or Frame Scale
- PA Regions – When displaying multiple regions, you can choose to display one, some, or all on one graph. You can also choose a different color for the data on the chart for each PA Region displayed.

PA-Mode (Multi-wavelength)

- Display Options – Auto Scale and PA Average or PA Average Threshold for the Y axis.
- Chart Y Axis – Choose whether or not to Separate Wavelengths.
- Chart X Axis – Time Scale or Frame Scale.
- PA Regions – When displaying multiple regions, you can choose to display one, some, or all on one graph. You can also choose a different color for the data on the chart for each PA Region displayed.
- PA Wavelengths – Only displayed when the Separate Wavelengths option is enabled. Choose which wavelengths to display on the graph and what icon you want for each wavelength.
- PA Components – Only displayed when viewing a PA-Mode (Multi-wavelength) that had components added before acquisition (within the Multi-wavelength Scan Settings panel). Choose which components to display on the graph and what icon you want for each component.

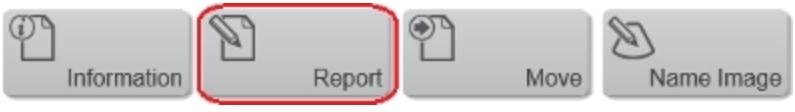
4 You can save your edits by tapping **Save**.

5 (Optional) Enter a new name for the graph. Once saved, an image of the graph will be saved to the Report in the Graphs section.



To view your saved PA Region graph

1 Navigate to the Study Browser. Select the image that you performed the measurement on, or select the series containing that image. Tap **More** and select **Report**.

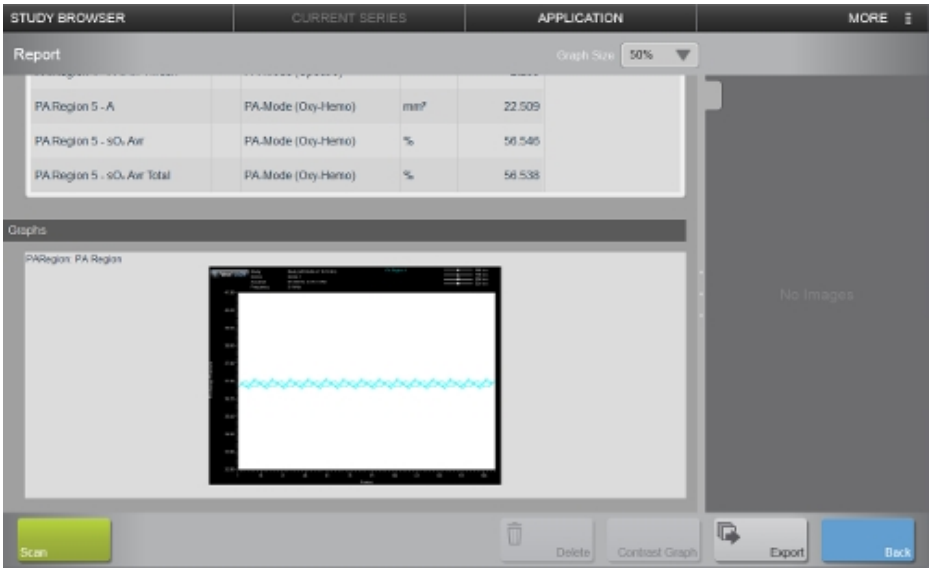


2 The Report window is displayed containing the saved graph.

Within the Report screen, you can perform the following actions:

- Change Graph Size – Select either 100%, 50% or 25% from the drop down list.
- Delete – Tap this button to delete the graph from the report.
- Export – Tap this button to export the report with the graph data.

Note: The graph image will not be exported, only the numerical data.



To export your saved PA Region graph

1 From the Report page, tap **Export**, the export window will be displayed.

2 In the folder browser, browse to the location where you want to export the data and select the folder.

3 (Optional) Tap **New Folder** to create a new folder. Enter a name then tap **Done**.

4 Under Export Type, Measurement report will already be selected.

(Optional) To export all of the images with measurements in the report, enable the option **Include images with measurements**, then select from other image options that will become available.

5 (Optional) Rename the report by typing a new name in the text box.

6 Tap **Export**. A progress bar will be displayed and once the export is complete a confirmation message will be displayed.

To measure signal changes in a PA-Mode (Multi-wavelength) loop

1 Acquire or load a PA-Mode (Multi-wavelength) image to review.

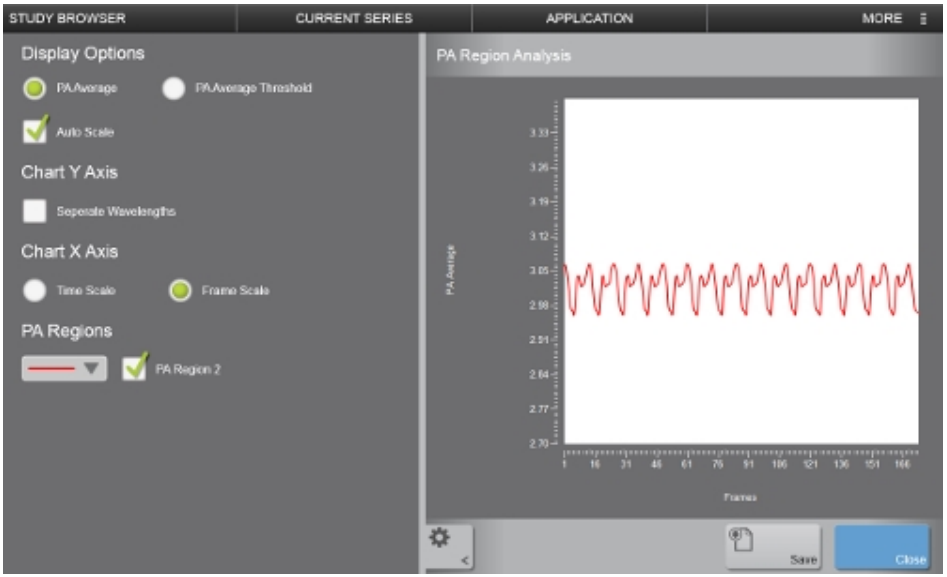
2 Tap **Measurements**, then tap **PA Region**.

3 Place your measurement, as described in "PA Region measurement" on page 337.

4 (Optional) Multiplex your image, by tapping the **Multiplex Wavelengths** button. Tap the On/Off button to enable/disable this option.

5 Tap the PA Region on the Measurement panel, then tap the graph icon.

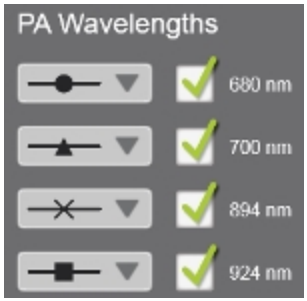
6 The system software calculates the PA signal within the boundaries of the region curve and displays the data in the PA Region Analysis window.



7 The PA Region Analysis window is different depending on if the image is Multiplexed or not.

a. If you chose not to Multiplex your image, a Separate Wavelengths option is available under the Chart Y Axis section. Tap the Separate Wavelengths checkbox to allow separation of the curve based on wavelength.

   Once the Separate Wavelengths option is checked, all of the wavelengths used to acquire the image are displayed. Uncheck the wavelengths that you do not want displayed on your graph and select what icon the data line will be displayed with on the graph.



b. If you chose to Multiplex your image, the layers will automatically be separated and the Separate Components checkbox will be disabled. Select what layers to be displayed by checking or unchecking the layers listed in the PA Layers section of the PA Region Analysis window. Toggle to display the additional measurement options—PA Average (Calculation) and PA Average Threshold (Calculation)—from the Display Options section.

   When an image is Multiplexed, the Separate Components is enabled automatically. The PA Layers list is populated with the layers you created in the Multiplex Control panel. Uncheck the layers that you do not want displayed on your graph.

To measure signal changes in a PA-Mode (Spectro) loop

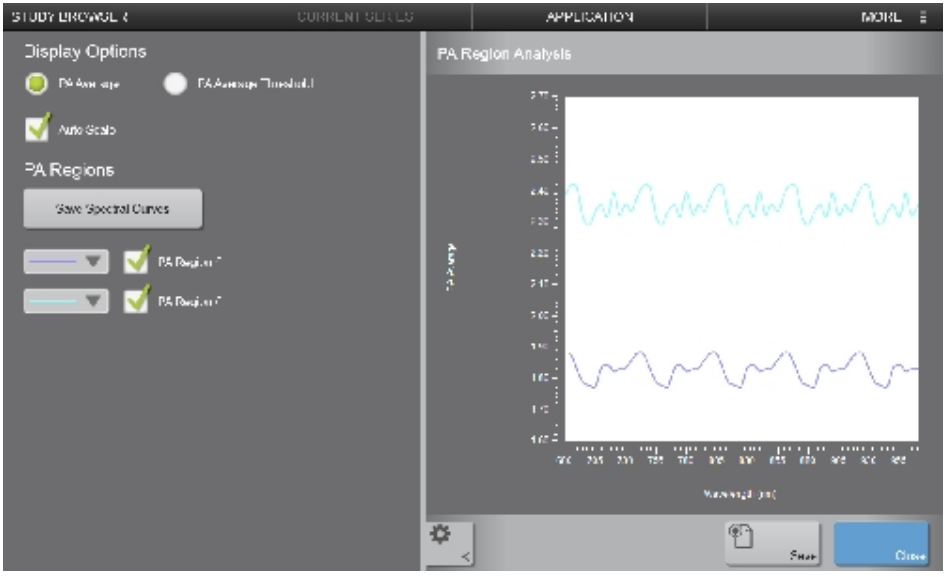
1 Acquire or load a PA-Mode (Spectro) image to review.

2 Tap **Measurements**, then tap **PA Region**.

3 Place your measurement, as described in "PA Region measurement" on page 337.

4 Tap the PA Region on the Measurement panel, then tap the graph icon.

5 The system software calculates the PA signal within the boundaries of the region curve and displays the data in the PA Region Analysis window.



6 The PA Region Analysis window is different depending on if the image is Multiplexed or not.

a. If you chose not to Multiplex your image, an additional Save Spectral Curves option is available in the PA Regions section. The PA Region(s) will also be listed with the option to enable/disable and the option to select what color the line of data will be displayed as on the graph.

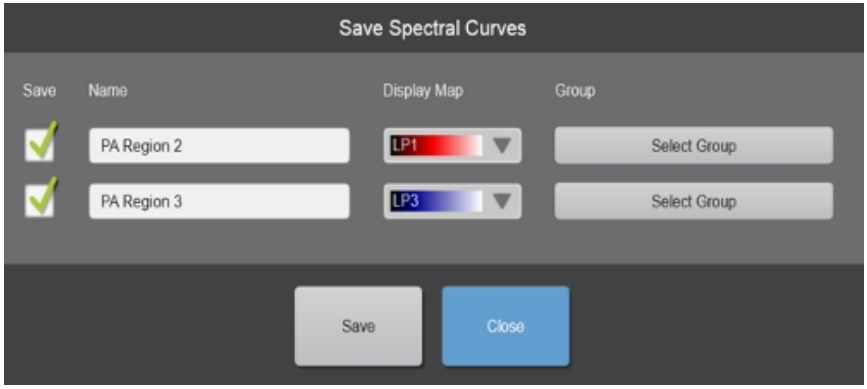
   Once the spectral curve is saved, you will see your curve on the

Photoacoustics page in System Settings. See "Photoacoustics" on page 187 for more information.

To save a Spectral Curve

1 On a PA-Mode (Spectro) image with a PA Region, tap the graphs button.

2 Tap **Save Spectral Curves.** The Save Spectral Curves panel is displayed.



3 Select which PA Region to save by tapping the check box for each PA Region you want to save.

4 (Optional) Change the PA Region default name by tapping the text box and typing a new name.

5 (Optional) Tap the Display Map drop down and choose a color. When unmixing a Multi-wavelength or Spectro image, the default display map for the component will be set to this option.

6 (Optional) Tap **Select Group** to display a tree that lists all available groups. Select an existing group for your PA Region or create a new group.

7 Tap **Save** when you are done.

b. If you chose to Multiplex your image, you have the option to check or uncheck each PA Region and the ability to select what color the line of data will be displayed as on the graph.

   You also have a PA Components section with a list of layers that you can check or uncheck and/or select what icon the line of data will be displayed with on the graph.

Measuring blood oxygenation

When you are analyzing an Oxy-Hemo sub-mode image, you can select specific regions of interest and precisely measure the percentage level of blood oxygenation in that region.

The Vevo LAZR-X Imaging System provides two display types for Oxy-Hemo acquisition. Choose the appropriate display before taking measurements:

a. OxyZated Display Type. Helps to calculate and quantify oxygen saturation; also particularly useful for studying the hypoxic state of tumor microenvironment to predict disease burden, studying fetal/maternal physiology, and studying stroke/ischemia.

b. HemoMeaZure Display Type. Helps to measure and quantify hemoglobin content; also particularly useful for studying anemia.

To complete an oxygenation measurement

1 Acquire an Oxy-Hemo image or load an Oxy-Hemo image to review.

2 Tap Display Map and select an appropriate map—PA1–PA9.

3 Tap Display Layout and select a layout—Both, PA Only, B-Mode Only or Side by Side.

4 Select your Display Type for PA-Mode (Oxy-Hemo). Tap **Display Type**, then tap either OxyZated or HemoMeaZure.

5 Tap **Measurements**, then **PA Region**. An active anchor point for the measurement will be placed on the image.

6 Drag the anchor point to the desired start point, and then tap **Set**.

7 Tap and drag the anchor point to trace the desired area.

8 When you are done drawing your measurement, lift your finger from the control panel and tap **Done**. The completed Oxy-Hemo measurement appears.

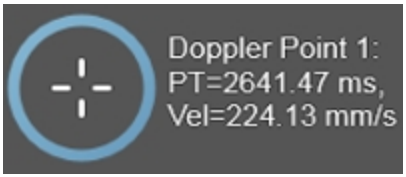
Point measurement

Point measurements are available in PW Doppler Mode and PW Tissue Doppler Mode.

1 Tap the **Measurements** button.

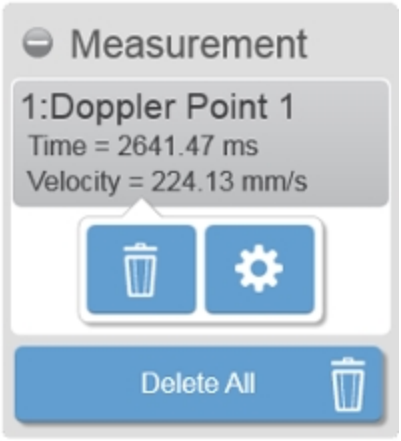
2 Tap the **Point** button.

The measurement is placed on the spectral display.



3 Tap and drag the anchor point to the desired location on the image.

4 As you move the anchor point, the measurement parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



5 The measurement and image are automatically saved as the measurement is adjusted.

Time measurement

Time measurements are available in PW Doppler Mode, PW Tissue Doppler Mode, M-Mode, and AM-Mode.

To add a time measurement

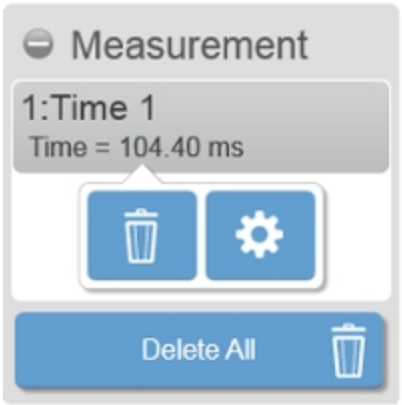
1 Tap the **Measurements** button.

2 Tap the **Time** button.

The measurement is placed on the image.

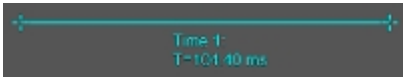
3 Tap and drag either anchor point left or right, to the desired location on the image.

As you move either anchor point, the measurement parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



4 Tap and drag the measurement line to the desired location on the image.

5 The measurement and image are automatically saved as the measurement is adjusted.



Velocity measurement

Use the velocity measurement to determine the velocity of vascular flow.

Velocity measurements are available in PW Doppler Mode, PW Tissue Doppler Mode, M-Mode, and AM-Mode. The measurement is performed slightly differently in PW Doppler Mode and PW Tissue Doppler Mode, than in M-Mode and AM-Mode.

To add a velocity measurement in PW Doppler Mode and PW Tissue Doppler Mode

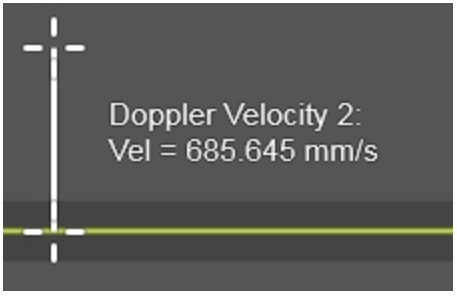
1 Tap the **Measurements** button.

2 Tap the **Velocity** button.

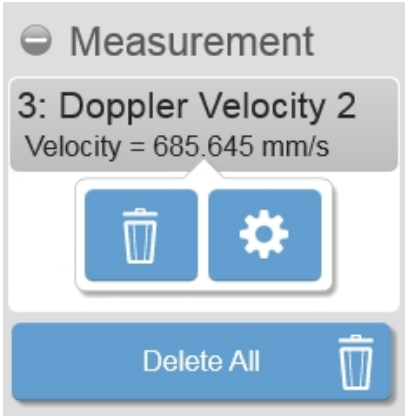
The measurement is placed on the image as a vertical line from the baseline.

3 Tap and drag the free anchor point to the desired location on the image. Only the anchor point that is not on the baseline can be moved.

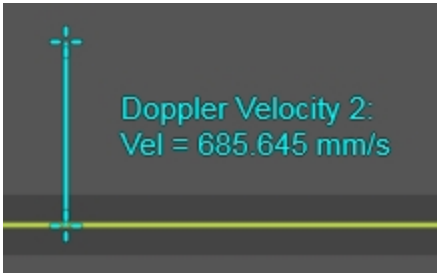
The point on the baseline is fixed to the baseline, but will move horizontally with the other point. The free anchor point can be moved above and below the baseline to measure positive and negative velocities.



4 Remove your finger from the control panel when you are done. The measurement parameters will update on the Measurement panel. See "Using the Measurement Panel" on page 274.



5 The measurement and image are automatically saved as the measurement is adjusted.



To add a velocity measurement in M-Mode and AM-Mode

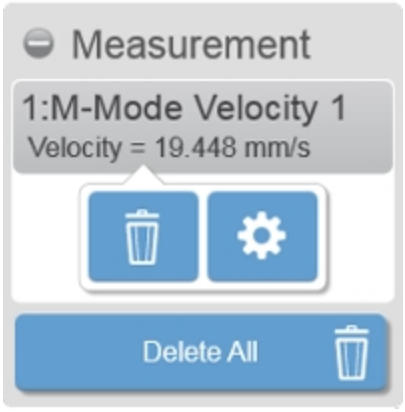
1 Tap the **Measurements** button.

1 Tap the **Velocity** button.

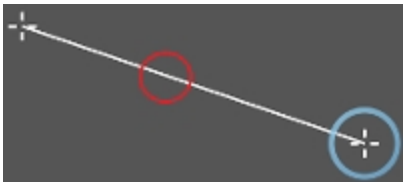
The measurement is placed on the image.

2 Tap and drag one of the anchor points to the desired location on the image.

3 As you move the anchor point, the measurement parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



4 To move the entire measurement, tap and drag on the measurement line.



5 The measurement and image are automatically saved as the measurement is adjusted.

VTI measurement

When you want to measure the Velocity Time Integral (VTI) over a series of cycles, you have two options. You can:

a. Add a manual VTI measurement; manually define the VTI by tracing the contour of the waveform.

b. Add an automatic VTI measurement; use the automatic frequency trace feature to instantly plot the caliper points on the frequency waveform before you apply the VTI measurement. See "Auto Trace" on page 290.

VTI Measurements are available in PW Doppler Mode and PW Tissue Doppler Mode.

To add a manual VTI measurement

1 Tap the **Measurements** button.

2 Tap the **VTI** button.

The VTI measurement is placed on the spectral display of the image.

3 Tap and then drag the initial anchor point anywhere in the spectral area of the image.

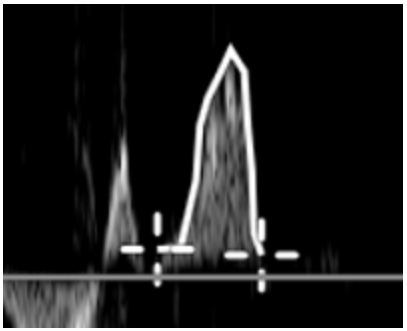
The system constrains your VTI measurement to either the top or bottom side of the baseline, depending on the placement of the initial anchor point. The system prevents your trace from crossing the baseline.

4 Tap **Set** to set the initial anchor of the VTI measurement at a specific point on the waveform.

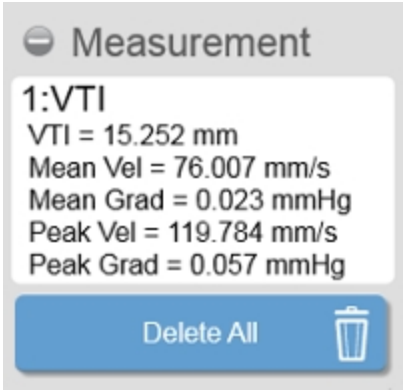
The **Close** button is displayed. Only tap **Close** when you finish drawing the contour of the waveform.

5 Tap and drag the active anchor to define the trace along the contour of the waveform.

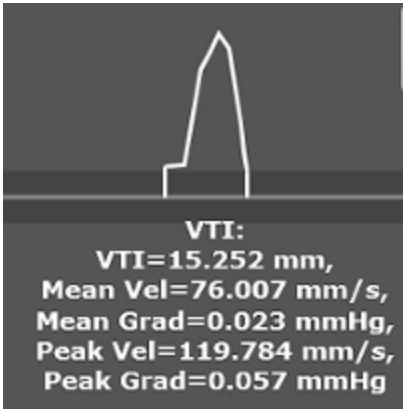
While you are defining the trace, you will be able to clear/erase part or all of the trace by dragging the active anchor left of the current position.



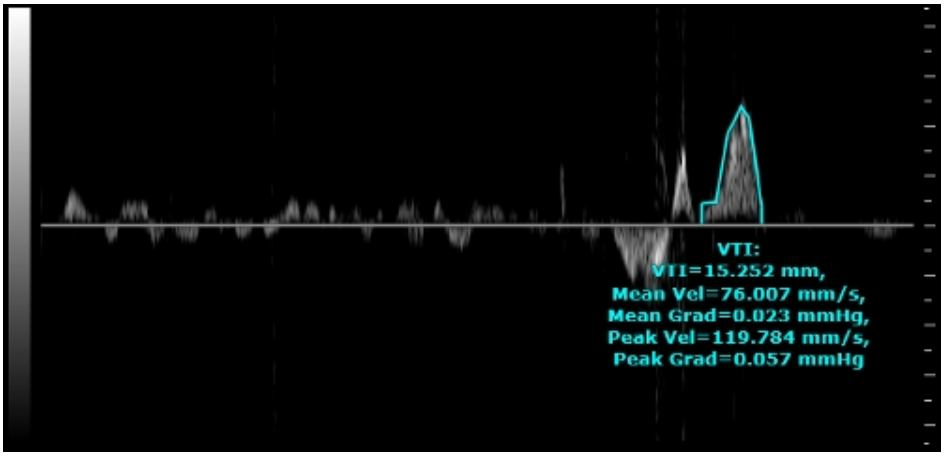
As you draw your measurement, the measurement parameters are updated on the Measurement panel. See "Using the Measurement Panel" on page 274.



6 Tap Close when you are done.



7 Once the VTI measurement is closed, you cannot edit it.



To add an automatic VTI measurement

1 Enable the Auto Trace using the **Auto Trace** button. See "Auto Trace" on page 290.

2 Tap the **Measurements** button.

3 Tap the **VTI** button.

4 An active anchor for the measurement is placed on the spectral display of the image.

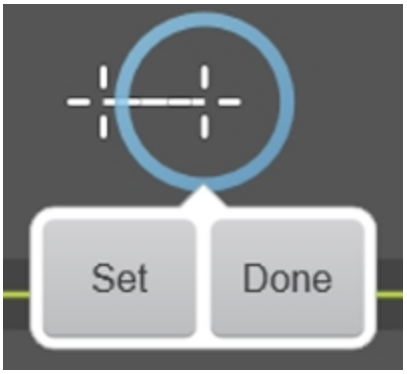
5 Tap and drag the active measurement anchor anywhere on the spectral display.

The system constrains your VTI measurement to either the top or bottom side of the baseline, depending on the placement of the initial anchor point. The system prevents your trace from crossing the baseline.

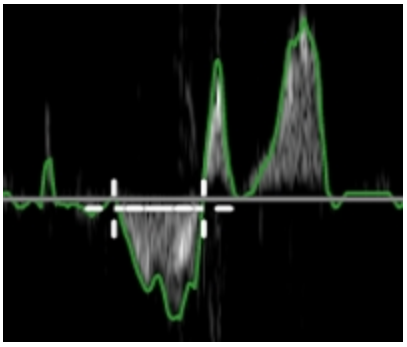
6 Tap **Set** to place the first anchor point at the beginning of a cardiac cycle.

7 Drag the anchor to the next cycle location and tap **Set** to define the initial cycle of the VTI trace.

Note: Tap **Done** only when you have finished your measurement.



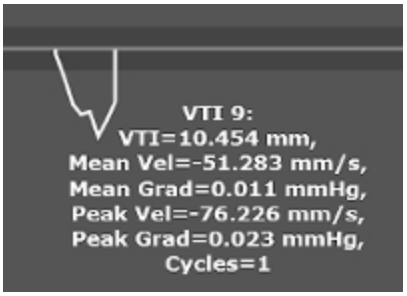
8 Continue to tap **Set** on the beginning and end of the cardiac cycle waveforms.

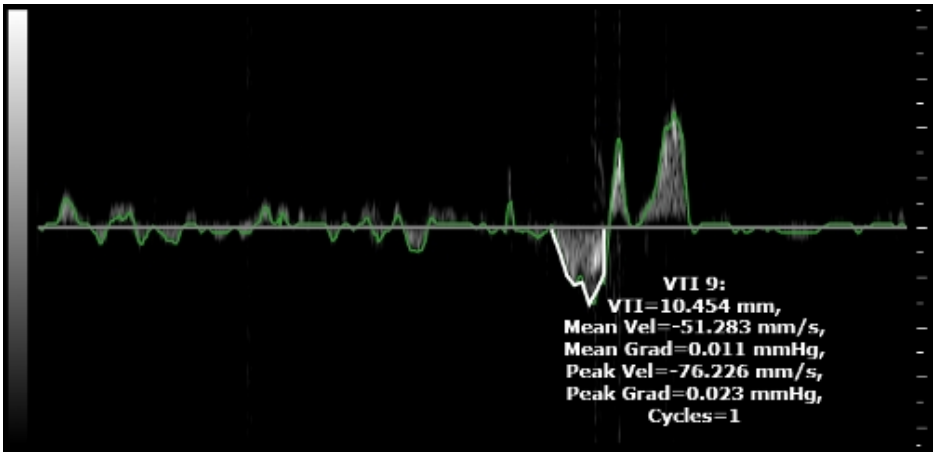


9 Tap **Done** when you are finished.

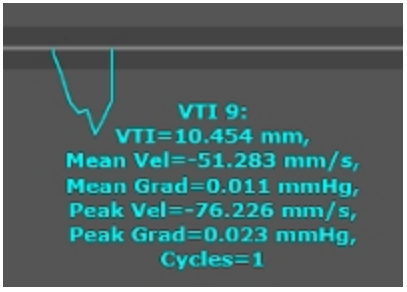
The range of peak and mean frequency traces that you selected are displayed on your spectral data on the image display.

In the example below, Peak Auto was selected. The green trace shows the largest velocity values, (positive and negative), along the entire clip.





10 Once the VTI measurement is closed, you cannot edit it.



Scanning

Warning: High levels of ultrasound energy can damage tissue. Avoid contact between your skin and the transducer face when the system is scanning.

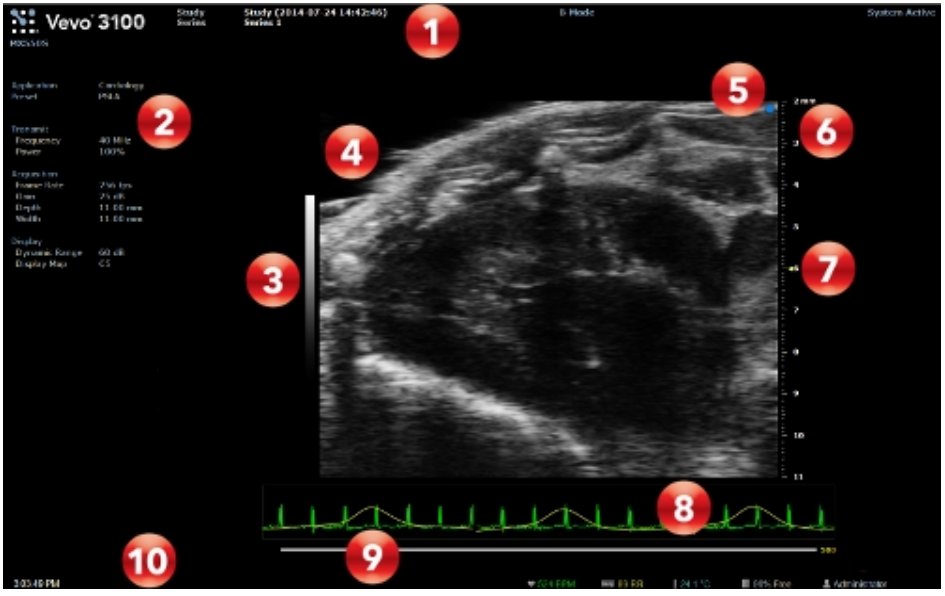
Vevo Imaging System offers many different scanning modes:

Frame-based image modes	Time-based image modes	Additional modes
B-Mode	M-Mode and Anatomical M-Mode (AM-Mode)	3D Mode
Color Doppler Mode	Pulsed Wave (PW) Doppler Mode	4D-Mode
Power Doppler Mode	PW Tissue Doppler Mode	RF Mode
Nonlinear Contrast Mode		
EKV Mode		
PA-Mode		

The Vevo Imaging System also provides the ability for hands-free, voice activated control. See "Vevo Voice" on page 399 for more information on the voice commands you use and what equipment is required.

Viewing the image display

While scanning and reviewing images, you will view your image data on the image display. The features on the screen and the image parameters will differ slightly in each scanning mode.



B-Mode image display:

1. Image status area
2. Mode settings panel
3. Display map
4. Image area
5. Transducer orientation indicator
6. Image scale

7. Focal zone indicator
8. Physiological data trace
9. Clip buffer
10. Status bar

Image status area

The following information is shown on the image status area:

- The transducer in use.
- The study/series information.
- Image status, i.e live or review. Additional status messages are available for 3D Mode, 4D-Mode, EKV Mode and PA-Mode.
- Image number for the current image and the total number of images in the series.

Mode settings panel

The mode settings panel displays a unique set of information depending on the current control selections.

Specific values for image controls are displayed. As you modify the settings during imaging, your changes are temporarily highlighted so you can see the updates.

Display map

Indicates the chosen display map for the image. The display map can be changed using the **display map** control.

Image area

This is the area where the image data acquired by the transducer appears. When you export a stored image and configure your export to send only the image area, this is the area of the window that the system exports, along with header information.

The image area in not interactive, you control the content of the image area from the control panel.

Transducer orientation indicator

The blue dot corresponds to the orientation ridge on the transducer nose and indicates the orientation relative to the anatomy.

Tap either of the orientation buttons to flip the image between the following options: **Right**, **Left**, **Up** and **Down**.

You can also tap the upper part of the image area to flip the image. Tap the side of the image you would like to change the orientation to.

Change the orientation in M-Mode and AM-Mode by tapping inside the B-Mode scout window. Tapping either **Up** or **Down** will also flip the M-Mode window and the image scale.

Change the orientation in PW Doppler Mode and PW Tissue Doppler mode by tapping inside the B-Mode scout window. Tapping either **Up** or **Down** will not flip the PW Doppler data window or Doppler scale.

Image scale

Indicated in millimeters, the distance from the face of the transducer to the tissue being imaged.

Focal zone indicator

When you acquire data, use the **Focal Zone** control on the control panel to adjust the number and configuration of the focal zones in order to optimize the image based on its depth.

Physiological data trace

Displays the animal's dynamic heart rate, respiration rate and blood pressure data.

Note: The animal's temperature is not included as a data trace however, it is shown on the status bar and also to the right of the physiological data trace window.

This data is gathered by the animal physiological monitoring system that connects to the Vevo Imaging Station. See "Physiology" on page 116.

During acquisition, this area shows the live physiological parameters. During review, this area shows the physiological parameters at the time of acquisition. During review, live physiological data values for the animal are also shown on the status bar.

Clip buffer

Displays the length of the clip. The triangular white marker identifies the individual frame number within the clip. To display a sub-range of the original clip, use the **Clip Sub-range** button.

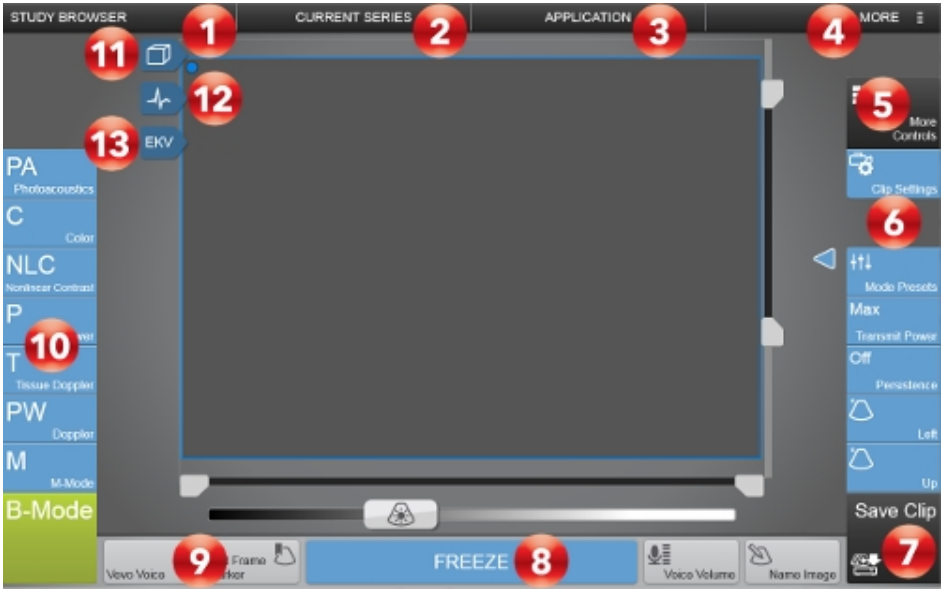
Status bar

The following information is shown on the status bar:

- Monitored physiological values in real time during image acquisition, if the Vevo Imaging Station is connected and the system is configured appropriately. These value are color-coded to correspond to the physiological trace.
- Percentage of free space to store image data so you can see when you should start to back up your image data to free up space on the system.
- Current user name
- Current time.
- Current Vevo Voice state (if enabled).
- Various status updates when imaging parameters are changed and some image processing progress information.

Using the control panel during scanning

You can control image acquisition and management through the control panel. A general overview of the interface is provided here and specific details are provided with each scanning mode.



Control panel elements:

1. Study Browser
2. Current Series
3. Application
4. More
5. More Controls

6. Imaging controls bar
7. Save Clip
8. Freeze
9. General controls bar
10. Scanning modes
11. 3D/4D tab
12. Physiology tab
13. EKV/Laser tab

Study Browser

Tap this control to open the Study Browser. See "Data Management" on page 227.

Current Series

Tap this control to open current series. See "Current series" on page 247.

Application

Tap this control to switch to another application. See "Application" on page 65.

More

Tap this control to access the Help, System Settings, or to log out from the system. See "Settings" on page 132.

More Controls

Tap this control to access additional controls that are not displayed on the Imaging Controls bar or General Controls Bar or a mode that is not displayed in the Scanning Modes. See "Customizing controls" on page 388.

Imaging controls bar

Controls available in the controls bar depend on the imaging mode, your system configuration, and whether the image is live scanning or review. See "Customizing controls" on page 388. Also refer to each scanning mode to see information on mode-specific controls. See "Scanning" on page 374.

Save Clip

Tap this control to save the current video clip. See "Saving images" on page 690.

Freeze

Tap this control to stop scanning and review or save the clip. See "Freeze" on page 689.

General controls bar

The controls on either side of the freeze button are the general controls. These controls are available during live scanning and review. To see the details on each of the available general controls, see "Customizing controls" on page 388.

Scanning modes

Tap one of these controls to begin scanning in that mode. The modes are described in the following sections. See also "Customizing controls" on page 388.

3D/4D tab

Tap this control to setup 3D or 4D scanning. See "3D Mode" on page 620 and "4D-Mode" on page 650.

Physiology tab

Tap this control to access the physiology panel. See "Physiology" on page 116.

EKV/Laser tab

The EKV tab is displayed when acquiring in B-Mode, and the Laser Tab (not displayed in the image above, but is displayed below) is only displayed while acquiring in PA-Mode.

Tap this control to setup EKV scanning or Laser calibration. See "EKV Mode image acquisition" on page 673 and "PA-Mode" on page 540, respectively.

Using the control panel during review

When you stop scanning, the control panels provides the following options:

Control panel elements:

1. Play Speed
2. Clip slider
3. Play/Pause
4. Export
5. Delete (shown for saved images only)
6. Next/Previous image (shown for saved images only)
7. Slide to Scan

Play Speed

Allows control of the playback speed of a clip. Tap the **Play Speed** button and use the **Up** button and **Down** buttons to cycle through the available options.

Note: This control is not available when reviewing a single frame or when reviewing any time based modes during playback.

Clip slider

The slider shows the current position within the clip. The slider can be dragged to view a different frame or time in the clip. The arrows at each end of the slider can be used to move in small increments.

Note: This control is not available when reviewing a single frame or when reviewing any time based modes during playback.

Play/Pause

Allows for the clip to be paused during playback, and to resume playback. Tap the button to toggle the playback state.

Note: This control is not present when reviewing a single frame.

Export

Allows you to export the current image.

Delete

Use this control to delete the current image. A confirmation message is displayed before the image is deleted.

Note: Only available for saved images.

Next/Previous Image

Tap the arrows to cycle through the images in the same series as the current image.

Note: Only available for saved images.

Slide to Scan

To continue live imaging, drag or swipe the **Slide to Scan** slider to the right.

Customizing controls

There are three categories of controls on the control panel during scanning and reviewing images that can be customized.

- Mode controls
- General controls
- Imaging controls

Note: Only one control is available on every panel and cannot be customized, the Screen Pointer.

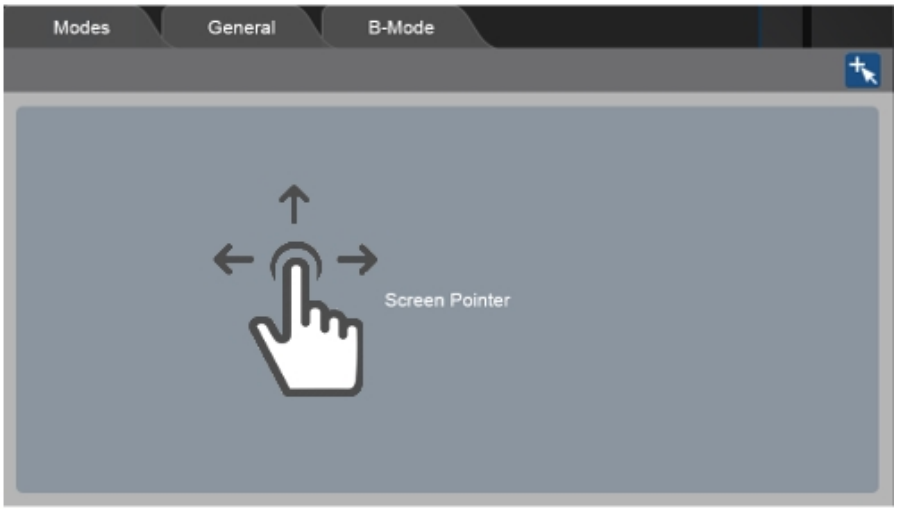
Screen Pointer

The Screen Pointer is useful if you have a second monitor attached to the system and would like to point out features on the image display to others during an imaging session.

Note: The Screen Pointer will not be saved with your image.

1 Tap the Screen Pointer button located on the top right corner of any control panel.

2 Once enabled, the panel will become a template for the image display.



3 Tap and drag anywhere within the template to display a red pointer on the image display.

4 To disable the Screen Pointer, tap the active screen pointer icon the top right corner or anywhere outside of the panel.

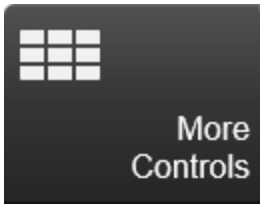
Customizing the control panel

For each of the three categories of customizable controls, there is a tab located in the More Controls panel accessed through the **More Controls** button. By default, certain controls are shown on each of the customizable bars. The remaining controls are still accessible in the More Controls window.

You do not have to place a control on a bar to use it, controls can be used directly from the More Controls panel.

To customize your controls

1 Tap **More Controls**.



2 Tap the desired tab within the More Controls panel. When live scanning, there is a Modes tab, a General tab, and a tab for each active mode. When in review, the Modes tab is not available.

3 Drag the desired control from the panel to the bar or vice versa. Controls on the Modes tab go on the Modes bar, controls on the General tab go on the General bar, and controls for each imaging mode tab go on the Imaging Controls bar.

4 Close the More Controls panel by tapping the **More Controls** button or anywhere else on the control panel.

Mode controls

The mode controls appear on the left side of the control panel during live imaging. The button placement for each mode, except for B-Mode, can be customized. The B-Mode button is permanently docked on the lower left corner of the control panel during scanning.

See "Scanning" on page 374 for available modes. The available modes may differ depending on your system configuration.

General controls

The General controls are located along the bottom of the control panel (on either side of the Slide to Scan/Freeze button) and stay on the control panel regardless of the mode during live scanning and in review.

The options available for the General controls include:

Start Recording

Tap this control to start a save for frame based modes. This button clears the existing buffer, then acquires and saves the number of frames (or length of time) specified for that mode.

This control is disabled during review.

Available for B-Mode, PA-Mode (Single), PA-Mode (Oxy-Hemo) and PA-Mode (Multi-wavelength), Color Doppler Mode, Power Doppler Mode, Nonlinear Contrast Mode, M-Mode and AM-Mode.

Clip Settings

Tap the **Clip Settings** control to open the Clip Settings panel. Within the Clip Settings panel, you can set various options for saving a clip, including the clip length in each mode. See "Saving images" on page 690.

Add Frame Marker

Mark events on frames of cine loops using the Add Frame Marker button. Once the Add Frame Marker button is tapped a small marker is added to the cine loop buffer and an Add Notes flyout button appears.

Use the Add Notes button to add notes about that particular frame marker. Within the Frame Marker Notes panel, you can delete a marker and clear notes for all markers that are included in that particular image.

See "Frame markers" on page 404 for more information.

Name Image

This control allows you to enter a name for an image.

Using the Name Image button will trigger a save of either a clip or frame. Select either Save Clip or Save Frame on the Save tab in Clip Settings for the **On "Name Image"** option.

New Series

Tap this button to close the current series and open a new one. If you are scanning, this is quicker than going into the Study Browser.

Note: Opening a new series will also create a new study.

Report

Tap this button to see a report of the measurements and calculations for the current series. Scanning stops when you open the report.

Tap **Scan** to restart scanning.

Reset Preset

If you have selected a mode preset while scanning and have changed some of the scanning parameters, tapping this control will reset the controls to the currently selected preset values.

Note: This control is disabled during review.

Note: When imaging in a mode that uses B-Mode as the background image over which the active mode data are applied (ie. PA-Mode), you must use the Reset Preset button for your active mode found in More Controls on the active mode panel.

Save Application

Tap this control to save the current configuration in all modes into a new application for the current transducer. See "Applications and Presets" on page 135.

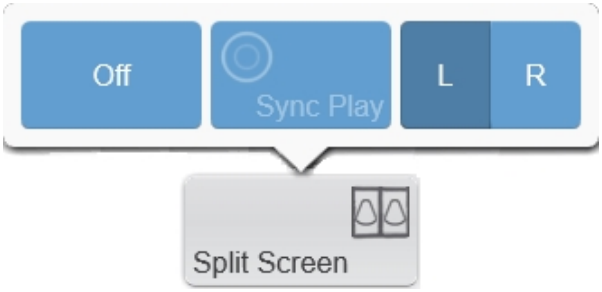
Note: This control is disabled during review.

Save Frame

Tap this control to save a single frame in frame-based modes (i.e. B-Mode, Color Doppler Mode, Power Doppler Mode , and Nonlinear Contrast Mode). In time-based modes, this control stores a clip.

Split Screen

Tap this control to enable split screen viewing. This feature allows you to compare two images side by side in the image display, or to view a stored or acquired image next to a live image.



This allows images to be compared side by side. Only one side can be acquiring live data at a time. Use the L/R toggle to switch the active side from left to right.

You cannot display live images in both panels. Tap **Split Screen** to turn on Split Screen view and configure the view:

- Off – Turn split screen view off.
- Sync Play – Syncs the playback between two frame-based images.

  Note: Sync play is not available for 4D-Mode images.

  Note: Sync Play is available for EKV Mode images, but only when both images are EKV Mode.
- L/R – Toggles between the left and right images panels on the image display.

Start/Stop

This button is available while acquiring data in PA-Mode, M-Mode, AM-Mode, PW Doppler, and PW Tissue Doppler. It provides the same functionality as the Start/Stop flyout from these mode controls.

Using this control allows you to position the transducer in a customized location. This control toggles between the full B-Mode image and the desired mode.

This control is disabled during review.

Infusion Pump

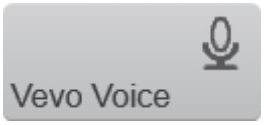
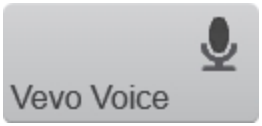
Tap this button to control infusions using the Vevo Infusion Pump through the Vevo Imaging System software. This button is available in acquisition and review and is available for all modes.

Once the Infusion Pump button is tapped, a flyout will be displayed. Tap **Start Infusion** or tap and hold **Quick Infuse** to start an injection. Tap **Stop Infusion** or tap and hold **Quick Withdraw** to stop an injection. Tap **Infusion Settings** to select the settings for the Preset, Syringe and Infusion.

See "Vevo Infusion Pump" on page 102 for more details.

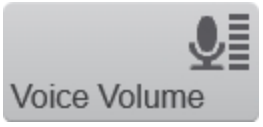
Vevo Voice

Tap this button to enable Vevo Voice. It provides voice activated controls during live scanning and in review. See "Vevo Voice" on page 399 for a list of commands and hardware suggestions.

	
Off	On

Voice Volume

Adjusts the volume level when using Vevo Voice. Tap **Voice Volume** and adjust the volume using the slider flyout.



Imaging controls

You can adjust parameters that are available during live scanning and review, using the imaging controls. i.e. image size, power, gain, etc.

For each imaging mode, you can drag your commonly used controls onto the controls bar located on the right side of the control panel.

Different controls are available when you are scanning or reviewing an image. The controls can be customized for both scanning or review for each mode.

Note: When imaging in multiple modes, you can access the available controls from both modes. For example, you can choose from both B-Mode and M-Mode controls when scanning in M-Mode.


Modes
General
B-Mode
M-Mode
More Controls
RF
Display Layout
Save Mode Preset
Clip Settings
Slow
Sweep Speed
Mode Presets
0°
AM-Mode Angle
Max
Transmit Power
15.8 mm
Gate Size
Orientation
Display Map

Vevo Voice

The Vevo Imaging System supports voice activated commands to scan, acquire, save and review images.

You can decide whether or not to have Vevo Voice constantly on or user controlled. See "General" on page 171 in System Settings.

You can also program the foot pedal for Vevo Voice, see "Foot Pedal Configuration" on page 175 (General page in System Settings).

Note: Vevo Voice requires time to 'train' the software to recognize users voices. The estimated time varies for each user. Using Vevo Voice regularly will increase its accuracy and efficiency.

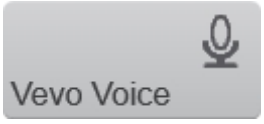
Enabling Vevo Voice

To enable Vevo Voice

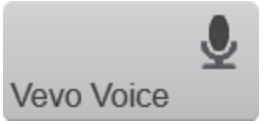
1 From the mode window, tap **More Controls**.

2 Go to the General page.

3 Enable Vevo Voice by tapping the **Vevo Voice** button.



Off



On

Note: If you choose to have Vevo Voice 'Constantly On', the Vevo Voice button will automatically be on.

Vevo Voice commands

The following are voice commands to use during scanning or review.

Enable the **Show recognized voice commands and confidence levels** option to display how well the software recognizes your voice commands. Enabling this option will display text and confidence levels on the bottom left of the image display. The text displayed is what the system's software interprets from your voice. The confidence levels displayed are how well your voice and the text match.

Note: If you choose to enable the 'Constantly On' voice option you must say '*Vevo*' before using a command. If you choose the 'User Controlled' voice option you must tap the Vevo Voice button before using a command:

Vevo Voice commands:

- Scan
- Freeze
- Save Clip or Cine Store
- Save Frame or Frame Store
- Next Mode
- Play or Pause
- Next or Previous image
- B-Mode/Doppler/PA Gain up or down
- PRF up or down

When scanning, the following voice commands can be used.

Note: If the 'Constantly on' voice option is enabled, before using these commands, you must say either '*Vevo go to*' , '*Vevo switch to*' or ''*Vevo*' *(followed by the mode name)*'.

If you want to scan in a spectrum based mode (*) or PA-Mode, you must also say '*Vevo start*' or '*Vevo update*':

- B-Mode
- Color Doppler Mode
- M-Mode*
- Nonlinear Contrast Mode
- PA-Mode
- Power Doppler Mode
- PW Doppler Mode*
- PW Tissue Doppler Mode*

Note: Using Next Mode will switch to the next mode that is listed above the current mode according to the Scanning Mode buttons order on the left of the control panel.

When switching to a spectrum based mode (M-Mode, PW Doppler Mode, PW Tissue Doppler Mode) or PA-Mode, using Next Mode once will evoke the mode Start state—to begin scanning you must say Next Mode again.

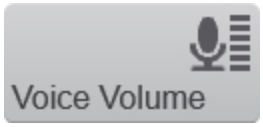
System volume of Vevo Voice

To adjust the system volume of Vevo Voice

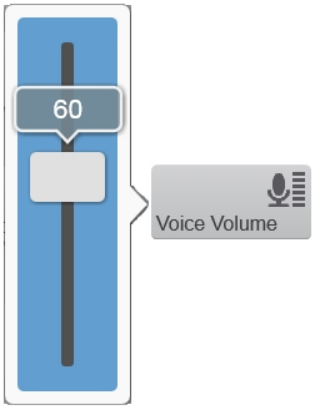
1 From the mode window, tap **More Controls**.

2 Go to the General page.

3 Tap **Voice Volume**.



4 Adjust the Voice Volume slider.



Required hardware

You must purchase additional hardware in order to use Vevo Voice.

Hardware suggestions

- Microphone with USB plug.
- Webcam or microphone with USB plug.

- Microphone + USB adapter. USB adapters are available to convert a Stereo Audio Adaptor to USB (sometimes referred to as USB Stereo Sound Adaptor, USB External Sound Card, or USB Stereo Audio Adaptor).

Note: Once you attach your hardware to the USB, a system restart may be required.

Frame markers

Frame markers are small markers on the clip buffer to indicate an important point in the acquisition, like an injection or withdraw from the Vevo Infusion Pump. Frame markers can be placed when the image is paused or during playback and additional notes can be added. You can find the Add Frame Marker button on the General Controls via More Controls. Drag and drop the button from the General Controls page to the general controls bar.

The frame markers are displayed on the clinical display below the image area as blue indicators on the clip buffer.

Frame markers are available in the following modes and states:

- B-Mode – Acquisition, Review
- Color Doppler Mode – Acquisition, Review
- Power Doppler Mode – Acquisition, Review
- Nonlinear Contrast Mode – Acquisition, Review
- PA-Mode – Acquisition, Review
- 3D Mode – Review (only for the 2D view)
- 4D-Mode - Review (only for the 2D view)
- EKV Mode - Review

Note: Once a 3D or 4D image is loaded into 3D or 4D, the frame markers are removed.

When adding frame markers, please note the following:

- If the cine buffer fills up and the frame that the frame marker is on gets pushed out of the buffer, the frame marker will be deleted.

  Note: If the frame marker is deleted while editing the notes for it in the Frame Marker Notes panel, the software will disable the buttons.

- During playback you cannot toggle between the available frame markers on the Frame Marker panel.
- A frame marker and its notes will be exported with the image and with a report.
- When adding notes during acquisition, scanning will not stop.
- You cannot place more than one frame marker on a frame.
- If the study is locked, the Frame Marker panel will be disabled.

Frame markers and the Vevo Infusion Pump

When acquiring data, the software will mark the start and end of an infusion or withdraw with a frame marker on the clip buffer.

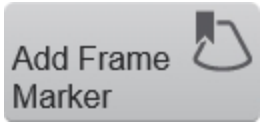
The software will annotate the frame markers as they are added, according to the start or end of an infusion/withdraw and what method you use. The annotation will describe the action of the Pump (Start or Stop), the Mode used (Infuse or Withdraw), Final volume and Final time of the infusion.

See the "Vevo Infusion Pump" on page 102 for more instructions on how to use the Infusion Pump.

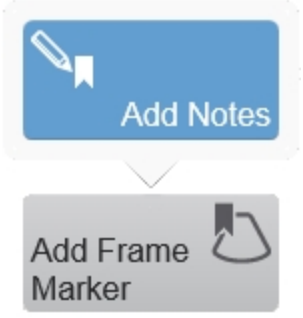
Frame markers during acquisition

To add a frame marker during acquisition

1 While acquiring data, tap **Add Frame Marker**. A frame marker is placed on the cine loop.



2 (Optional) Tap the Add Notes flyout to add notes immediately after placing a frame marker.



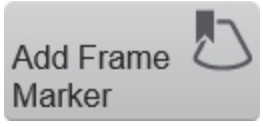
3 Frame markers will be listed on the Frame Marker panel. They will be numbered sequentially, their notes displayed and the frame where they are located will also be listed.

Frame markers in review

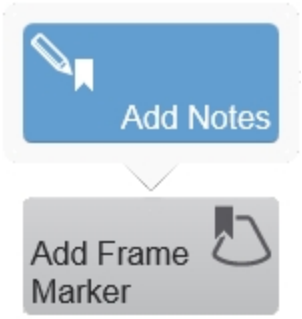
To add a frame marker in review

1 Load an image into review.

2 Tap the Add Frame Marker button. A frame marker is placed on the cine loop.



3 (Optional) Tap the Add Notes flyout to add notes immediately after placing it.



4 Frame markers will be listed on the Frame Marker panel. They will be numbered sequentially and will also have the frame where they are located.

5 (Optional) Edit the frame marker default name.

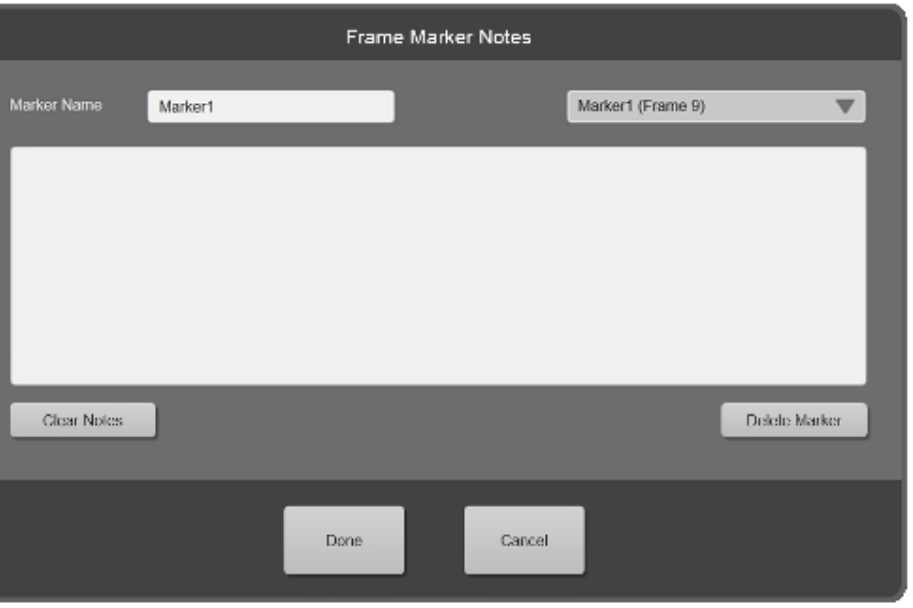
i. Tap the note button.

ii. Enter a new name in the Marker Name text box.

To add notes to a frame marker

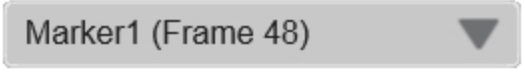
1 Select a frame marker from the Frame Marker panel.

2 Tap the notes button. The Frame Marker Notes panel will be displayed.



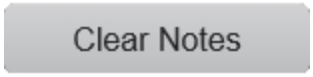
3 Enter text in the notes text area.

4 (Optional) Select a different frame marker from the drop down list.



Note: The software will automatically commit all changes to the currently selected frame marker if you select another frame marker from the drop down menu.

5 (Optional) Tap **Clear Notes** to delete all text in the notes text box.



6 (Optional) Tap **Delete Marker** to delete the frame marker (including any notes).

7 Tap **Done** when complete or **Cancel** to cancel any changes you have made.

B-Mode

B-Mode is the system's default imaging mode. The system displays echoes in a two-dimensional view by assigning a brightness level based on the echo signal amplitude. B-Mode is the imaging mode you will work with most often because it is the most effective mode for locating anatomical structures. If you have seen a conventional ultrasound image, then you are already familiar with B-Mode.

You will also:

- Use B-Mode in other imaging modes as the background image over which the active mode data are applied.
- Use B-Mode as a real-time orientation window in other imaging modes to visually guide the transducer to the desired location.

B-Mode acquisition

To acquire an image in B-Mode

If you want to add physiological data to your image, then perform the following steps before you begin acquiring data:

- Set up your system for physiological data acquisition.
- Prepare your animal on the animal platform.
- Set up blood pressure monitoring.

For detailed information, refer to the Vevo Integrated Rail System III Operator Manual.

1 Tap **B-Mode.**

2 Adjust the controls as needed. See "B-Mode controls" on page 420.

3 Save the image for later review using **Save Clip**. See "Saving images" on page 690.

Visualizing injections with the Needle Guide

In ultrasound guided injection applications, the needle guide overlay feature helps you visualize the alignment of your needle with your injection target.

To ensure that your needle appears in the image area, the needle must be aligned with the transducer in a coupling medium such as gel or water, or inserted in the anatomy of the animal.

If you intend to save a clip of your injection, make sure that you have set your B-Mode clip size to a sufficient length to capture the event, before you begin.

The Needle Guide feature is only available while acquiring data in B-Mode.

To perform an image-guided needle injection

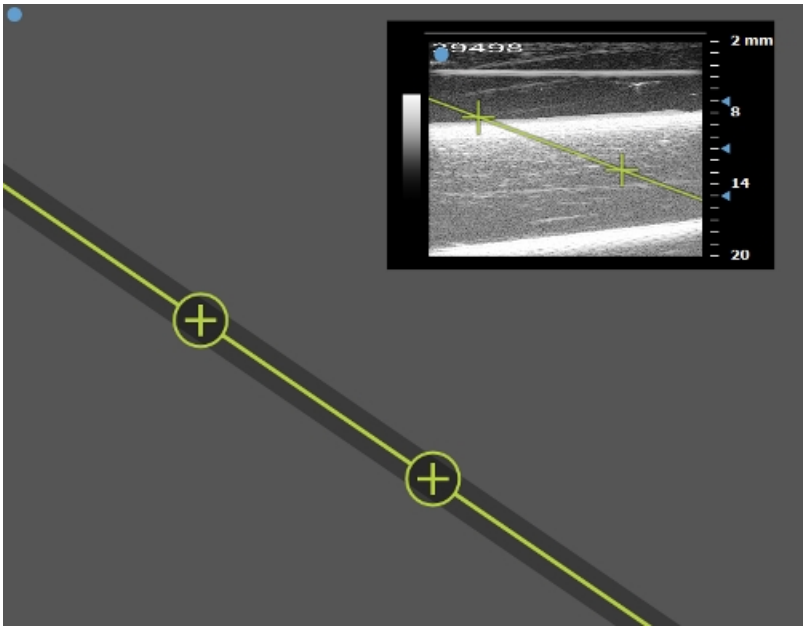
1 Begin acquiring image data in B-Mode.

2 With the injection target below focus (in or out of the plane), and using the Vevo Imaging Station, physically extend the needle into the image toward the

expected target location. Bring the needle tip as close to the focal depth as possible.

3 Tap **Needle Guide** control to activate the Needle Guide overlay feature.

4 Drag the Needle Guide controls to the desired location on the control panel. You will see the changes in the overlay on the image display.



5 Drag the first caliper to the location where the needle enters the edge of the image window.

6 Drag the second caliper to the tip of the needle (where it appears on the image display). The Needle Guide overlay extends through both calipers and across the B-Mode image area.

7 Using the Vevo Imaging Station physically retract the needle. Ensure that the needle moves along the needle guide overlay.

8 Bring the target into the image plane and line up the target with the needle guide that indicates the needle tip.

9 Physically bring the needle into the image plane.

10 Advance the needle tip to the tissue target and start your guided injection.

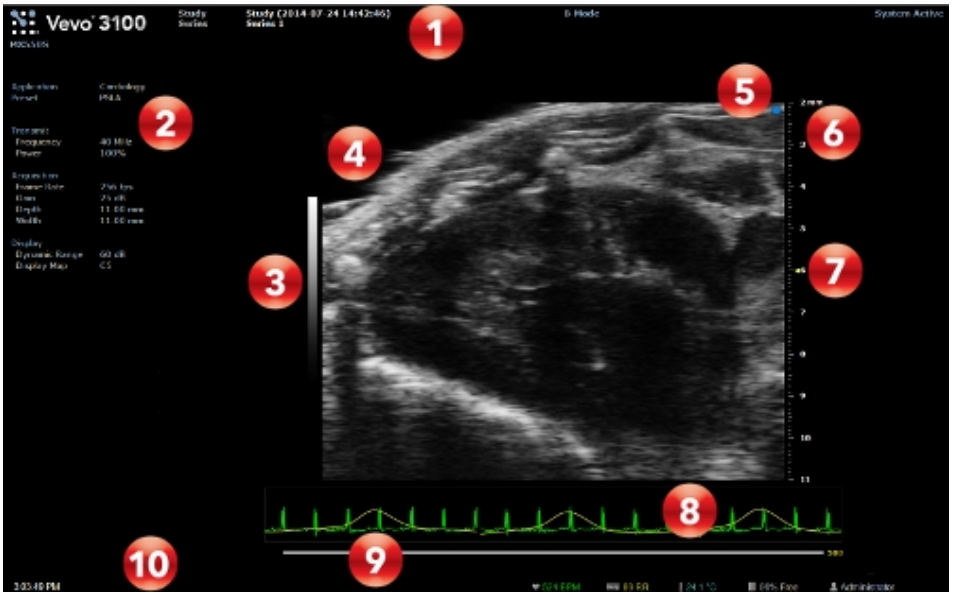
11 When the needle tip is within the target area inject the sample.

12 Tap Save Clip to save a clip of the injection event.

13 Physically retract the needle using the Vevo Imaging Station.

B-Mode image display

You view your image data on the B-Mode image display.



B-Mode image display:

1. Image status area
2. Mode settings panel
3. Display map
4. Image area
5. Transducer orientation indicator
6. Image scale
7. Focal zone indicator

8. Physiological data trace
9. Clip buffer
10. Status bar

B-Mode control panel

When imaging in B-Mode, there are a number of controls on the control panel that you can manipulate to optimize your image.

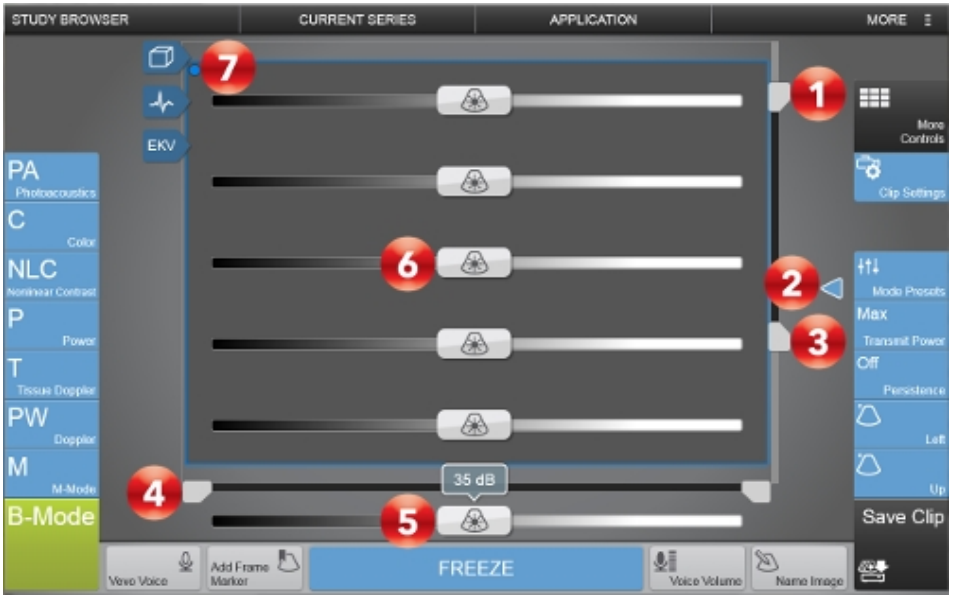


Image controls:

1. Image depth offset
2. Focal zone
3. Image depth

4. Image width
5. Gain
6. Time gain compensation (TGC)
7. Transducer orientation indicator

Image depth offset

Slide this control up or down to adjust the distance from the face of the transducer at which the system begins to display the ultrasound image. For example, if your transducer is set to acquire data from 2 mm to 12 mm, when you slide the control down 1 mm, the image display will only show the data between 3 mm and 12 mm. The image depth offset is displayed in millimeters beside the slider control as you adjust it.

Note: The minimum depth varies by transducer.

Focal zone

When you acquire data, these blue arrows indicate the current focus depth. Adjust the depth of the B-Mode focal zone or focal zones on your image by dragging the arrows up or down. When you have more than one focal zone this control moves the position for all focal zones as a group. Drag up to decrease the depth. Drag down to increase the depth.

Use the **Focal Zones** control to place up to three focal zones to your image and adjust the spacing of the focal zones. See "B-Mode controls" on page 420.

Image depth

Slide this control up or down to adjust how deep you want to display the ultrasound signal. Slide down to increase the depth. Slide up to decrease the depth. The image depth is displayed in millimeters beside the slider control as you adjust it and also in the lower left corned of the image display.

Note: The depth value in the lower left corner of the image display is always the total acquired depth of the unzoomed image. When you zoom, this value stays the same.

Note: The available depth is transducer dependent.

Image width

Slide these controls left or right to adjust the physical width of the area the transducer is imaging. Slide outwards relative to the image to increase the width. Slide inwards to decrease the width. The sliders move together and the image width is displayed in millimeters above the slider control as you adjust it.

Note: The closer you can reasonably narrow the width of your image around your target structure, the higher the system sets the acquisition frame rate. This is especially helpful when you are studying cardiac tissue movement.

Gain and TGC controls

Gain refers to amplifying the intensity of the returning sound waves on the screen display. Increasing the gain brightens the image. Decreasing the gain

darkens the image. Use the Gain control to adjust the visual intensity of the signal.

As you adjust the master gain control the Time Gain Compensation (TGC) controls are displayed. During image acquisition in any B-Mode-based imaging mode, each slider adjusts the ultrasound signal to compensate for minor attenuation as it returns through deeper situated tissue.

Each slider adjusts the return signal across a specific depth band. Slide the control to the right to boost the signal and brighten the image data in that horizontal band, and left to attenuate the signal and darken that band.

The current value is displayed above the control as you adjust it.

To adjust gain by using the gain sliders

1 Drag the slider left or right, to decrease or increase the master gain respectively:

2 When the master gain control is touched, five TGC sliders will appear on the control panel. Drag each slider left or right.

- The top slider adjusts the near gain of the B-Mode image, controlling the display intensity in the near field (nearer to the transducer).
- The middle slider adjust the middle gain of the B-Mode image, controlling the display intensity in the middle field.
- The bottom slider adjusts the far gain of the B-Mode image, controlling the display intensity in the far field (further from the transducer).

Note: The five gain sliders are in order from the top to bottom and are named in presets as follows: Near Gain, Near Middle Gain, Middle Gain, Far Middle Gain, Far Gain.

Transducer orientation indicator

The blue dot corresponds to the orientation ridge on the transducer nose and indicates the orientation relative to the anatomy.

Tap either of the orientation buttons to flip the image between the following options: **Right**, **Left**, **Up** and **Down**.

B-Mode controls

The following table provides an overview of the B-Mode controls and when they are available.

If the listed control is not on the Controls bar, it will be in More Controls. You can customize which controls appear in the Controls bar, see "Customizing controls" on page 388.

Some controls appear only when the image is live or when the image is in review and some controls appear in both cases.

B-Mode controls

Control	Live	Review
Annotation		✓
Brightness		✓

B-Mode controls

Control	Live	Review
Clip Settings	✓	✓
Clip Sub-range		✓
Contrast		✓
Display Map	✓	✓
Dynamic Range	✓	
Focal Zone	✓	
Left/Right	✓	✓
Load into 3D		✓
Magnify Scale		✓
Measurements		✓
Mode Presets	✓	
Needle Guide	✓	✓

B-Mode controls

Control	Live	Review
Persistence	✓	
RF	✓	✓
Save Mode Preset	✓	✓
Show Values and Labels		✓
Transmit Power	✓	
Up/Down	✓	✓
Vevo HD	✓	
Zoom	✓	✓

Tap **Annotation** to add annotations to your acquired or stored image. Select the desired text from the annotation page or enter custom text. See "Annotations" on page 265.

Indicates the image brightness level. Tap the **Brightness** control and adjust the slider up or down to obtain the required setting. The setting is displayed on the button for easy reference and is stored with the image.

Tap the **Clip Settings** button to open the Clip Settings panel. You can set various options for saving a clip, including the clip length for each mode. See "Saving images" on page 690.

Allows an acquired, but unsaved clip to be cropped before saving. Also, for saved and unsaved clips, use this control to limit the playback of a clip to only a portion of the full clip length.

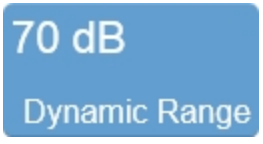
For an unsaved clip, tap **Clip Sub-range** and drag the sliders that appear on the Clip Slider to the desired position. Tap **Crop & Save**. Tap **Cancel** to remove the crop sliders.

For a saved clip, tap **Clip Sub-range** and drag the sliders that appear on the Clip Slider to the desired position. Tap **Cancel** to remove the crop sliders.

Indicates the image contrast level. Tap **Contrast** and then adjust the slider up or down to obtain the required setting. The setting is displayed on the button for easy reference and is stored with the image.

Allows a choice of predefined sets of overlays and image maps that you can apply any time during live scanning or review. Tap the **Display Map** control to see the available maps for the active imaging mode.

In B-Mode, you also have the option of choosing a color for the display of the data.

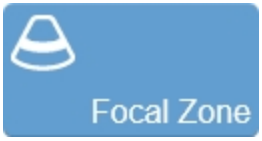


This control adjusts the input signal strength that is mapped to the spectral display.

To set the Dynamic Range, tap the control to show the flyout. Adjust the slider to adjust in 1 dB increments or tap the **Up** and **Down** buttons to increase and decrease by 5 dB increments. Tap **Default** to return to the system default setting for the current transducer.

The range allowed is dependent on transducer type.

The setting is displayed on the control for easy reference and the value is stored with the image.



This control adjusts the number and configuration of focal zones on your B-Mode based image.

Focal zones enhance the resolution across your image, while slightly reducing the acquisition frame rate. The system always displays at least one focal zone, and you can apply a maximum of two additional zones depending on the transducer.

When you add focal zones the system maximizes the resolution for a larger area of your image, and reduces the acquisition frame rate.

To adjust the focal zone tap the **Focal Zone** button and then tap the **Up** and **Down** buttons to cycle through the available options:

- Single zone
- Two zones, narrow
- Two zone, wide
- Three zones, narrow
- Three zones, wide

Note: Some of the system factory presets do not allow for adjustments of the focal zones and therefore this control will be disabled. However, if the selected preset uses Vevo HD, disabling Vevo HD will enable the Focal Zone control.

Used to load a 3D Mode clip into the rendered 3D view. This control is only available in review when the clip was acquired in 3D Mode.

Use this control to change the magnification level of the area that is shown when a measurement or annotation is being placed.

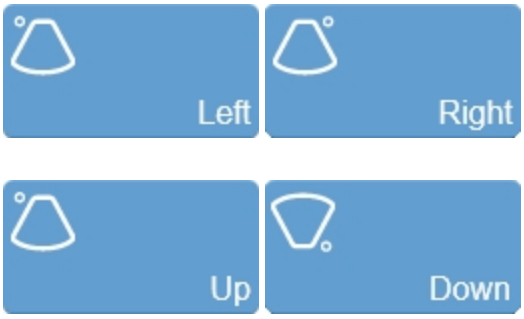
Tap the **Magnify Scale** button and then tap the **Increase** or **Decrease** flyout buttons to select a magnification level between 2x and 8x.

Tap **Mode Presets** to see the available presets and then select an appropriate set of optimized image acquisition settings. This button is active during image acquisition in every mode other than EKV Mode, 3D Mode and 4D-Mode.

The list of presets includes the factory default presets as well as any custom presets you have added to the system. All custom presets are mode, application, transducer, and user dependent where all default presets are only mode, application and transducer dependent.

You can customize the preset values to your specific application. See "Applications and Presets" on page 135.

This control turns the Needle Guide on and off. For more information, see "Visualizing injections with the Needle Guide" on page 412.



Sets the image orientation, allowing you to align the image with the transducer. The blue dot in the corner of the control panel and image display corresponds to this setting.

Tap either of the orientation controls to toggle the orientation between the following options: **Left**, **Right**, **Up**, and **Down**.

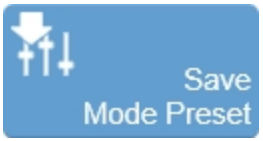
Persistence applies a pixel averaging algorithm to the most recently acquired frames to produce a more uniform view of the faster moving tissue in the image data. Persistence reduces distracting artifacts such as shimmering and motion artifacts. This feature is most useful when you are imaging uniform tissues such as the liver, kidney, or prostate.

Tap **Persistence** and then tap the **Up** and **Down** buttons to cycle through the available options–Off, Low, Med, High.

RF button in live imaging

RF button in review

The RF button is used to toggle the data collection and display of RF Mode. During live imaging, you can turn both the data collection, and the display, on and off. In review, the RF Display button will only be enabled for images that were captured with RF data. See "RF Mode " on page 683.



The Save Mode Preset button is used to save the mode specific parameters being used in the current mode. This allows you to apply these exact parameters again later using the Mode Presets button.

1 Begin scanning in the desired mode.

2 Adjust the controls to optimize your image.

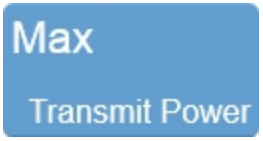
3 Tap **Save Mode Preset** to save the current settings as a preset.

4 Enter the name of your preset in the displayed field and tap **Done** to save the setting.

The new preset appears in the mode-specific flyout when you use the Mode Presets control.

Create your B-Mode presets first. B-Mode includes the largest number of controls that can be saved. Many other modes are based on B-Mode, including Color Doppler Mode, Nonlinear Contrast Mode and PA-Mode. These modes include fewer available settings. If your study protocol requires any of these B-Mode based modes you will still be able to use your B-Mode presets.

Use this control to show or hide measurement values and labels on an image in review.



Adjusts the power of the ultrasound signal transmission.

To adjust the Transmit Power, tap the **Transmit Power** button, then tap the desired power level—**Max**, **High**, **Med**, **Low** or **Min**.

Vevo HD image technology reduces speckle noise and artifacts in images while preserving and enhancing critical tissue information. This real-time image processing algorithm allows you to visualize your high-resolution data like never before. Vessel walls appear sharp; pre-palpable lesions are clearly delineated; rib shadows are reduced.

The Vevo HD button is only available if Vevo HD has been enabled for the preset that you select.

Tap the **Vevo HD** button to toggle the control on and off.

Use this control to zoom in on the image during scanning or in review.

Tap the **Zoom** button to activate the adjustable zoom control. Tap the **In** or **Out** button or drag the slider to activate the zoom function. The zoom factor is displayed within a range from 1.0x to 8.0x on the Zoom button.

You can also use a two finger spread gesture within the image area to zoom in; once activated, four arrows will be displayed indicating zoom is on. To zoom out, use a two finger pinch gesture.

To view other areas of the zoomed image, pan the image by dragging one finger in any direction within the image area.

A magnifier icon and location guide is shown in the image area on the image display. The location guide displays the original image area with a white inner area that represents the zoomed area.

You can save an image with the zoom state activated and if you load the image in review, you can zoom again using the same control.

If you wish to return to a 1.0x zoom factor, tap **Default** from the zoom controls.

Please note the following:

- The maximum zoom factor may be less depending on the image size and the minimum physical size of the image that can be displayed.
- If you change presets while in the zoom state, the zoom state will be turned off.
- If your image contains measurements and annotations, the text is not enlarged when zoom is activated.

B-Mode generic measurements

B-Mode provides several generic measurement tools. Use these tools when you want to add measurements to an image.

To access the generic measurements for B-Mode

1 Do one of the following:

   a. If you are acquiring image data tap **Freeze**, **Measurements** and then select a measurement.

   b. If you are in the Study Browser open an image, tap **Freeze**, and then tap **Measurements** and select a measurement.

2 Placing a measurement will automatically save the image.

The following generic measurements are available for B-Mode images:

- Angle
- Area
- Linear
- Ellipse
- LV Area Long
- LV Area Short
- Distance

M-Mode

Motion mode (M-Mode) provides the trace of a line from the 2D image displayed over time. A single beam of ultrasound is transmitted and reflected signals are displayed as dots of varying intensities, creating lines across the screen.

M-Mode is used primarily to measure the movement and dimensions of cardiac structures such as chambers and walls.

M-Mode works fundamentally differently than B-Mode. Where B-Mode is a frame-based image that uses multiple scanning beams to create its image, M-Mode is a time-based image that uses just one beam.

So, when you have guided your transducer beam to the depth that gives you a proper cross-section of the heart, you can then set M-Mode to lay its single beam across that cross-section. In effect, it is like positioning a tight string through the heart, and recording the movement of the heart structure cross-sections along that string.

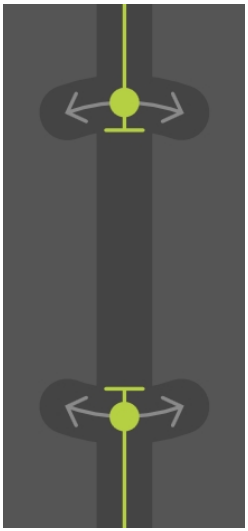
This way, the movement of the heart structures move up and down that single line so you can then take measurements along that line over time.

M-Mode image acquisition

To acquire an image in M-Mode

1 Tap **M-Mode**.

The system begins acquiring B-Mode image data and displays the green M-Mode sample gate overlay on the B-Mode scout image.



2 Position the M-Mode gate and adjust the gate size. See "M-Mode control panel" on page 439.

3 Tap the M-Mode **Start** button.

The dual-window M-Mode image area workspace appears. The M-Mode window is on the bottom, the B-Mode scout window is on the top. The system begins storing data in the acquisition buffer, and live acquisition data appears in both windows.

4 Adjust the controls as needed. See "M-Mode controls" on page 443. Also see "B-Mode controls" on page 420.

5 Save the image for later review using **Save Clip** or **Save Frame**. See "Saving images" on page 690.

6 Tap the M-Mode **Stop** button to return to the single B-Mode scout window or tap **Freeze**, to stop scanning.

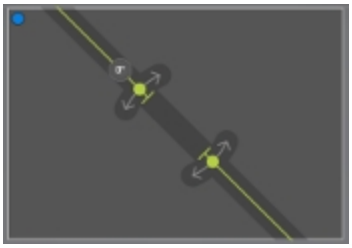
Anatomical M-Mode

Anatomical M-Mode (AM-Mode) is a modification to the standard M-Mode and is typically used in electrocardiography. You can use it to steer the sample volume to any angle, rather than positioning the sample volume in a strict vertical position. AM-Mode therefore provides a tool to obtain anatomically correct visualization and measurements for the left ventricle.

Unlike M-Mode data, which is acquired directly along a single acquisition line, AM-Mode data are re-constructed. The system generates an AM-Mode spectrum from the acquired B-Mode clip based on the ultrasound gray scale information along the sample volume line.

All controls that are available in M-Mode are also available in AM-Mode, see "M-Mode controls" on page 443. Once you change the angle of the sample gate you are automatically in AM-Mode. See "M-Mode image acquisition" on page 433.

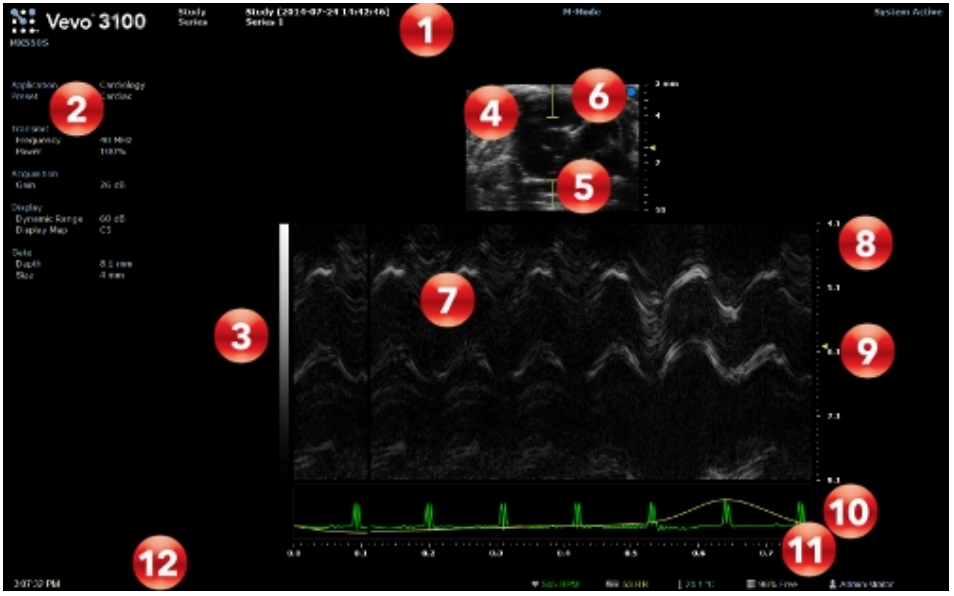
Tap the arrow on the M-Mode overlay to activate the AM-Mode handles. Drag either end of the gate to align the sample volume along the desired anatomy. The **AM-Mode Angle** control can also be used.



AM-Mode image display

M-Mode image display

The M-Mode image display is similar to the B-Mode image display with some differences.



M-Mode image display:

1. Image status area
2. Mode settings panel
3. Display map
4. B-Mode scout window
5. Sample gate overlay
6. Transducer orientation indicator
7. M-Mode window

8. Image scale
9. Focal zone indicator
10. Physiological data trace
11. Clip time scale
12. Status bar

Mode settings panel

The mode settings panel displays a unique set of information depending on the current control selections.

Specific values for image controls are displayed. As you modify the settings during imaging, your changes are temporarily highlighted so you can see the updates.

Important: In M-Mode, the frame rate displayed is for the B-Mode image.

B-Mode scout window

The region of interest is located between the green wireframe brackets. Use this window to position your transducer and set the wireframe brackets so you can acquire the most useful data.

M-Mode window

Displays the cross-section image data acquired along the sample gate line as displayed in the B-Mode scout window.

Sample gate overlay

Displays the cross-section image data acquired along the sample gate line in the B-Mode scout window. When you review an image, this is the workspace where you use the image measurement tools to apply your measurements. See "M-Mode control panel" below.

M-Mode control panel

When imaging in M-Mode there are a number of controls on the control panel that you can manipulate to optimize your image.

These controls adjust the image in the M-Mode data window, which corresponds to the sample gate volume.

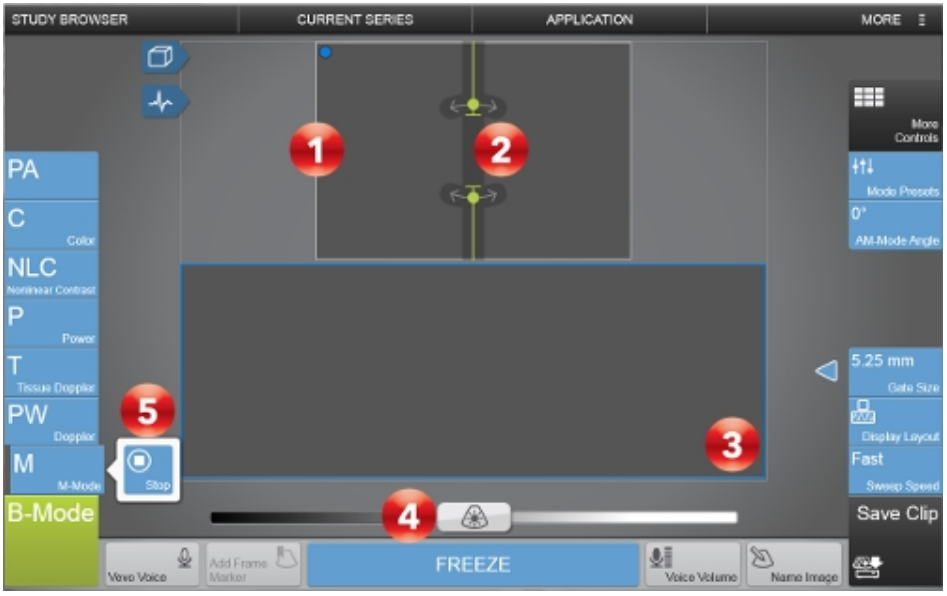


Image Controls:

1. B-Mode scout window
2. Sample gate
3. M-Mode window
4. Gain
5. M- Mode Start/Stop flyout button

To set the M-Mode sample gate

In M-Mode, the region of interest is the image data that the transducer acquires along the vertical line between the brackets of the green overlay in the B-Mode image. This line is called the sample gate.

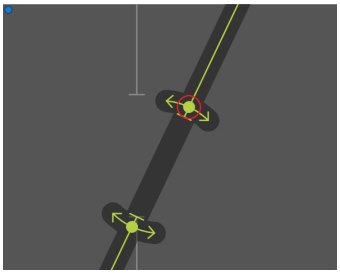
1 Begin acquiring data in M-Mode. See "M-Mode image acquisition" on page 433.

2 Position your transducer to display your region of interest in the center of the B-Mode scout window.

3 While watching the B-Mode scout window, drag the sample gate to the desired position.

4 To change the size of the gate, tap and drag one end of the gate, or use a pinch. The Gate Size button can also be used.

5 (Optional) Adjust the angle of the line by dragging either gate line point away from the gate line. The AM-Mode Angle button can also be used.



Note: The moment the angle changes from 0 degrees to any other value, the system is acquiring data in AM-Mode. See "Anatomical M-Mode" on page 435. Reset the gate angle to zero by tapping the **0°** button on the sample gate line.

6 After you change the position, size or angle of the gate, the system pauses briefly to apply the new settings and then starts acquiring data again.

To increase the B-Mode image window

You can return to B-Mode at any time by tapping the M-Mode **Stop** flyout button to adjust the image width, depth, and depth offset, and also increase the size of the B-Mode window for placement or sizing of the sample gate overlay.

You can increase the B-Mode window in order to position your transducer and sample gate more precisely:

1 Tap the M-Mode **Stop** flyout button to display the full B-Mode window.

2 Adjust the B-Mode image size. See "B-Mode control panel" on page 416.

3 Tap the M-Mode **Start** flyout to return to M-Mode imaging.

To change the sweep speed of the M-Mode data

You can change the sweep speed of the M-Mode data using a pinch motion in the M-Mode Data Window. The **Sweep Speed** button can also be used. See "M-Mode controls" on the facing page.

To change the layout of the screen

The configuration of the image data on the screen can be customized to change the relative size of the B-Mode scout window and the M-Mode data window. Use the **Display Layout** button to customize this layout. See "M-Mode controls" on the facing page.

To change the focal zone

A focal zone indicator will be displayed on both the image display and the control panel. The image display will have a focal zone indicator on both the B-Mode and the M-Mode image and the control panel will display a focal zone indicator on either the M-Mode strip or the B-Mode scout.

When acquiring an image in M-Mode, the focal zone indicator is located beside the M-Mode window on the control panel.

When acquiring an image in AM-Mode, the focal zone indicator is located beside the B-Mode scout window on the control panel. Adjust the focal zone anywhere within the B-Mode scout, regardless of the size of the gate.

M-Mode controls

In M-Mode imaging, you can adjust the following controls in addition to most of the B-Mode controls.

If the listed control is not on the Controls bar, it will be in More Controls. You can customize which controls appear in the Controls bar, see "Customizing controls" on page 388.

Some controls appear only when the image is live or when the image is in review and some controls appear in both cases.

Note: Except where indicated, all M-Mode controls also apply to AM-Mode.

Some controls are related to generic measurements for this mode. See "M-Mode generic measurements" on page 453 for details.

Accessing B-Mode controls

While imaging in another mode, certain B-Mode controls remain available.

The B-Mode controls can be accessed in three ways:

a. Tapping on the B-Mode image (the active overlay will become gray).

b. Tap **More Controls** and then tap on the B-Mode tab.

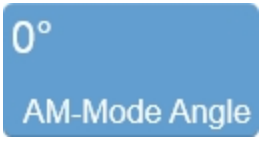
c. Tap on the handle of the PA-Mode box to switch.

M-Mode controls

Control	Live	Review
AM-Mode Angle	✓	
Annotation		✓
Brightness		✓
Clip Settings	✓	✓
Contrast		✓
Display Layout	✓	✓
Display Map	✓	✓
Gate Size	✓	
Left/Right	✓	✓
Magnify Scale		✓
Measurements		✓
Mode Presets	✓	

M-Mode controls

Control	Live	Review
RF	✓	✓
Save Mode Preset	✓	✓
Show Values and Labels		✓
Sweep Speed	✓	✓
Transmit Power	✓	
Up/Down	✓	✓
Zoom		✓



Adjusts the sample volume to an angle other than the vertical position.

In M-Mode, this control adjusts the gate angle. If you set an angle to any value other than 0°, the system begins acquiring data in AM-Mode.

In AM-Mode:, this control adjusts the angle of the line of acquisition.

To set the angle, tap the **AM-Mode Angle** button and use the **Up** and **Down** buttons to adjust the angle, or use the slider. You can also tap **0°** to return to M-Mode.

Tap **Annotation** to add annotations to your acquired or stored image. Select the desired text from the annotation page or enter custom text. See "Annotations" on page 265.

Indicates the image brightness level. Tap the **Brightness** control and adjust the slider up or down to obtain the required setting. The setting is displayed on the button for easy reference and is stored with the image.

Tap the **Clip Settings** button to open the Clip Settings panel. You can set various options for saving a clip, including the clip length for each mode. See "Saving images" on page 690.

Indicates the image contrast level. Tap **Contrast** and then adjust the slider up or down to obtain the required setting. The setting is displayed on the button for easy reference and is stored with the image.

Use this control to change the size of the B-Mode scout window relative to the other imaging data window or trace.

Tap **Display Layout** and then tap to select one of the available options—**No Scout Full Trace**, **1/3 Scout 2/3 Trace**, **1/2 Scout 1/2 Trace**, **2/3 Scout 1/3 Trace**.

Allows a choice of predefined sets of overlays and image maps that you can apply any time during live scanning or review. Tap the **Display Map** control to see the available maps for the active imaging mode.

In M-Mode, you also have the option of choosing a color for the display of the data.

This control adjusts the size of the sample gate in millimeters (mm). The control adjusts the distance of the vertical line between the two calipers.

Tap the **Gate Size** button, then tap the **Up** button to increase the size or tap the **Down** button to decrease the size.

Note: You can also tap and drag either gate handle directly on the B-Mode scout to adjust the gate size, position and angle or use a two finger pinch or spread gesture on the gate to decrease or increase the length of the gate.

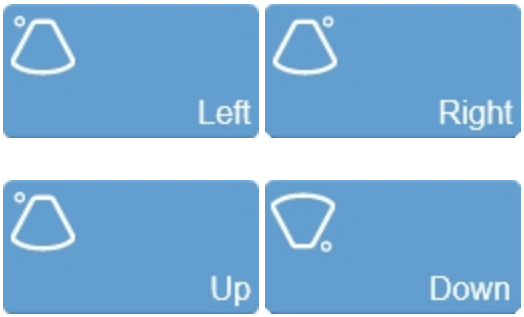
Use this control to change the magnification level of the area that is shown when a measurement or annotation is being placed.

Tap the **Magnify Scale** button and then tap the **Increase** or **Decrease** flyout buttons to select a magnification level between 2x and 8x.

Tap **Mode Presets** to see the available presets and then select an appropriate set of optimized image acquisition settings. This button is active during image acquisition in every mode other than EKV Mode, 3D Mode and 4D-Mode.

The list of presets includes the factory default presets as well as any custom presets you have added to the system. All custom presets are mode, application, transducer, and user dependent where all default presets are only mode, application and transducer dependent.

You can customize the preset values to your specific application. See "Applications and Presets" on page 135.



Sets the image orientation, allowing you to align the image with the transducer. The blue dot in the corner of the control panel and image display corresponds to this setting.

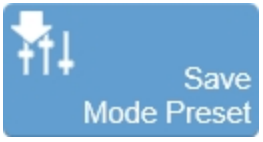
Tap either of the orientation controls to toggle the orientation between the following options: **Left**, **Right**, **Up**, and **Down**.

Change the orientation in M-Mode and AM-Mode by tapping inside the B-Mode scout window. Tapping either **Up** or **Down** will also flip the M-Mode window and the clip time scale.

RF button in live imaging

RF button in review

The RF button is used to toggle the data collection and display of RF Mode. During live imaging, you can turn both the data collection, and the display, on and off. In review, the RF Display button will only be enabled for images that were captured with RF data. See "RF Mode " on page 683.



The Save Mode Preset button is used to save the mode specific parameters being used in the current mode. This allows you to apply these exact parameters again later using the Mode Presets button.

1 Begin scanning in the desired mode.

2 Adjust the controls to optimize your image.

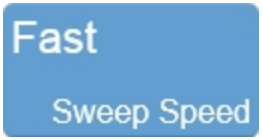
3 Tap **Save Mode Preset** to save the current settings as a preset.

4 Enter the name of your preset in the displayed field and tap **Done** to save the setting.

The new preset appears in the mode-specific flyout when you use the Mode Presets control.

Create your B-Mode presets first. B-Mode includes the largest number of controls that can be saved. Many other modes are based on B-Mode, including Color Doppler Mode, Nonlinear Contrast Mode and PA-Mode. These modes include fewer available settings. If your study protocol requires any of these B-Mode based modes you will still be able to use your B-Mode presets.

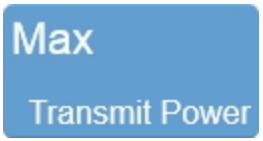
Use this control to show or hide measurement values and labels on an image in review.



Adjusts the scale of the data in the spectral data window. A faster sweep speed will increase the speed and compress the clip image.

In cardiac applications you might want to decrease the sweep speed so you can view more wall movements over more cardiac cycles in the window, or increase the speed so you can view more wall detail over one cycle.

To set the sweep speed, tap **Sweep Speed** and adjust the slider or tap to select one of the available options—**Fast**, **Medium**, or **Slow**.



Adjusts the power of the ultrasound signal transmission.

To adjust the Transmit Power, tap the **Transmit Power** button, then tap the desired power level–**Max**, **High**, **Med**, **Low** or **Min**.

Use this control to zoom in on the M-Mode spectral image in review.

Tap the **Zoom** button to activate the adjustable zoom control. Tap the **In** or **Out** button or drag the slider. The zoom factor is displayed within a range from 1.0x to 8.0x.

Once zoom is activated, four arrows will be displayed indicating that zoon is on. To view other areas of the zoomed image, pan the image by dragging one finger in any direction within the image area.

A magnifier icon and location guide is shown in the image on the image display. The location guide displays the original image area with a white inner area that represents the visible zoom area.

You can resave an image with the zoom state activated and if you load the image in review, you can zoom again using the same control.

If you wish to return to the image to a 1.0x zoom state, tap **Default** from the zoom controls.

Please note the following:

- The maximum zoom factor may be less depending on the image size and the minimum physical size of the image that can be displayed.
- If you change presets while in the zoom state, the zoom state will be turned off.
- If your image contains measurements and annotations, the text is not enlarged when zoom is activated.

Note: Zoom is only allowed in the M-Mode window in a vertical direction; zoom is not available for the 2D scout or the 2D image with M-Mode sample gate.

M-Mode generic measurements

M-Mode provides several generic measurement tools. Use these tools when you want to add measurements to an image.

To access the generic measurements for M-Mode

1 Do one of the following:

   a. If you are acquiring image data tap **Freeze**, **Measurements** and then select a measurement.

   b. If you are in the Study Browser open an image, tap **Freeze**, and then tap **Measurements** and select a measurement.

2 Placing a measurement will automatically save the image.

The following generic measurements are available for M-Mode images:

- Depth
- Heart Rate
- LV 2 Wall
- LV 4 Wall
- Time
- Velocity

PW and PW Tissue Doppler Mode

PW Doppler Mode (Pulsed Wave Doppler) is used to measure the velocity and direction of flow. The detected PW Doppler signal is presented as both a spectral image on the image display as well as an audio output through the system's speakers.

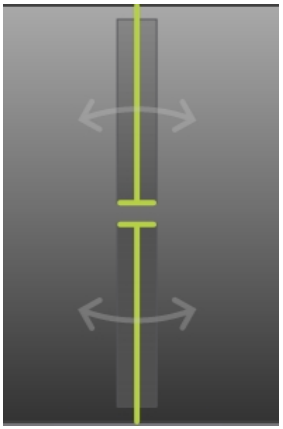
PW Tissue Doppler mode operates similar to PW Doppler mode. See "PW Tissue Doppler Mode image acquisition" on page 458. Except where noted, capturing and analyzing images with PW Tissue Doppler is performed the same way as capturing and analyzing images with PW Doppler.

PW Doppler Mode image acquisition

To acquire an image in PW Doppler Mode

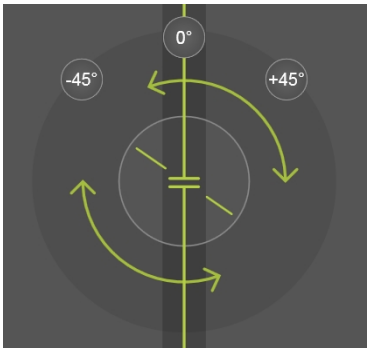
1 Tap **PW Doppler**.

The wireframe sample volume line appears.



2 Perform the following actions, as needed:

- While observing the B-Mode scout window, drag the green wireframe as close as possible to your region of interest.
- Adjust the gate size by pinching or using the **Gate Size** button.
- Correct the angle. Tap the double-headed arrows on the sample gate, and then perform one of the following:
    a. tap the **+45°**, **0°**, or **-45°** button.
    b. drag the round handle circularly to correct the angle.



Note: See "PW Doppler Mode controls" on page 469.

- Tap the **Beam Steering** control to steer the Control-Beam angle if your target vessel is at or near perpendicular to the transducer face.

3 Display the spectral trace by tapping the PW Doppler Mode **Start** button.

4 Adjust the sweep speed by tapping **Sweep Speed** and then adjusting the slider or tapping a sweep speed option—**Fast**, **Medium**, or **Slow**.

5 Adjust the PW Doppler controls as needed. See "PW Doppler Mode controls" on page 469.

6 Save the image for later review using **Save Clip** or **Save Frame**. See "Saving images" on page 690.

Note: Tapping **Save Frame** in PW Doppler or PW Tissue Doppler will save a clip, not a frame.

7 Tap the **Stop** button to return to the single B-Mode scout window or tap **Freeze**, to stop scanning.

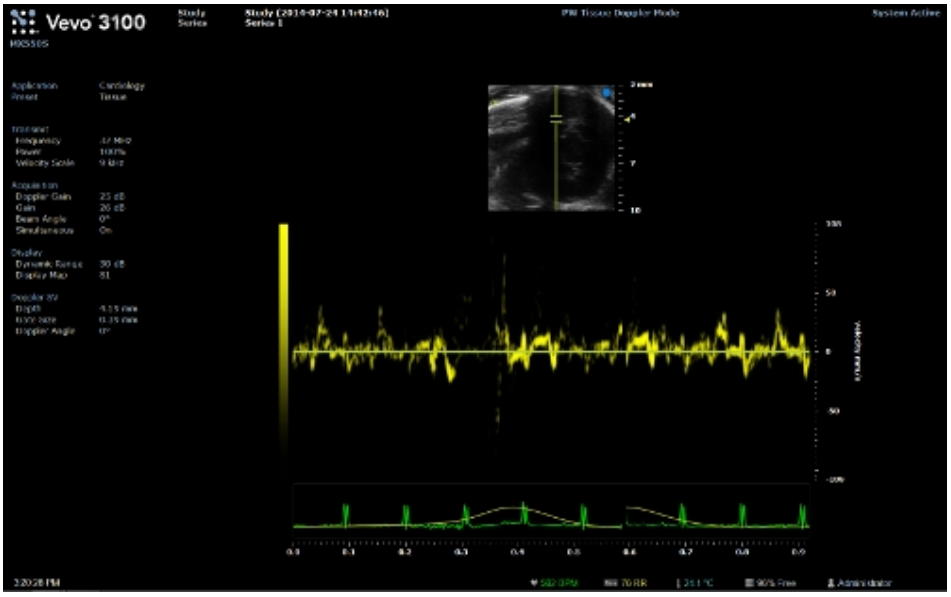
PW Tissue Doppler Mode image acquisition

You acquire PW Tissue Doppler Mode images exactly the same way as you would acquire PW Doppler Mode images. The only difference is that the data is processed in a slightly different way.

In PW Tissue Doppler, the system filters out signals from blood flow so it can more accurately display signals that define slower moving myocardial tissue.

Except where noted, all controls and parameters that apply to PW Doppler also apply to PW Tissue Doppler.

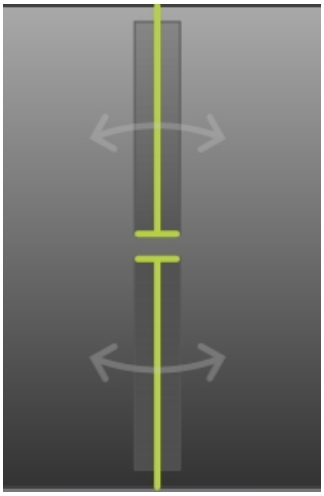
PW Tissue Doppler image display



To acquire an image in PW Tissue Doppler Mode

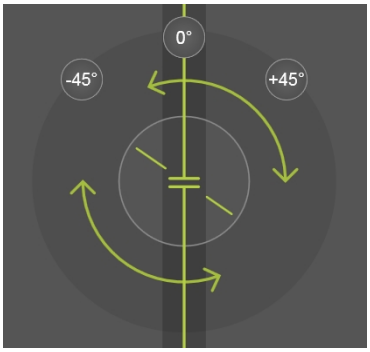
1 Tap **Tissue Doppler**.

The wireframe sample volume line appears.



2 Do any of the following as needed:

- While observing the B-Mode scout window, drag the green wireframe as close as possible to your region of interest.
- Adjust the gate size by pinching or using the **Gate Size** button.
- Correct the angle. Tap the double-headed arrows on the sample gate, and then perform one of the following:
    a. tap the **+45°**, **0°**, or **-45°** button.
    b. drag the round handle circularly to correct the angle.



Note: See "PW Doppler Mode controls" on page 469.

- Tap the **Beam Steering** control to steer the Control-Beam angle if your target vessel is at or near perpendicular to the transducer face.

3 Display the spectral trace by tapping the PW Doppler Mode **Start** button.

4 Adjust the sweep speed by tapping **Sweep Speed** and then adjusting the slider or tapping a sweep speed option—**Fast**, **Medium**, or **Slow**.

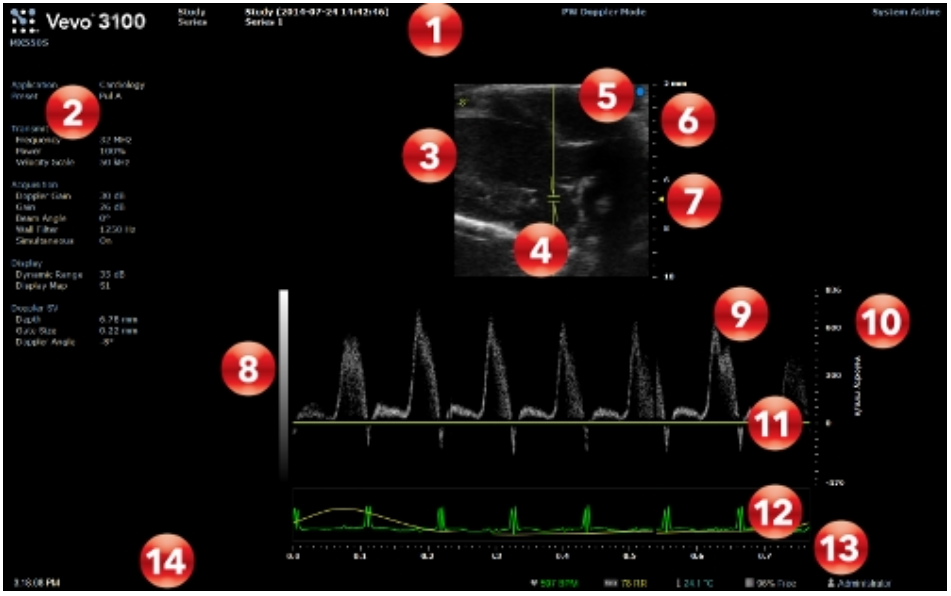
5 Adjust the PW Tissue Doppler controls as needed. See "PW Doppler Mode controls" on page 469.

6 Save the image for later review using **Save Clip**. See "Saving images" on page 690.

7 Tap the PW Tissue Doppler **Stop** flyout button to return to the single B-Mode scout window or tap **Freeze**, to stop scanning.

PW Doppler Mode image display

The PW Doppler Mode image display is similar to the B-Mode image display with some differences.



PW Doppler Mode image display:

1. Image status area
2. Mode settings panel
3. B-Mode scout window
4. Sample gate overlay
5. Transducer orientation indicator
6. Image scale
7. Focal zone indicator

8. Display map
9. PW Doppler data window
10. Doppler scale
11. PW Doppler baseline
12. Physiological data trace
13. Clip time scale
14. Status bar

B-Mode scout window

The region of interest is located between the green overlay brackets. Use this window to position your transducer and set the wireframe brackets so you can acquire the best data.

Blockout zones

The block out zones are areas where the transducer does not retrieve reliable data. Their size and configuration are based on a number of factors. They are marked as blue areas and are an indication to place the sample volume away from these areas.

Sample gate overlay

This region of interest is the image data that the transducer acquires along the vertical line between the brackets of the green wireframe in the B-Mode image. Use the control panel to adjust the sample gate. See "PW Doppler Mode control panel" on page 466.

PW Doppler data window

Displays the sample volume image data that is defined in the B-Mode scout window above. The most current data begins at the right side of the window. The trailing data in the clip acquisition buffer extends to the left.

PW Doppler baseline

The horizontal zero line that divides the spectral display into positive velocities (flow moving toward the transducer) and negative velocities (flow moving away from the transducer).

PW Doppler Mode control panel

When imaging in PW Doppler mode there are a number of controls on the control panel that you can manipulate to optimize your image.

Note: The control panel controls are the same in PW Tissue Doppler as in PW Doppler.

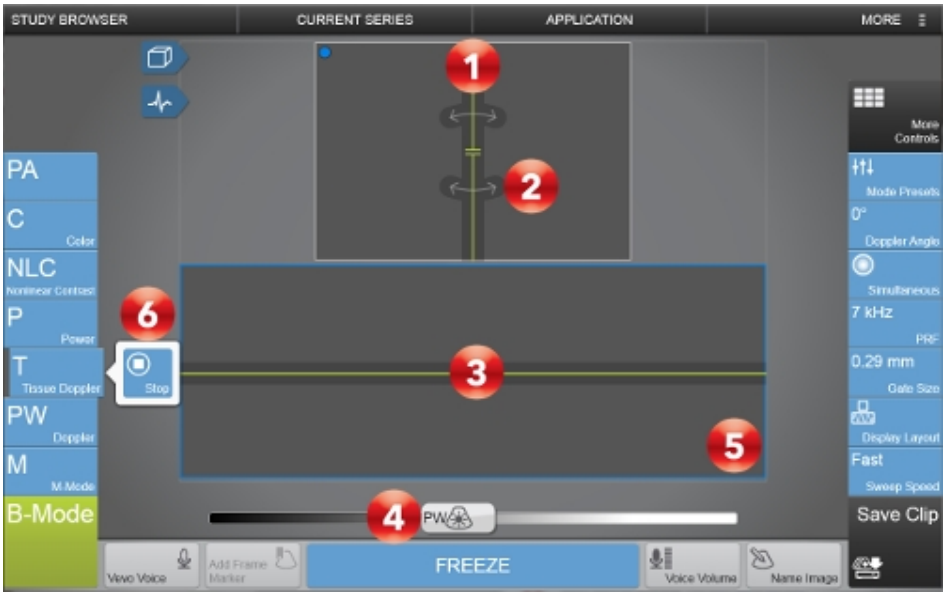


Image controls:

1. Sample gate
2. Beam steering
3. PW Doppler Baseline
4. PW Doppler gain

5. PW Doppler Mode window
6. PW Doppler Mode Start/Stop flyout button

To position and resize the sample gate

In PW Doppler Mode, the region of interest is the image data that the transducer acquires along the vertical line between the brackets of the green wireframe in the B-Mode image. This line is called the sample gate.

1 Begin acquiring data in PW Doppler Mode. See "PW Doppler Mode image acquisition" on page 455.

2 Position the sample gate by dragging it left, right, up or down on the control panel.

3 Resize the gate by doing one of the following:

a. Pinch the gate.

b. Use the **Gate Size** button.

4 You can steer the beam angle:

- Tap **Beam Steering** and select an angle.

To increase the B-Mode image window

You can increase the B-Mode window in order to position your transducer and sample gate more precisely:

You can return to B-Mode at any time by tapping **Stop** to adjust the Image Width, Depth, and Depth Offset, and also increase the size of the B-mode window for placement or sizing of the Sample Gate overlay.

1 Tap the PW Doppler Mode **Stop** flyout button to display the full B-Mode window.

2 Adjust the B-Mode image size. See "B-Mode control panel" on page 416.

To change the sweep speed of the PW Doppler Mode data

♦ Change the sweep speed of the PW Doppler Mode data by tapping the **Sweep Speed** button and use the slider or tap to select either the **Fast**, **Medium**, or **Slow** flyout buttons. See "PW Doppler Mode controls" on the facing page.

To change the layout of the screen

The configuration of image data on the screen can be customized to change the relative size of the B-Mode scout window to the PW Doppler Mode data window. You can also choose to display the PW Doppler Mode data window without any B-Mode scout.

♦ Tap the **Display Layout** button to customize this layout. See "PW Doppler Mode controls" on the facing page.

PW Doppler Mode controls

In PW Doppler Mode, you can adjust the following controls in addition to most of the B-Mode controls.

If the listed control is not on the Controls bar, it will be in More Controls. You can customize which controls appear in the Controls bar, see "Customizing controls" on page 388.

Some controls appear only when the image is live or when the image is in review and some controls appear in both cases.

Note: Except where indicated, all PW Doppler controls also apply to PW Tissue Doppler.

Some controls are related to generic measurements for this mode. See "PW Doppler Mode generic measurements" on page 486 for details.

Accessing B-Mode controls

While imaging in another mode, certain B-Mode controls remain available.

The B-Mode controls can be accessed in three ways:

a. Tapping on the B-Mode image (the active overlay will become gray).

b. Tap **More Controls** and then tap on the B-Mode tab.

c. Tap on the handle of the PA-Mode box to switch.

PW Doppler Mode controls

Control	Live	Review
Annotation		✓
Auto Trace	✓	✓
Baseline	✓	✓
Beam Steering	✓	
Brightness		✓
Clip Settings	✓	✓
Contrast		✓
Display Layout	✓	✓
Display Map	✓	✓
Doppler Angle	✓	✓
Dynamic Range	✓	
Gate Size	✓	

PW Doppler Mode controls

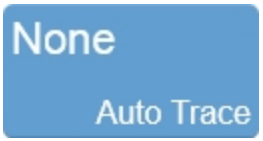
Control	Live	Review
Invert	✓	✓
Left/Right	✓	✓
Magnify Scale		✓
Measurements		✓
Mode Presets	✓	
PRF	✓	
RF	✓	✓
Save Mode Preset	✓	✓
Scale Unit	✓	✓
Show Values and Labels		✓
Simultaneous	✓	
Sweep Speed	✓	✓

PW Doppler Mode controls

Control	Live	Review
Transmit Power	✓	
Up/Down	✓	✓
Volume	✓	✓
Wall Filter*	✓	

**Not available in PW Tissue Doppler*

Tap **Annotation** to add annotations to your acquired or stored image. Select the desired text from the annotation page or enter custom text. See "Annotations" on page 265.

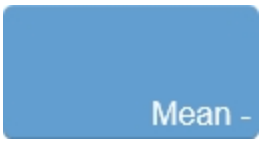


You can set the system to apply a range of peak and mean frequency traces to your PW Doppler spectral data. You can apply these traces in real-time while scanning or to an acquired clip.

Select the appropriate auto trace option from the Peak or Mean frequency options. The options in the flyout are on/off toggle controls. You can select one or more options.

Use the sensitivity slider on the left side of the flyout to adjust the VTI threshold for a trace.

Option	Description
Peak	
	Applies a purple trace to all positive peak frequency signal traces (flow moving toward the transducer face) along the entire clip.
	Applies a pink trace to all negative peak frequency signal traces along the entire clip.
	Applies a green trace to the largest velocity values, positive and negative, along the entire clip.
Mean	

Option	Description
	Applies a blue trace to all positive mean frequency signal traces (flow moving toward the transducer face) along the entire clip.
	Applies a magenta trace to all negative mean frequency signal traces along the entire clip.

Adjusts the vertical position of the horizontal zero frequency line (the baseline) that divides the image data coming toward the transducer face from the image data moving away from the transducer face.

Tap the **Baseline** button and use the **Up** and **Down** buttons to select the required value. The baseline adjusts in increments of 10% during acquisition and 5% during review.

You can also adjust the baseline in 1% increments by tapping and dragging the baseline on the control panel (in both acquisition and review).

Use this control to generate flow direction information when the orientation of the target vessel is perpendicular or almost perpendicular to the ultrasound beam.

This control applies a graduated series of transmission and reception delays to the ultrasound sound signals of each element in the transducer. These carefully calibrated sequences can effectively steer the ultrasound beam in order to detect very small frequency shifts.

You can steer the beam angle to **-15°**, **0°**, or **+15°**, depending on the orientation of your transducer.

In both PW Doppler Mode and PW Tissue Doppler Mode, the current beam angle shown is the angle between the ultrasound beam and the direction of the flow.

Indicates the image brightness level. Tap the **Brightness** control and adjust the slider up or down to obtain the required setting. The setting is displayed on the button for easy reference and is stored with the image.

Tap the **Clip Settings** button to open the Clip Settings panel. You can set various options for saving a clip, including the clip length for each mode. See "Saving images" on page 690.

Indicates the image contrast level. Tap **Contrast** and then adjust the slider up or down to obtain the required setting. The setting is displayed on the button for easy reference and is stored with the image.

Use this control to change the size of the B-Mode scout window relative to the other imaging data window or trace.

Tap **Display Layout** and then tap to select one of the available options—**No Scout Full Trace**, **1/3 Scout 2/3 Trace**, **1/2 Scout 1/2 Trace**, **2/3 Scout 1/3 Trace**.

Allows a choice of predefined sets of overlays and image maps that you can apply any time during live scanning or review. Tap the Display Map control to see the available maps for the active imaging mode.

Adjusts the angle correction in 1-degree increments (-80° to 80°) between the vertical line of the ultrasound pulse (from the face of the transducer) and the direction of vascular flow in the sample volume.

The green line indicates the direction of flow.

You can also adjust the angle by tapping the double-headed arrows on the control panel within the B-Mode scout image and dragging to change the angle.

When the system receives the return signal, it applies an algorithm to the signal data to correct for the delta. This produces usable PW Doppler Mode data.

This control adjusts the input signal strength that is mapped to the spectral display.

To set the Dynamic Range, tap the control to show the flyout. Adjust the slider to adjust in 1 dB increments or tap the **Up** and **Down** buttons to increase and decrease by 5 dB increments. Tap **Default** to return to the system default setting for the current transducer.

The range allowed is dependent on transducer type.

The setting is displayed on the control for easy reference and the value is stored with the image.

In PW Doppler Mode and PW Tissue Doppler Mode the dynamic range applies to the spectral display in the lower window. It does not apply to the B-Mode scout window.

This control adjusts the size of the sample gate in millimeters (mm). The control adjusts the distance of the vertical line between the two calipers.

Tap the **Gate Size** button, then tap the **Up** button to increase the size or tap the **Down** button to decrease the size.

Note: You can also tap and drag either gate handle directly on the B-Mode scout to adjust the gate size, position and angle or use a two finger pinch or spread gesture on the gate to decrease or increase the length of the gate.

Switches the displayed direction of the flow, helping to reduce the need of repositioning the transducer. Tap the button to invert the spectral display in the lower window—it does not apply to the B-Mode scout window.

Changing the invert state will automatically save the image.

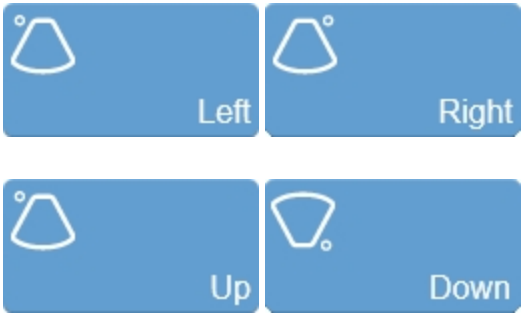
Use this control to change the magnification level of the area that is shown when a measurement or annotation is being placed.

Tap the **Magnify Scale** button and then tap the **Increase** or **Decrease** flyout buttons to select a magnification level between 2x and 8x.

Tap **Mode Presets** to see the available presets and then select an appropriate set of optimized image acquisition settings. This button is active during image acquisition in every mode other than EKV Mode, 3D Mode and 4D-Mode.

The list of presets includes the factory default presets as well as any custom presets you have added to the system. All custom presets are mode, application, transducer, and user dependent where all default presets are only mode, application and transducer dependent.

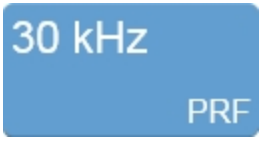
You can customize the preset values to your specific application. See "Applications and Presets" on page 135.



Sets the image orientation, allowing you to align the image with the transducer. The blue dot in the corner of the control panel and image display corresponds to this setting.

Tap either of the orientation controls to toggle the orientation between the following options: **Left**, **Right**, **Up**, and **Down**.

Change the orientation in PW Doppler Mode and PW Tissue Doppler mode by also tapping inside the B-Mode scout window. Tapping either **Up** or **Down** will not flip the PW Doppler data window or Doppler scale.



Use this control to adjust the Pulse Repetition Frequency (PRF). Higher values apply to faster flow and low values apply to slow flow.

To select the required value, tap the **PRF** control and use the slider for finer adjustments, or tap the **Up**/**Down** buttons.

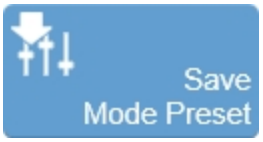
Use the **Scale Unit** control to set the PW Doppler Mode Scale (Y axis) to display either velocity or frequency.

In PW Doppler Mode, this control is also used to adjust the range of the scale of the Y axis on the spectral data window by adjusting the PRF of the ultrasound signal. Use this control when the spectral waveform is either too compressed or too expanded for your purposes.

RF button in live imaging

RF button in review

The RF button is used to toggle the data collection and display of RF Mode. During live imaging, you can turn both the data collection, and the display, on and off. In review, the RF Display button will only be enabled for images that were captured with RF data. See "RF Mode " on page 683.



The Save Mode Preset button is used to save the mode specific parameters being used in the current mode. This allows you to apply these exact parameters again later using the Mode Presets button.

1 Begin scanning in the desired mode.

2 Adjust the controls to optimize your image.

3 Tap **Save Mode Preset** to save the current settings as a preset.

4 Enter the name of your preset in the displayed field and tap **Done** to save the setting.

The new preset appears in the mode-specific flyout when you use the Mode Presets control.

Create your B-Mode presets first. B-Mode includes the largest number of controls that can be saved. Many other modes are based on B-Mode, including Color Doppler Mode, Nonlinear Contrast Mode and PA-Mode.

These modes include fewer available settings. If your study protocol requires any of these B-Mode based modes you will still be able to use your B-Mode presets.

Create your B-Mode presets first and then add the PW Doppler Mode specific settings.

Use this control to select the units in which to indicate the velocity of blood flow. Tap **Scale Unit**, then tap to select either **Velocity** or **Frequency**.

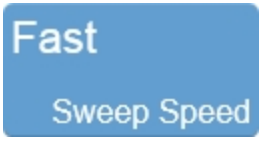
Use this control to show or hide measurement values and labels on an image in review.

This toggle control sets the system to acquire live data simultaneously in both the B-Mode scout window as well as in the PW Doppler Mode image window.

In the dual window view, use this feature when you want to adjust your sample volume in the B-Mode scout window while you view the waveform data in the PW Doppler Mode window.

1 Tap **Simultaneous** to activate the simultaneous state.

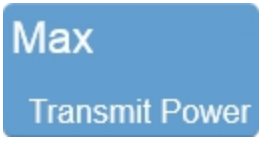
2 Tap **Simultaneous** again to freeze the scout window and return to PW Doppler image data only.



Adjusts the scale of the data in the spectral data window. A faster sweep speed will increase the speed and compress the clip image.

In cardiac applications you might want to decrease the sweep speed so you can view more wall movements over more cardiac cycles in the window, or increase the speed so you can view more wall detail over one cycle.

To set the sweep speed, tap **Sweep Speed** and adjust the slider or tap to select one of the available options—**Fast**, **Medium**, or **Slow**.



Adjusts the power of the ultrasound signal transmission.

To adjust the Transmit Power, tap the **Transmit Power** button, then tap the desired power level—**Max**, **High**, **Med**, **Low** or **Min**.

Adjusts the PW Doppler Mode audio volume.

Tap **Volume** and then tap **Up**/**Down** to increase/decrease the volume.

Filters out signals that correspond to low velocity axial motion that appear as a horizontal black band along either side of the white baseline. Typically these include vessel wall movements, cardiac wall movements and tissue movements caused by respiration.

Increase the filter to reduce the lower velocity signals and bring the waveform of the spectral data closer to the baseline. Reduce the filter to display more low velocity signals.

Tap the **Wall Filter** button and use the **Up** and **Down** buttons to cycle through the available options—Min, Low, Med, High or Max.

Note: The **Wall Filter** control does not apply to PW Tissue Doppler.

PW Doppler Mode generic measurements

PW Doppler and PW Tissue Doppler modes provide several generic measurement tools. Use these tools when you want to add measurements to an image.

To access the generic measurements for PW Doppler Mode

1 Do one of the following:

   a. If you are acquiring image data tap **Freeze**, **Measurements** and then select a measurement.

   b. If you are in the Study Browser open an image, tap **Freeze**, and then tap **Measurements** and select a measurement.

2 Placing a measurement will automatically save the image.

The following generic measurements are available for PW Doppler images:

- Acceleration
- Point
- Heart Rate
- Time
- Velocity

- VTI

> **Note:** The VTI measurement can be done with or without Auto Trace. See "Auto Trace" on page 290.

Color and Power Doppler Mode

Color Doppler uses the principles of PW Doppler Mode to produce an image of a blood vessel. In addition, the system converts the doppler sounds into colors that are overlaid on the image of the blood vessel to represent the relative velocity and direction of blood flow through the vessel.

This mode is useful for blood flow applications such as:

- Distinguishing non-vascular tissue structures from vascular tissue structures.
- Identifying vascular structures that can be more difficult to identify in other ultrasound modes.

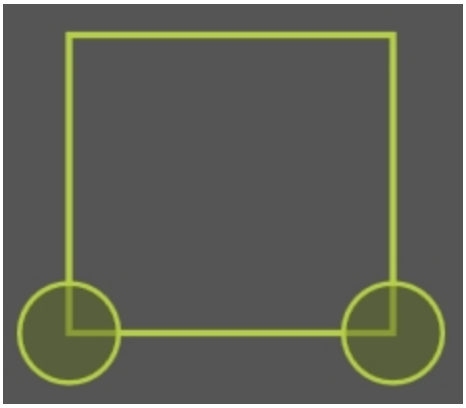
Power Doppler mode operates similar to Color Doppler mode. See "Power Doppler Mode image acquisition" on page 490. Except where noted, capturing and analyzing images with Power Doppler is performed the same way as capturing and analyzing images with Color Doppler.

Color Doppler Mode image acquisition

To acquire an image in Color Doppler Mode

1 Tap **Color**.

The Color Doppler Mode box is displayed on the control panel and as an overlay on the image display.



2 Position the Color Doppler Mode box as needed by dragging the it left, right, up or down on the control panel.

3 Resize the Color Doppler Mode box by dragging one of the handles located on the left and right bottom corners  .

4 Steer the Color Doppler Mode box if needed, by tapping **Beam Steering** and selecting an angle.

5 Adjust the Color Doppler gain using the gain slider.

6 Adjust other controls as needed. See "Color Doppler Mode controls" on page 498 and also "B-Mode controls" on page 420.

7 Save the image for later review using **Save Clip**. See "Saving images" on page 690.

8 Tap the **Color** button to return to B-Mode scanning or tap **Freeze** to stop scanning.

Power Doppler Mode image acquisition

Power Doppler Mode provides tools to visualize and measure flow dynamics. This imaging mode displays the intensity of the returning Doppler signal and assigns a color range to the energy generated by moving blood flow.

This is useful for applications such as detecting vascularity in and around orthotopic and subcutaneous tumors and producing a measure of relative quantification.

The Power Doppler image display is the same as Color Doppler Mode, see "Color Doppler Mode image display" on page 493.

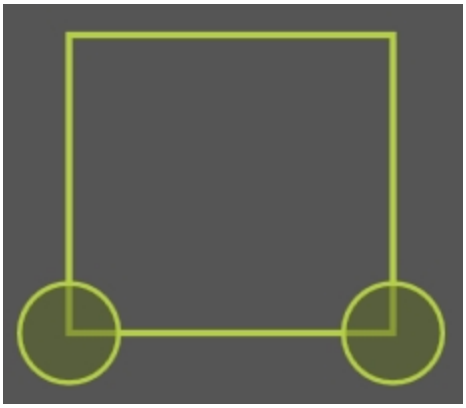
The Power Doppler controls are similar to Color Doppler Mode, see "Color Doppler Mode controls" on page 498.

Power Doppler image display

To acquire an image in Power Doppler mode

1 Tap **Power**.

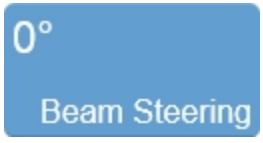
The Power Doppler Mode box is displayed on the control panel and as an overlay on the image display.



2 Position the Power Doppler Mode box as needed by dragging the box left, right, up or down on the control panel.

3 Resize the Power Doppler Mode box by dragging one of the corner handles located on the left and right bottom corners  .

4 Steer the Power Doppler box if needed, by tapping **Beam Steering** and selecting an angle.



5 Adjust the Power Doppler gain using the gain slider.

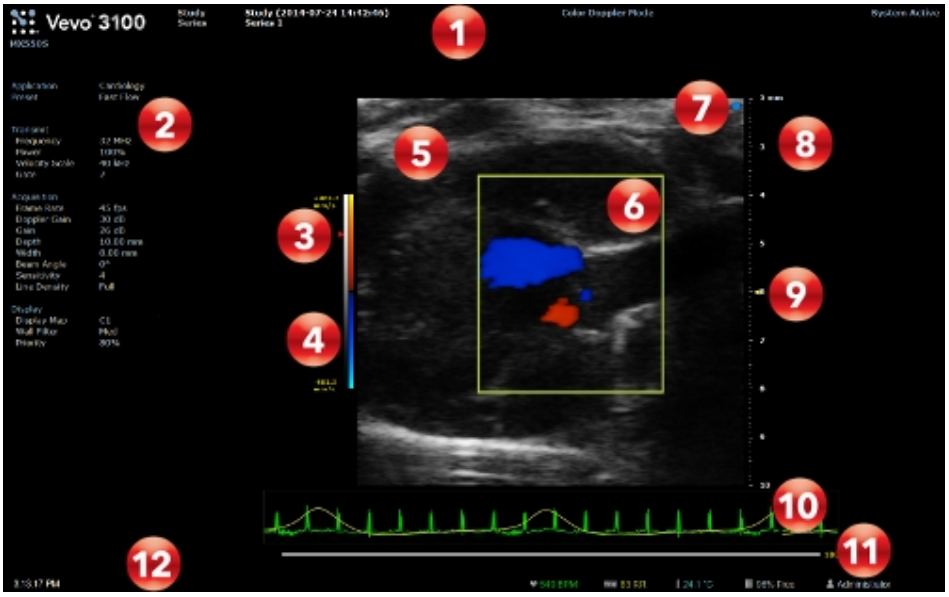
6 Adjust other controls as needed. See "Color Doppler Mode controls" on page 498 and also "B-Mode controls" on page 420.

7 Save the image for later review using **Save Clip**. See "Saving images" on page 690.

8 Tap the **Power** button to return to B-Mode scanning or tap **Freeze** to stop scanning.

Color Doppler Mode image display

The Color Doppler Mode image display is similar the B-Mode image display with some differences.



Color Mode image display:

1. Image status area
2. Mode settings panel
3. Priority indicator

4. Color display map and velocity scale
5. Image area
6. Color Doppler Mode box
7. Transducer orientation indicator
8. Image scale
9. Focal zone indicator
10. Physiological data trace
11. Clip buffer
12. Status bar

Color Doppler Mode box

In Color Doppler Mode, the region of interest is located within the Color Doppler Mode box. Data are displayed as follows:

- Vascular flow moving away from the transducer is displayed in blue colors.
- Vascular flow moving toward the transducer is displayed in red colors.

The system applies the Color Doppler Mode-based colors only to the image data within the Color Doppler Mode box. In Power Doppler Mode, the system applies the Power Doppler Mode-based colors only to the image data within the Power Doppler Mode box.

Color display map and velocity scale

Two display maps are shown to the left of the image while in Color Doppler Mode; the left column is the B-Mode display map and the right column is the color display map.

The color display map follows the acronym BART color principle for doppler imaging (blue=away from the transducer, red=toward the transducer). In this principle, positive vascular flows are indicated by colors in the red range, while negative flows are indicated by colors in the blue range. Flow velocities for each direction increase from dark to light.

In Color Doppler Mode, a velocity scale corresponding to the display map is shown to the left of the display maps. These velocities are not shown for Power Doppler Mode.

When imaging in Power Doppler Mode, the right column is the power display map. The darker colors indicate lower intensity signals.

Priority indicator

This control adjusts the priority relationship between the overlay data and the background B-Mode data so you can eliminate false readings. Tap the **Priority** control and adjust accordingly using the slider, **Up**/**Down** buttons or default button.

Color Doppler Mode control panel

When imaging in Color Doppler Mode there are a number of controls on the control panel that you can manipulate to optimize your image.

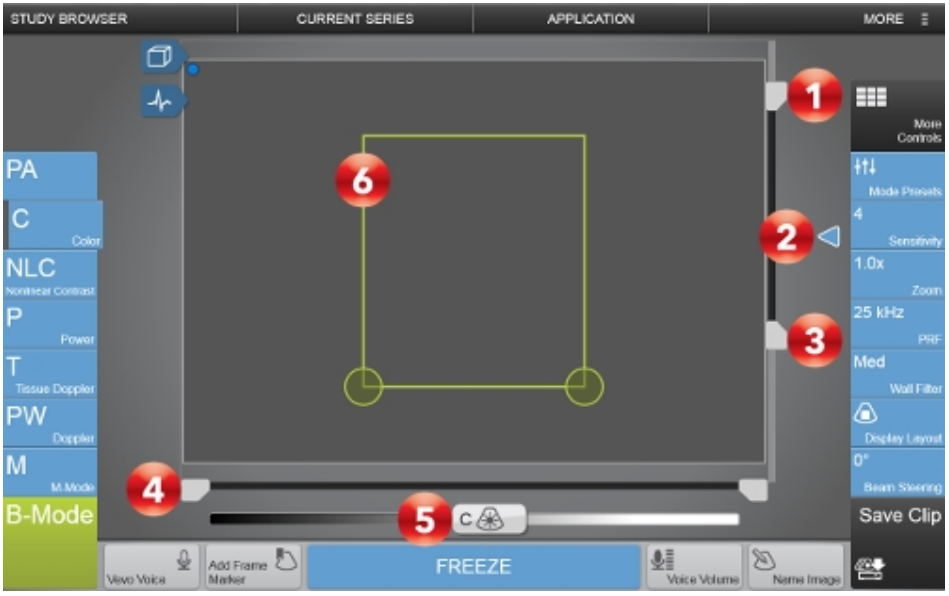


Image controls:

1. Image depth offset
2. Focal depth
3. Image depth
4. Image width
5. Color Doppler Mode gain
6. Color Doppler Mode box

To position and resize the Color Doppler Mode box

In Color Doppler Mode, the region of interest is located within the Color Doppler Mode box. The system applies the Color Doppler Mode based colors only to the image data within the Color Doppler Mode box.

1 Begin acquiring data in Color Doppler Mode. See "Color Doppler Mode image acquisition" on page 488.

2 Position the Color Doppler Mode box by dragging the it left, right, up or down on the control panel.

3 Resize the Color Doppler Mode box by dragging one of the handles located on the bottom left and right corners  .

4 Steer the Color Doppler box if needed, by tapping **Beam Steering** and selecting an angle.

After you change the angle or position of the Color Doppler Mode box, the system pauses briefly to apply the new settings and then starts acquisition.

To set the Color Doppler Mode gain

The Color Doppler Mode gain is the frequency shift in increments of 1.0 dB. When you are in Color Doppler Mode the gain control on the control panel adjusts the doppler gain. Color Doppler Mode gain is indicated with a 'C' on the Gain control.

Slide the gain control left or right to adjust the visual intensity of the signal that returns to the face of the transducer. Slide right to add gain and brighten the mode data, slide left to reduce gain and darken the mode data.

You can switch to adjust the B-Mode gain by tapping on the B-Mode image. The Color Doppler Mode box will become gray and the gain control bar will switch to B-Mode gain.

Color Doppler Mode controls

In Color Doppler Mode imaging, you can adjust the following controls in addition to most of the B-Mode controls.

If the listed control is not on the Controls bar, it will be in More Controls. You can customize which controls appear in the Controls bar, see "Customizing controls" on page 388.

Some controls appear only when the image is live or when the image is in review and some controls appear in both cases.

Note: Except where indicated, all Color Doppler controls also apply to Power Doppler Mode.

Accessing B-Mode controls

While imaging in another mode, certain B-Mode controls remain available.

The B-Mode controls can be accessed in three ways:

a. Tapping on the B-Mode image (the active overlay will become gray).

b. Tap **More Controls** and then tap on the B-Mode tab.

c. Tap on the handle of the PA-Mode box to switch.

Color Doppler Mode controls

Control	Live	Review
Annotation		✓
Beam Steering	✓	
Brightness		✓
Clip Settings	✓	✓
Clip Sub-range		✓
Display Layout	✓	✓
Display Map	✓	✓
Dynamic Range*	✓	✓
Gate	✓	

Color Doppler Mode controls

Control	Live	Review
Left/Right	✓	✓
Line Density	✓	
Load into 3D		✓
Magnify Scale		✓
Measurements		✓
Mode Presets	✓	
Persistence	✓	
PRF	✓	
Priority	✓	✓
RF	✓	✓
Save Mode Preset	✓	✓
Sensitivity	✓	

Color Doppler Mode controls

Control	Live	Review
Show Values and Labels		✓
Transmit Power	✓	
Up/Down	✓	✓
Wall Filter	✓	
Zoom	✓	✓

**Only available in Power Doppler*

Tap **Annotation** to add annotations to your acquired or stored image. Select the desired text from the annotation page or enter custom text. See "Annotations" on page 265.

Use this control to generate flow direction information when the orientation of the target vessel is perpendicular or almost perpendicular to the ultrasound beam.

This control applies a graduated series of transmission and reception delays to the ultrasound sound signals of each element in the transducer. These carefully calibrated sequences can effectively steer the ultrasound beam in order to detect very small frequency shifts.

You can steer the beam angle to **-15°**, **0°**, or **+15°**, depending on the orientation of your transducer.

In Color Doppler Mode and Power Doppler Mode, this control changes the Color Doppler Mode box and Power Doppler Mode box angles.

Indicates the image brightness level. Tap the **Brightness** control and adjust the slider up or down to obtain the required setting. The setting is displayed on the button for easy reference and is stored with the image.

In Color Doppler Mode and Power Doppler Mode the Display Layout must be set to either **B-Mode Only** or **Both** to edit Brightness.

Tap the **Clip Settings** button to open the Clip Settings panel. You can set various options for saving a clip, including the clip length for each mode. See "Saving images" on page 690.

Allows an acquired, but unsaved clip to be cropped before saving. Also, for saved and unsaved clips, use this control to limit the playback of a clip to only a portion of the full clip length.

For an unsaved clip, tap **Clip Sub-range** and drag the sliders that appear on the Clip Slider to the desired position. Tap **Crop & Save**. Tap **Cancel** to remove the crop sliders.

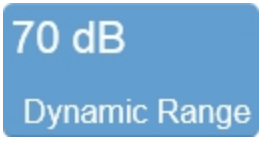
For a saved clip, tap **Clip Sub-range** and drag the sliders that appear on the Clip Slider to the desired position. Tap **Cancel** to remove the crop sliders.

Use this control to change which data are being displayed on the image display. This does not affect the actual data collection and can be changed at any time during live scanning or review.

Tap the button and select one of the available options: **B-Mode Only**, **Both** or **Color Only**.

When the **Both** Display Layout option is selected, you can toggle between the B-Mode and Color Doppler Mode image by tapping the B-Mode image area and the edge of the Color Doppler Mode Box, respectively.

Allows a choice of predefined sets of overlays and image maps that you can apply any time during live scanning or review. Tap the **Display Map** control to see the available maps for the active imaging mode.



This control adjusts the input signal strength that is mapped to the spectral display.

To set the Dynamic Range, tap the control to show the flyout. Adjust the slider to adjust in 1 dB increments or tap the **Up** and **Down** buttons to increase and decrease by 5 dB increments. Tap **Default** to return to the system default setting for the current transducer.

The range allowed is dependent on transducer type.

The setting is displayed on the control for easy reference and the value is stored with the image.

Note: This control is available for Power Doppler Mode only. It does not apply to Color Doppler Mode.

Adjusts the size of the multiple sample volumes that span the depth of the region of interest, indexed in a range from 1 to 6. Set your gate to 1 for the best axial resolution and 6 for the best sensitivity.

Tap **Gate**, then tap **Up/Down** to increase/decrease the gate size.

Use this control to adjust the resolution of your image by adjusting how many lines of image data the transducer acquires over your image area.

The higher you set the line density, the lower the system sets the acquisition frame rate. Because of this trade off, you might find that higher line density is most useful for examining features in tissue that don't move very much such as liver, spleen, pancreas, and prostate.

For cardiology applications, you will typically keep the line density lower so you can increase the frame rate to increase temporal resolution over the time span of a complete cardiac cycle.

Tap the **Line Density** control and choose the desired option. The available options depend on the application you are using.

Used to load a 3D Mode clip into the rendered 3D view. This control is only available in review when the clip was acquired in 3D Mode.

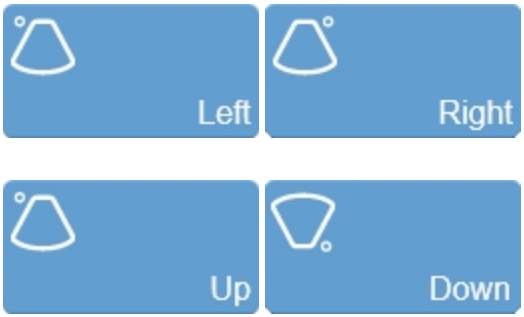
Use this control to change the magnification level of the area that is shown when a measurement or annotation is being placed.

Tap the **Magnify Scale** button and then tap the **Increase** or **Decrease** flyout buttons to select a magnification level between 2x and 8x.

Tap **Mode Presets** to see the available presets and then select an appropriate set of optimized image acquisition settings. This button is active during image acquisition in every mode other than EKV Mode, 3D Mode and 4D-Mode.

The list of presets includes the factory default presets as well as any custom presets you have added to the system. All custom presets are mode, application, transducer, and user dependent where all default presets are only mode, application and transducer dependent.

You can customize the preset values to your specific application. See "Applications and Presets" on page 135.

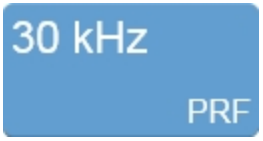


Sets the image orientation, allowing you to align the image with the transducer. The blue dot in the corner of the control panel and image display corresponds to this setting.

Tap either of the orientation controls to toggle the orientation between the following options: **Left**, **Right**, **Up**, and **Down**.

Persistence applies a pixel averaging algorithm to the most recently acquired frames to produce a more uniform view of the faster moving tissue in the image data. Persistence reduces distracting artifacts such as shimmering and motion artifacts. This feature is most useful when you are imaging uniform tissues such as the liver, kidney, or prostate.

Tap the **Persistence** button and use the **Up** and **Down** buttons to cycle through the available options—Off, Low, Med, High or Max.



Use this control to adjust the Pulse Repetition Frequency (PRF). Higher values apply to faster flow and low values apply to slow flow.

To select the required value, tap the **PRF** control and use the slider for finer adjustments, or tap the **Up/Down** buttons.

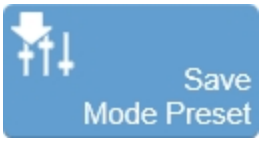
Adjusts the priority relationship between the overlay data and the background B-Mode data so you can eliminate false readings. Priority determines the threshold point on the gray scale above which the system does not apply color data. The red marker along the left side of the display map indicates the threshold point.

Tap the **Priority** button and use the **Up/Down** buttons to select the required value.

RF button in live imaging

RF button in review

The RF button is used to toggle the data collection and display of RF Mode. During live imaging, you can turn both the data collection, and the display, on and off. In review, the RF Display button will only be enabled for images that were captured with RF data. See "RF Mode " on page 683.



The Save Mode Preset button is used to save the mode specific parameters being used in the current mode. This allows you to apply these exact parameters again later using the Mode Presets button.

1 Begin scanning in the desired mode.

2 Adjust the controls to optimize your image.

3 Tap **Save Mode Preset** to save the current settings as a preset.

4 Enter the name of your preset in the displayed field and tap **Done** to save the setting.

The new preset appears in the mode-specific flyout when you use the Mode Presets control.

Create your B-Mode presets first. B-Mode includes the largest number of controls that can be saved. Many other modes are based on B-Mode, including Color Doppler Mode, Nonlinear Contrast Mode and PA-Mode.

These modes include fewer available settings. If your study protocol requires any of these B-Mode based modes you will still be able to use your B-Mode presets.

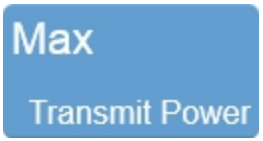
Adjusts the signal-to-noise ratio so that you can better:

- Identify weak-signal targets in the near field that are difficult to distinguish because they are very small
- Identify large targets in the far field that are difficult to distinguish due to attenuation

The higher you set the sensitivity level, the lower the system sets the frame rate.

Tap the Sensitivity button and use the Up and Down buttons to select the required value.

Use this control to show or hide measurement values and labels on an image in review.



Adjusts the power of the ultrasound signal transmission.

To adjust the Transmit Power, tap the **Transmit Power** button, then tap the desired power level—**Max**, **High**, **Med**, **Low** or **Min**.

Filters out signals that correspond to low velocity axial motion that appear as a horizontal black band along either side of the white baseline. Typically these include vessel wall movements, cardiac wall movements and tissue movements caused by respiration.

Increase the filter to reduce the lower velocity signals and bring the waveform of the spectral data closer to the baseline. Reduce the filter to display more low velocity signals.

Tap the **Wall Filter** button and use the **Up** and **Down** buttons to cycle through the available options—Min, Low, Med, High or Max.

Use this control to zoom in on the image during scanning or in review.

Tap the **Zoom** button to activate the adjustable zoom control. Tap the **In** or **Out** button or drag the slider to activate the zoom function. The zoom factor is displayed within a range from 1.0x to 8.0x on the Zoom button.

You can also use a two finger spread gesture within the image area to zoom in; once activated, four arrows will be displayed indicating zoom is on. To zoom out, use a two finger pinch gesture.

To view other areas of the zoomed image, pan the image by dragging one finger in any direction within the image area.

A magnifier icon and location guide is shown in the image area on the image display. The location guide displays the original image area with a white inner area that represents the zoomed area.

You can save an image with the zoom state activated and if you load the image in review, you can zoom again using the same control.

If you wish to return to a 1.0x zoom factor, tap **Default** from the zoom controls.

Please note the following:

- The maximum zoom factor may be less depending on the image size and the minimum physical size of the image that can be displayed.
- If you change presets while in the zoom state, the zoom state will be turned off.
- If your image contains measurements and annotations, the text is not enlarged when zoom is activated.

Important: When acquiring in Color Doppler Mode zoom is limited by the size of the Color Doppler Mode box.

Color Doppler Mode generic measurements

Color and Power Doppler each provide several generic measurement tools. Use these tools when you want to add measurements to an image.

To access the generic measurements for Color Doppler Mode

1 Do one of the following:

   a. If you are acquiring image data tap **Freeze**, **Measurements** and then select a measurement.

   b. If you are in the Study Browser open an image, tap **Freeze**, and then tap **Measurements** and select a measurement.

2 Placing a measurement will automatically save the image.

The following generic measurements are available for both Color Doppler and Power Doppler images:

- Angle
- Area
- Ellipse
- Linear
- Distance

Nonlinear Contrast Mode

Nonlinear Contrast (NLC) Mode is a high-frequency imaging mode that produces improved sensitivity in microbubble detection and quantification. This mode suppresses the tissue signal while increasing the detection of the contrast agents.

During acquisition the system modulates the amplitude of the ultrasound pulses, enabling a nonlinear response to microbubbles.

To acquire images in this mode you must use either the MX201, MX250, or MX250S transducer.

Nonlinear Contrast Mode image analysis

Additional analysis of your Nonlinear Contrast Mode images using Vevo CQ in Vevo LAB. Vevo CQ is a software application designed for quantifying perfusion kinetics in small-animal models by contrast-enhanced ultrasound imaging.

Nonlinear Contrast Mode image acquisition

In order to generate Nonlinear Contrast (NLC) images, you need to use contrast agents. See "Contrast agent technology" on page 519.

To acquire an image in Nonlinear Contrast Mode

If you want to add physiological data to your image, then perform the following steps before you begin acquiring data:

- Set up your system for physiological data acquisition.
- Prepare your animal on the animal platform.

- Set up blood pressure monitoring.

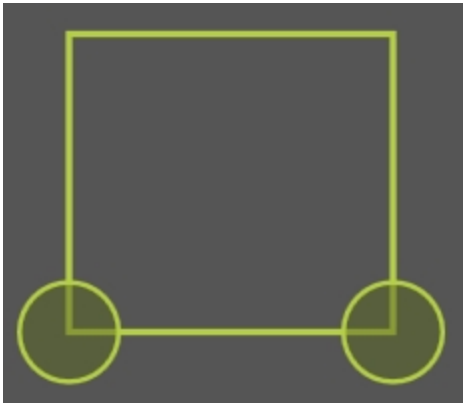
For detailed information, refer to the Vevo Integrated Rail System III Operator Manual.

1 Tap **Nonlinear Contrast**.

The NLC Mode box appears on the image area on the control panel.

The B-Mode image area and the NLC image data window appear side by side on the image display. You can change this layout using the **Display Layout** control.

2 Position the NLC Mode box as needed by dragging it left, right, up or down on the control panel.



3 Resize the NLC Mode box by dragging one of the handles located at the bottom left and right corners  .

4 Adjust your B-Mode image settings in order to optimize the image for the region of interest.

5 Select the appropriate preset for the study.

The presets are sets of optimized values (for tissue type, depth, etc) for a variety of protocols, such as tumor, heart, or kidney. For more information about the use of presets, see "Applications and Presets" on page 135.

6 Optimize your NLC settings, see "Nonlinear Contrast Mode controls" on page 525.

7 Inject the contrast agent according to the imaging protocol required for your experiment.

8 Save the image for later review. See "Saving images" on page 690.

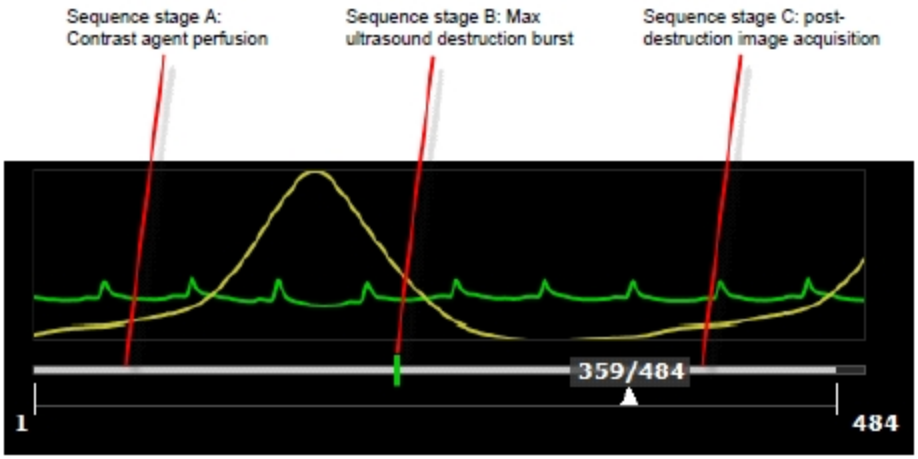
9 Tap the **NLC** button to return to B-Mode scanning or tap **Freeze**, to stop scanning.

Burst

To use the Burst feature

A Burst can be used when scanning with contrast agents to destroy the contrast agent in the region of interest. A manual Burst can be performed at any point using the **Burst** control, or by initiating a preconfigured sequence using the **Burst Sequence** control.

Use the **Burst Settings** to configure the Burst. See "Nonlinear Contrast Mode controls" on page 525.



Refer to the appropriate FUJIFILM VisualSonics technical protocols for details on MicroMarker preparation or animal preparation protocols. This information is not part of this document.

ECG and Respiration Gating

To acquire an image with ECG and Respiration Gating

The system also supports Nonlinear Contrast Mode acquisition using ECG and Respiration Gating. You must have the Vevo Imaging Station connected. For detailed information refer to the Vevo Integrated Rail System III Operator Manual.

1 Tap **NLC**.

2 Set your parameters to optimize the image, see "Nonlinear Contrast Mode controls" on page 525.

3 Open the Physiology panel and set one of the following:

a. Set the ECG trigger. Enable the T2 marker for acquisition at systole or T1 for acquisition at diastole. The position of ECG triggers can be set anywhere in the cardiac cycle; by default, they are set at systole and diastole. See "ECG Trigger" on page 128.

b. Set Respiration Gating. Enable the Respiration Gating and set the position of the window such that the acquisition starts and ends in between two breaths (represented by the peaks). See "Respiration Gating" on page 125.

4 Inject the contrast agent according to the imaging protocol required for your experiment.

5 Save the image for later review. See "Saving images" on page 690.

6 Tap the **NLC** button to return to B-Mode scanning or tap **Freeze**, to stop scanning.

Nonlinear Contrast 3D Mode image acquisition

Nonlinear Contrast 3D Mode adds Nonlinear Contrast data during a 3D Mode scan so you can reconstruct a volume that integrates the Nonlinear Contrast Mode data with the surrounding B-Mode 3D volume.

To acquire a Nonlinear Contrast 3D Mode image

1 Set up for a 3D Mode image acquisition session. See "3D Mode" on page 620.

2 Tap **NLC** to begin imaging. Adjust the settings to obtain the desired image, see "Nonlinear Contrast Mode controls" on page 525.

3 Tap **3D** and complete the 3D motor initialization process and 3D acquisition setup.

4 In the 3D panel, tap **Scan**.

The system acquires image slices across the motor track and combines them into a clip. Unlike a typical clip which contains slices along the same image plane over time, this clip contains a series of individual slices at different locations as the motor moves.

5 Tap **Save Clip** to save the Nonlinear Contrast 3D Mode image data.

6 Inject the contrast agent according to the specified protocol and then tap **3D**.

7 In the Motor Position panel, tap **Burst Scan**.

The system stops acquiring data and runs the destruction level ultrasound burst at each step along the motor track and then returns the motor to the initial position.

8 Tap **3D** to acquire post-destruction image data. Tap **Save Clip** to save the Nonlinear Contrast 3D Mode image data.

9 Tap **Save Clip** to save the Nonlinear Contrast 3D Mode image data.

Contrast agent technology

Nonlinear Contrast Mode imaging requires the use of contrast agents. Contrast agents are gas filled microbubbles that produce a strong echogenic signal when excited with an ultrasound pulse.

FUJIFILM VisualSonics provides a family of contrast agent kits for targeted and nontargeted applications.

Non-targeted contrast agents

Non-targeted contrast agents are injected into the vascular system either as a small bolus or continuous infusion using an infusion pump.

The contrast agents are free flowing in the vascular system for a period of time until they are either destroyed with a high-powered ultrasound sequence or are cleared through the system via the kidney and the liver.

Targeted contrast agents

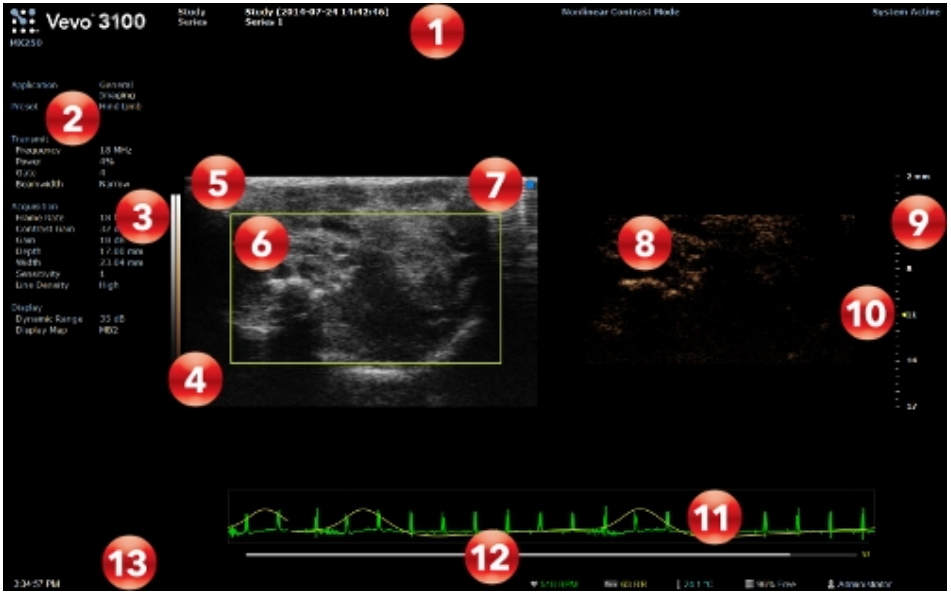
Targeted contrast agents are microbubbles similar to those used in non-targeted applications, but are conjugated with a ligand that will bind to specific molecular markers.

A targeted contrast agent flows freely through the vascular system until it finds the specific receptor. At this time it binds to the molecular marker on the endothelial surface of the vessel and will no longer flow freely.

An ultrasound image of a region with bound contrast agents displays the strong echogenic signal provided by the contrast agent.

Nonlinear Contrast Mode image display

The Nonlinear Contrast Mode image display is similar to the B-Mode image display with some differences.



Nonlinear Contrast Mode image display:

1. Image status area
2. Mode Settings panel
3. B-Mode display map
4. Contrast display map
5. B-Mode image area
6. NLC Mode box
7. Transducer orientation indicator

8. NLC image area
9. Image scale
10. Focal zone indicator
11. Physiological data trace
12. Clip buffer
13. Status bar

B-Mode image area

The region of interest is located within the green overlay. Use this window to position your transducer and set the location of the overlay box so you can acquire the most useful data.

NLC Mode box

In Nonlinear Contrast Mode, the system applies the colors only to the image data within the NLC Mode box.

The default display layout for NLC is to display the contrast data side by side with the B-Mode data. This can be changed using the **Display Layout** control.

Contrast display map

The right column of the two-toned scale is the contrast display map.

The left column of the scale is the display map for the B-Mode image.

Nonlinear Contrast Mode control panel

When imaging in Nonlinear Contrast mode there are a number of controls on the control panel that you can manipulate to optimize your image.

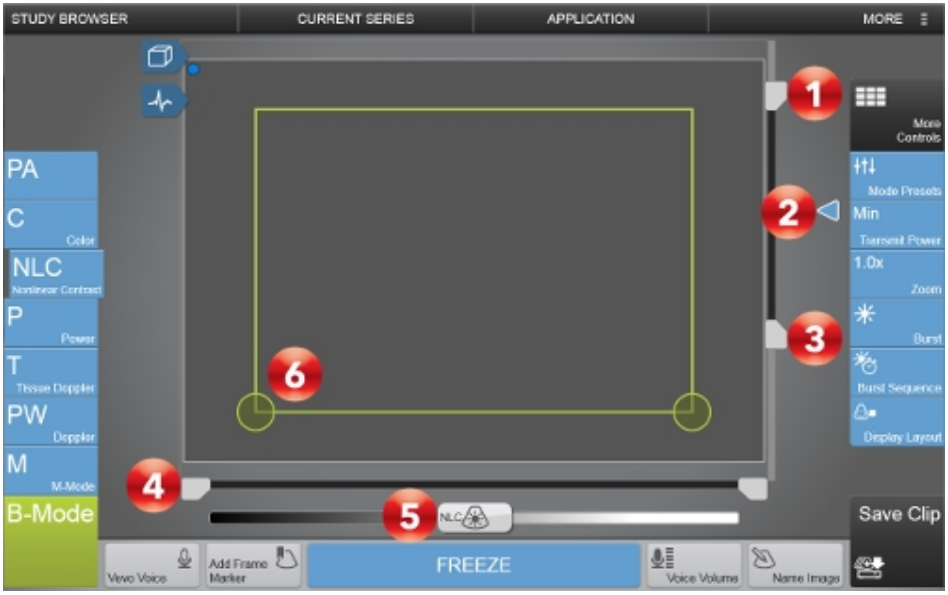


Image controls:

1. Image depth offset
2. Focal depth
3. Image depth
4. Image width
5. NLC gain
6. NLC Mode box

To position and resize the NLC Mode box

1 Begin acquiring data in Nonlinear Contrast mode. See "Nonlinear Contrast Mode image acquisition" on page 514.

2 Position the NLC Mode box by dragging the box left, right, up or down on the control panel.

3 Resize the NLC Mode box by dragging one of the handles on the bottom left and right corners  .

4 Adjust your B-Mode image settings in order to optimize the image for the region of interest. See "B-Mode controls" on page 420.

5 Optimize your NLC settings, see "Nonlinear Contrast Mode controls" on the facing page.

After you change the position or size of the overlay, the system pauses briefly to apply the new settings and then starts acquisition.

To set the Nonlinear Contrast gain

The contrast gain is the strength of the ultrasound signal in dB when it returns to the face of the transducer. Nonlinear contrast gain is indicated with a NLC on the gain control.

Slide the Gain control left or right to adjust the visual intensity of the signal when it returns to the face of the transducer. Slide right to add gain and brighten the mode data, slide left to reduce gain and darken the mode data.

You can switch to the B-Mode gain by tapping on the B-Mode image. The NLC Mode box will become gray and the gain control bar will switch to B-Mode gain.

Nonlinear Contrast Mode controls

In Nonlinear Contrast imaging, you can adjust the following controls in addition to most of the B-Mode controls.

If the listed control is not on the Controls bar, it will be in More Controls. You can customize which controls appear in the Controls bar, see "Customizing controls" on page 388.

Some controls appear only when the image is live or when the image is in review and some controls appear in both cases.

Some controls are related to generic measurements for this mode. See "Nonlinear Contrast Mode generic measurements" on page 539 for details.

Accessing B-Mode controls

While imaging in another mode, certain B-Mode controls remain available.

The B-Mode controls can be accessed in three ways:

a. Tapping on the B-Mode image (the active overlay will become gray).

b. Tap **More Controls** and then tap on the B-Mode tab.

c. Tap on the handle of the PA-Mode box to switch.

Nonlinear Contrast Mode controls

Control	Live	Review
Annotation		✓
Beamwidth	✓	
Brightness		✓
Burst	✓	
Burst Sequence	✓	
Burst Settings	✓	✓
Clip Settings	✓	✓
Clip Sub-range		✓
Display Layout	✓	✓
Display Map	✓	✓
Dynamic Range	✓	✓
Frame Rate	✓	

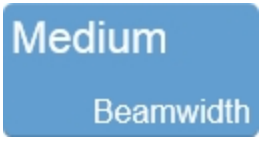
Nonlinear Contrast Mode controls

Control	Live	Review
Gate	✓	
Left/Right	✓	✓
Load into 3D		✓
Magnify Scale		✓
Measurements		✓
MIP		✓
Mode Presets	✓	
Persistence	✓	
Priority	✓	✓
RF	✓	✓
Save Mode Preset	✓	✓
Show Values and Labels		✓

Nonlinear Contrast Mode controls

Control	Live	Review
Transmit Power	✓	
Up/Down	✓	✓
Zoom	✓	✓

Tap **Annotation** to add annotations to your acquired or stored image. Select the desired text from the annotation page or enter custom text. See "Annotations" on page 265.



Changing the beamwidth can be used to suppress signal from tissue. A wider beamwidth will suppress more signal, while a more narrow beamwidth will show more signal from tissue. Select from **Narrow**, **Medium** or **Wide**.

Indicates the image brightness level. Tap the **Brightness** control and adjust the slider up or down to obtain the required setting. The setting is displayed on the button for easy reference and is stored with the image.

In Nonlinear Contrast Mode, the Display Layout must be set to either **B-Mode Only**, **Both** or **Side by Side** to edit Brightness.

Transmits an ultrasound pulse at maximum transmit power. This destroys the contrast agent in the region of interest. In the clip the system displays a green bar to mark the burst event.

This control starts a sequence of configurable events. When you tap the control, the system stores image data according to the Clip Settings and the Burst Settings.

The destruction burst event occurs automatically as a predefined percentage point of the entire clip length and for a predefined period in tenths of seconds between 0.1 and 1.0 seconds (defaults to 0.5 seconds).

Configures the burst settings for a Burst and Burst Sequence event.

Set the Burst duration for a predefined period in tenths of seconds between 0.1 and 1.0 seconds (defaults to 0.5)

Set the Burst sequence position at a specified location within the clip, defined as a percentage of the clip length as set in Clip Settings.

Tap the **Clip Settings** button to open the Clip Settings panel. You can set various options for saving a clip, including the clip length for each mode. See "Saving images" on page 690.

Allows an acquired, but unsaved clip to be cropped before saving. Also, for saved and unsaved clips, use this control to limit the playback of a clip to only a portion of the full clip length.

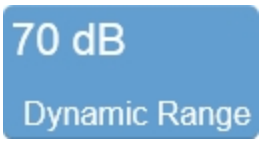
For an unsaved clip, tap **Clip Sub-range** and drag the sliders that appear on the Clip Slider to the desired position. Tap **Crop & Save**. Tap **Cancel** to remove the crop sliders.

For a saved clip, tap **Clip Sub-range** and drag the sliders that appear on the Clip Slider to the desired position. Tap **Cancel** to remove the crop sliders.

Use this control to change which data are being on the image display. This does not affect the actual data collection and can be changed at any time during live scanning or review.

Tap the button and select of the available options: **B-Mode Only**, **Both**, **Contrast Only**, or **Side by Side**.

Allows a choice of predefined sets of overlays and image maps that you can apply any time during live scanning or review. Tap the **Display Map** control to see the available maps for the active imaging mode.



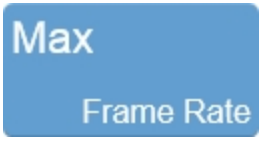
This control adjusts the input signal strength that is mapped to the spectral display.

To set the Dynamic Range, tap the control to show the flyout. Adjust the slider to adjust in 1 dB increments or tap the **Up** and **Down** buttons to increase and

decrease by 5 dB increments. Tap **Default** to return to the system default setting for the current transducer.

The range allowed is dependent on transducer type.

The setting is displayed on the control for easy reference and the value is stored with the image.



This control allows you to adjust the number of image frames per second that the system is acquiring. Lowering the frame rate allows you to capture a clip for a longer period of time.

Note: The frame rate shown on the button indicates the maximum value. Depending on other acquisition settings the system may not be able to achieve the exact frame rate selected, but will get as close as possible without exceeding the selected value.

Adjusts the size of the multiple sample volumes that span the depth of the region of interest, indexed in a range from 1 to 6. Set your gate to 1 for the best axial resolution and 6 for the best sensitivity.

Tap **Gate**, then tap **Up/Down** to increase/decrease the gate size.

Used to load a 3D Mode clip into the rendered 3D view. This control is only available in review when the clip was acquired in 3D Mode.

Use this control to change the magnification level of the area that is shown when a measurement or annotation is being placed.

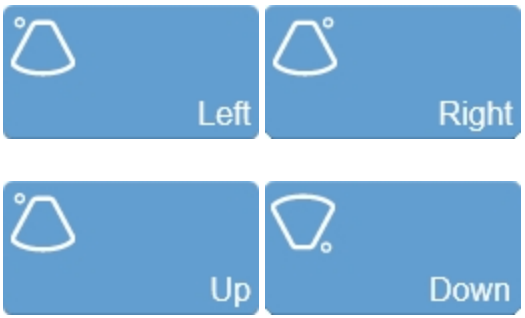
Tap the **Magnify Scale** button and then tap the **Increase** or **Decrease** flyout buttons to select a magnification level between 2x and 8x.

Applies a Maximum Intensity Persistence (MIP) to the image. This is helpful when you want to trace bubble paths in various vessel structured. Tap the button to toggle this setting on and off.

Tap **Mode Presets** to see the available presets and then select an appropriate set of optimized image acquisition settings. This button is active during image acquisition in every mode other than EKV Mode, 3D Mode and 4D-Mode.

The list of presets includes the factory default presets as well as any custom presets you have added to the system. All custom presets are mode, application, transducer, and user dependent where all default presets are only mode, application and transducer dependent.

You can customize the preset values to your specific application. See "Applications and Presets" on page 135.



Sets the image orientation, allowing you to align the image with the transducer. The blue dot in the corner of the control panel and image display corresponds to this setting.

Tap either of the orientation controls to toggle the orientation between the following options: **Left**, **Right**, **Up**, and **Down**.

Persistence applies a pixel averaging algorithm to the most recently acquired frames to produce a more uniform view of the faster moving tissue in the image data. Persistence reduces distracting artifacts such as shimmering and motion artifacts. This feature is most useful when you are imaging uniform tissues such as the liver, kidney, or prostate.

Tap **Persistence**, then tap the **Up/Down** buttons to cycle through the available options—Off, Low, Med, High, Max or MIP.

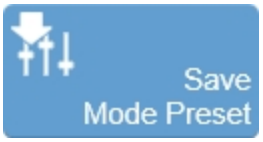
Adjusts the priority relationship between the overlay data and the background B-Mode data so you can eliminate false readings. Priority determines the threshold point on the gray scale above which the system does not apply color data. The red marker along the left side of the display map indicates the threshold point.

Tap the **Priority** button and use the **Up/Down** buttons to select the required value.

RF button in live imaging

RF button in review

The RF button is used to toggle the data collection and display of RF Mode. During live imaging, you can turn both the data collection, and the display, on and off. In review, the RF Display button will only be enabled for images that were captured with RF data. See "RF Mode " on page 683.



The Save Mode Preset button is used to save the mode specific parameters being used in the current mode. This allows you to apply these exact parameters again later using the Mode Presets button.

1 Begin scanning in the desired mode.

2 Adjust the controls to optimize your image.

3 Tap **Save Mode Preset** to save the current settings as a preset.

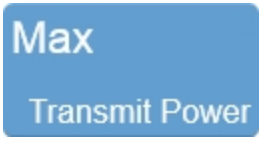
4 Enter the name of your preset in the displayed field and tap **Done** to save the setting.

The new preset appears in the mode-specific flyout when you use the Mode Presets control.

Create your B-Mode presets first. B-Mode includes the largest number of controls that can be saved. Many other modes are based on B-Mode, including Color Doppler Mode, Nonlinear Contrast Mode and PA-Mode.

These modes include fewer available settings. If your study protocol requires any of these B-Mode based modes you will still be able to use your B-Mode presets.

Use this control to show or hide measurement values and labels on an image in review.



Adjusts the power of the ultrasound signal transmission.

To adjust the Transmit Power, tap the **Transmit Power** button, then tap the desired power level—**Max**, **High**, **Med**, **Low** or **Min**.

Use this control to zoom in on the image during scanning or in review.

Tap the **Zoom** button to activate the adjustable zoom control. Tap the **In** or **Out** button or drag the slider to activate the zoom function. The zoom factor is displayed within a range from 1.0x to 8.0x on the Zoom button.

You can also use a two finger spread gesture within the image area to zoom in; once activated, four arrows will be displayed indicating zoom is on. To zoom out, use a two finger pinch gesture.

To view other areas of the zoomed image, pan the image by dragging one finger in any direction within the image area.

A magnifier icon and location guide is shown in the image area on the image display. The location guide displays the original image area with a white inner area that represents the zoomed area.

You can save an image with the zoom state activated and if you load the image in review, you can zoom again using the same control.

If you wish to return to a 1.0x zoom factor, tap **Default** from the zoom controls.

Please note the following:

- The maximum zoom factor may be less depending on the image size and the minimum physical size of the image that can be displayed.
- If you change presets while in the zoom state, the zoom state will be turned off.
- If your image contains measurements and annotations, the text is not enlarged when zoom is activated.

Important: When acquiring in Nonlinear Contrast Mode zoom is limited by the size of the NLC Mode box.

Note: When you activate zoom from inside the NLC Mode box the whole image is zoomed, not just the NLC Mode box area.

Nonlinear Contrast Mode generic measurements

Nonlinear Contrast Mode provides several generic measurement tools. Use these tools when you want to add measurements to an image.

To access the generic measurements for Nonlinear Contrast Mode

1 Do one of the following:

   a. If you are acquiring image data tap **Freeze**, **Measurements** and then select a measurement.

   b. If you are in the Study Browser open an image, tap **Freeze**, and then tap **Measurements** and select a measurement.

2 Placing a measurement will automatically save the image.

The following generic measurements are available for Nonlinear Contrast images:

- Angle
- Area
- Ellipse
- Linear
- Distance
- Contrast Region

PA-Mode

PA-Mode (Photoacoustics mode) is a method for obtaining optical contrast from biological tissues and detecting it with ultrasound. A PA-Mode image is acquired by illuminating tissue with pulsed laser light; thermoelastic expansion occurs and this expansion creates an ultrasound wave which can be detected with an ultrasound transducer.

Within PA-Mode there are four sub-modes to choose from:

- Single – Use when you want to acquire data at one wavelength.
- Spectro – Use for acquiring across the entire wavelength range (680-970 nm or 1200-2000 nm); typically used for characterizing photoacoustic contrast agents.
- Oxy-Hemo – Use when you want to see an overlay of oxygen saturation on one image. These images are created by acquiring two wavelengths—750 nm and 850 nm.
- Multi-wavelength – Use when you want to scan with multiple custom wavelengths, components or both and have the ability to multiplex and unmix your data.

To acquire images in PA-Mode you must use MX series transducers with a Vevo Fiber Jacket and Vevo Optical Fiber. See "Transducers" on page 85 section for instructions.

Warning: Before you begin using the Vevo LAZR-X Imaging System, you must read the safety warnings and cautions provided in the "Vevo LAZR-X Imaging System safety" on page 709, to prevent unnecessary exposure to radiation.

If the laser is altered for any reason, you assume the risk that is associated with a Class 4 laser.

Important: Contact your facilities LSO (Laser Safety Officer) for additional information regarding safety and precautions. An LSO is a person who has the authority to monitor and enforce the control of laser hazards and effect the knowledgeable evaluation and control of laser hazards

Before you begin any acquisition in PA-Mode, it is recommended that you select a port (determines the wavelength range being used), and calibrate the laser using the External Energy Sensor. For more details, see "Laser ports" on page 80 and "Laser Calibration" on page 608.

PA-Mode image acquisition

Warning: Only those who have been formally trained by FUJIFILM VisualSonics to use this laser system may operate the Vevo LAZR-X Imaging System.

Warning: Only MX series transducers with a Vevo Fiber Jacket and Vevo Optical Fiber manufactured by FUJIFILM VisualSonics may be used with the Vevo LAZR-X Imaging System

Laser radiation: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Acquiring images

PA-Mode (Single)

PA-Mode (Single) are images from data acquired at one wavelength.

To acquire an image in PA-Mode (Single)

1 Tap **PA**.

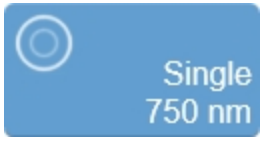
2 The system begins acquiring B-Mode image data with the PA-Mode box and Guide Area overlays displayed. (Optional) Enable the Guide Line via the flyout when PA Guide is tapped.

i. Position the skin line within the guide area.

ii. Position the PA-Mode box as needed by dragging the box left, right, up or down on the control panel. Resize the PA-Mode box by dragging one of the handles located on the bottom left and right corners  .

> **Note:** By default, if the B-Mode image dimensions are changed, the PA-Mode box will maximize to fit the entire image. Making the PA-Mode box smaller will disable this feature. Manually maximizing the PA-Mode box will re-enable this feature.

3 Tap **Single**.



4 (Optional) Change the wavelength via the PA-Mode single wavelength button—this can be done by using either the bookmarked wavelengths or by using the up/down buttons.

5 Set PA-Mode scan parameters (ie. Frame Delay, Persistence, Resp Gating).

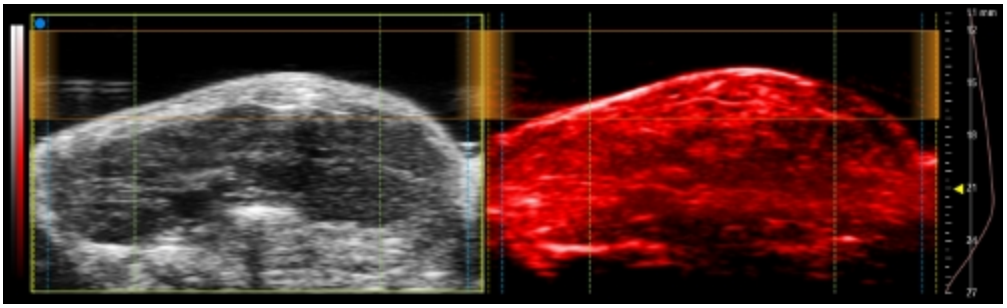
6 (Optional) Load or save a new preset. To load/save a preset for PA-Mode, you must activate the PA-Mode box (tap the PA-Mode box on the control panel to activate it). When the PA-Mode box is not activated (gray), any preset you load or save applies to B-Mode.

7 Tap the PA-Mode **Start** button.

The system will start scanning in PA-Mode (Single) and will display the wavelength on the PA-Mode button, on the image display (above the image area) and also listed in the acquisition parameters under Wavelength.

The dual-window PA-Mode image area appears on the image display. The PA-Mode window is on the right, the B-Mode window is on the left. The system begins storing data in the acquisition buffer, and live acquisition data appears in both windows.

(Optional) Change the Display Layout to either B-Mode Only, Both, PA Only or Side by Side.



8 Adjust the controls as needed. See "PA-Mode controls" on page 587 and also "B-Mode controls" on page 420.

9 Adjust the PA-Mode gain slider.

10 When you adjust the PA-Mode gain, 5 TGC sliders will be displayed. Slide the control to the right to boost the signal and brighten the image data in that horizontal band, and left to attenuate the signal and darken that band.

11 Tap the PA-Mode **Stop** button to return to the B-Mode image with the PA-Mode box overlay or tap **Freeze** to stop scanning.

12 Tap **Save Clip** or **Save Frame** to save the image. See "Saving images" on page 690.

PA-Mode (Spectro)

Spectro is a multiple-wavelength PA-Mode image acquisition sub-mode that acquires images at defined steps across the entire wavelength range.

FUJIFILM VisualSonics provides a Vevo Contrast Agent Phantom (imaging chamber), tubing and system software to aid in the characterization of photoacoustic contrast agents. See "Vevo Spectral Unmixing" on page 563.

To acquire an image in PA-Mode (Spectro)

1 Tap **PA**.

2 The system begins acquiring B-Mode image data with the PA-Mode box and PA-Mode Guide overlay displayed. (Optional) Enable the Guide Line via the flyout when PA Guide is tapped.

i. Position the skin line within the guide area.

ii. Position the PA-Mode box as needed by dragging the box left, right, up or down on the control panel. Resize the PA-Mode box by dragging one of the handles located on the bottom left and right corners  .

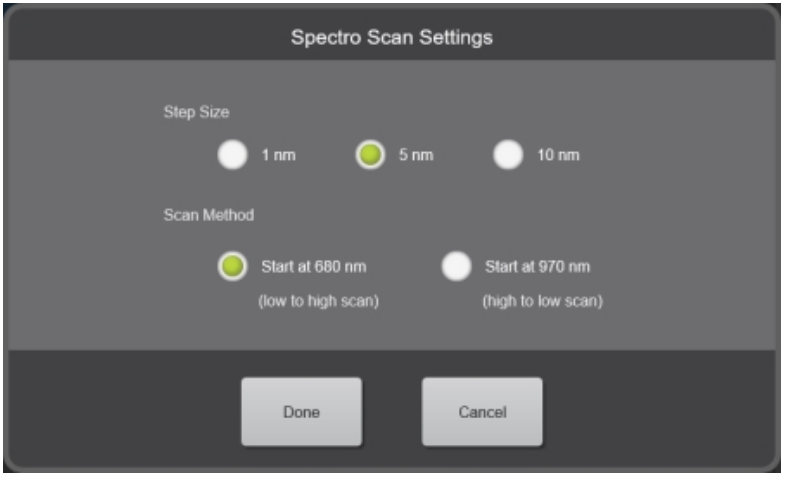
> **Note:** By default, if the B-Mode image dimensions are changed, the PA-Mode box will maximize to fit the entire image. Making the PA-Mode box smaller will disable this feature. Manually maximizing the PA-Mode box will re-enable this feature.

3 Tap **Spectro**.

4 Set PA-Mode scan parameters (ie. Frame Delay, Persistence, Resp Gating).

5 (Optional) Set PA-Mode (Spectro) scan settings, by tapping **Spectro Settings**.

The Spectro Scan Settings panel will be displayed.



Spectro Scan settings panel displayed when using the Signal port (680-970 nm).

i. Select your Step Size. Choose between 1, 5 or 10 nm. Default is 5 nm.

ii. Set your Scan Method. Choose either a low to high scan (starts at 680 nm or 1200 nm) or high to low scan (starts at 970 nm or 2000 nm) depending on the laser port you use. Default is low to high scan.

iii. Tap **Done** when you are finished or **Cancel** to use the default settings.

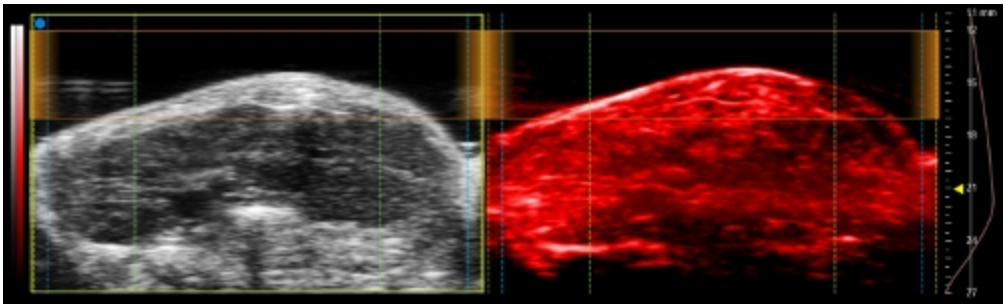
6 (Optional) Load or save a new preset. To load/save a preset for PA-Mode, you must activate the PA-Mode box–tap the PA-Mode box on the control panel to activate it. When the PA-Mode box is not activated (gray), any preset you load or save applies to B-Mode.

7 Tap the PA-Mode **Start** button.

The system will start scanning in PA-Mode (Spectro). The wavelengths will be displayed on the image display above the image area and also listed in the acquisition parameters under Wavelength.

The dual-window PA-Mode image area appears on the on the image display. The PA-Mode window is on the right and the B-Mode window is on the left. The system begins storing data in the acquisition buffer, and live acquisition data appears in both windows.

(Optional) Change the Display Layout to either B-Mode Only, Both, PA Only or Side by Side.



8 Adjust the controls as needed. See "PA-Mode controls" on page 587 and also "B-Mode controls" on page 420.

9 Adjust the PA-Mode gain using the gain slider.

10 When you adjust the PA-Mode gain, 5 TGC sliders will be displayed. Slide the control to the right to boost the signal and brighten the image data in that horizontal band, and left to attenuate the signal and darken that band.

11 When the PA-Mode (Spectro) scan has completed acquiring data at all required wavelengths, scanning will stop.

12 Tap **Save Clip** or **Save Frame** to save the image. See "Saving images" on page 690.

PA-Mode (Oxy-Hemo)

Use when you want to see an overlay of oxygen saturation on one image. These images are created by acquiring two wavelengths—750 nm and 850 nm.

Note: PA-Mode (Oxy-Hemo) is not available for the Vevo LAZR-X Imaging System using the Idler (1200-2000 nm).

To acquire an image in PA-Mode (Oxy-Hemo)

1 Tap **PA**.

2 The system begins acquiring B-Mode image data with the PA-Mode box and PA-Mode Guide overlay displayed. (Optional) Enable the Guide Line via the flyout when PA Guide is tapped.

i. Position the skin line within the guide area.

ii. Position the PA-Mode box as needed by dragging the box left, right, up or down on the control panel. Resize the PA-Mode box by dragging one of the handles located on the bottom left and right corners  .

Note: By default, if the B-Mode image dimensions are changed, the PA-Mode box will maximize to fit the entire image. Making the PA-Mode box smaller will disable this feature. Manually maximizing the PA-Mode box will re-enable this feature.

3 Tap **Oxy-Hemo**.

4 Set PA-Mode scan parameters (ie. Display Type, Frame Delay, Persistence, Resp Gating).

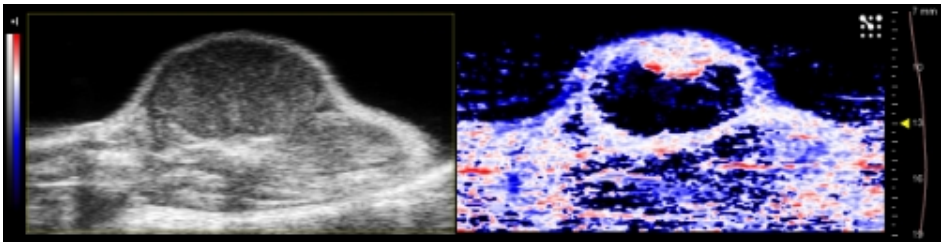
5 (Optional) Load or save a new preset. To load/save a preset for PA-Mode, you must activate the PA-Mode box–tap the PA-Mode box on the control panel to activate it. When the PA-Mode box is not activated (gray), any preset you load or save applies to B-Mode.

6 Tap the PA-Mode **Start** button.

The system will start scanning in PA-Mode (Oxy-Hemo). The wavelengths (750/850 nm) will be displayed on the image display above the image area and also listed in the acquisition parameters under Wavelength. Each image shown is acquired by combining the signals at 750 nm and 850 nm, this is why both wavelength values are displayed.

The dual-window PA-Mode image area appears on the image display. The PA-Mode window is on the right, the B-Mode window is on the left. The system begins storing data in the acquisition buffer, and live acquisition data appears in both windows.

(Optional) Change the Display Layout to either B-Mode Only, Both, PA Only or Side by Side.



7 Adjust the controls as needed. See "PA-Mode controls" on page 587 and also "B-Mode controls" on page 420.

8 Adjust the PA-Mode gain using the gain slider.

9 When you adjust the PA-Mode gain, 5 TGC sliders will be displayed. Slide the control to the right to boost the signal and brighten the image data in that horizontal band, and left to attenuate the signal and darken that band.

10 Tap the PA-Mode **Stop** button to return to the B-Mode image with the PA-Mode box overlay or tap **Freeze**, to stop scanning.

11 Tap **Save Clip** or **Save Frame** to save the image. See "Saving images" on page 690.

PA-Mode (Multi-wavelength)

Use for acquiring images at multiple wavelengths with the ability to multiplex and unmix the wavelengths used or components selected.

Spectral unmixing is a process where the system will unmix the acquired images according to components that you select upon acquisition and their respective spectral curves. The unmixing process then creates layers for the chosen components when viewing the image in review so you can select/deselect those components according to your study requirements.

Use the Multiplex control to assign color and other visual properties to each wavelength or component within your cine loop. You can then view these layers as individual or combined views on top of your data. See "Multiplex" on page 567 for more information.

The Vevo LAZR-X Imaging System provides an Automatic Spectral Unmixing option, see "Photoacoustics" on page 187 in System Settings. Enable this option if you want the system to unmix the components automatically after each multi-wavelength scan.

To acquire an image in PA-Mode (Multi-wavelength)

1 Tap **PA**.

2 The system begins acquiring B-Mode image data with the PA-Mode box and PA-Mode Guide overlay displayed. (Optional) Enable the Guide Line via the flyout when PA Guide is tapped.

i. Position the skin line within the guide area.

ii. Position the PA-Mode box as needed by dragging the box left, right, up or down on the control panel. Resize the PA-Mode box by dragging one of the handles located on the bottom left and right corners  .

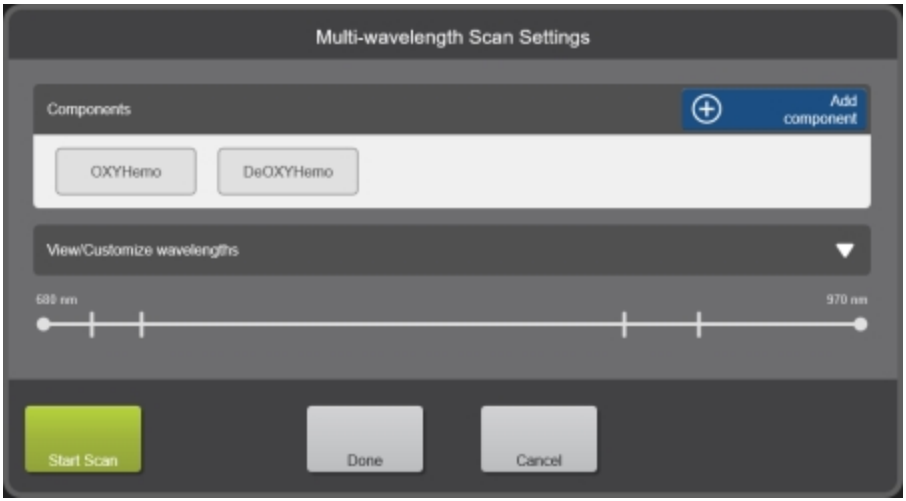
> Note: By default, if the B-Mode image dimensions are changed, the PA-Mode box will maximize to fit the entire image. Making the PA-Mode box smaller will disable this feature. Manually maximizing the PA-Mode box will re-enable this feature.

3 Set scan parameters (ie. Frame Delay, Persistence, Resp Gating).

4 (Optional) Load or save a new preset. To load/save a preset for PA-Mode, you must activate the PA-Mode box—tap the PA-Mode box on the control panel to activate it. When the PA-Mode box is not activated (gray), any preset you load or save applies to B-Mode.

5 Tap **Multi-wavelength**.

6 The Multi-wavelength Scan Settings is displayed. You can add additional components, delete existing components, view/customize wavelengths or start scanning.



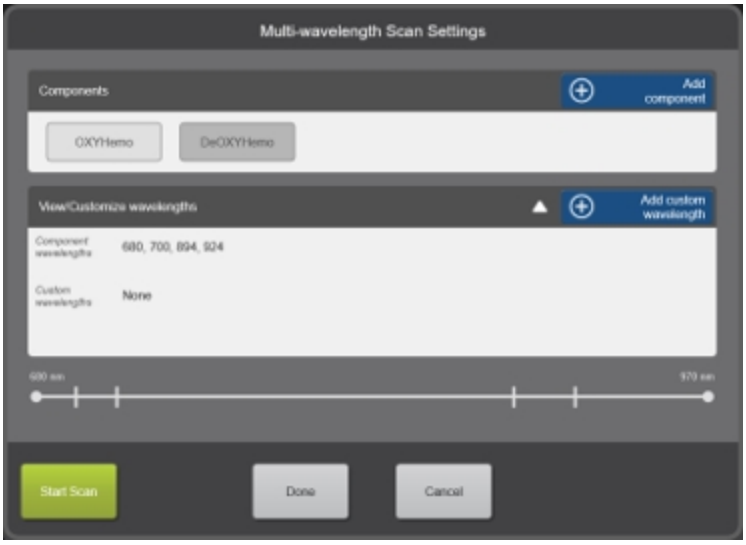
Note: The Done and Start Scan buttons will become disabled if there is less than one wavelength available in the View/Customize wavelengths section.

7 (Optional) Add additional components. Tap **Add component**.

The Selected Components panel is displayed. Tap components that you want to enable/disable in the Components list on the left. Chosen components are displayed on the graph to the right.

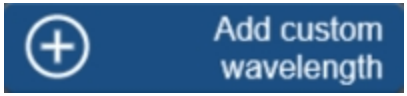
Tap **Done** when your updates are complete.

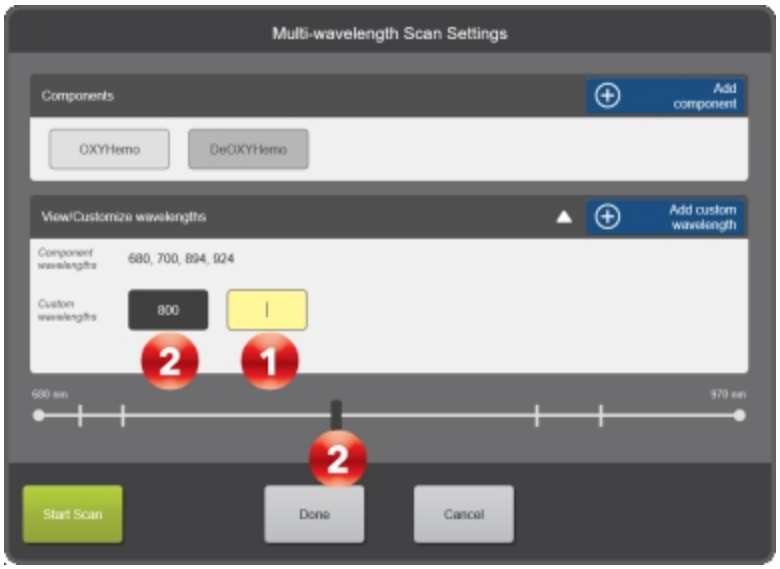
8 (Optional) View wavelengths. Tap the View/Customize wavelengths drop down menu to expand the window to display a list of default wavelengths for the chosen components and any custom wavelengths you added.



9 (Optional) Customize the wavelengths.

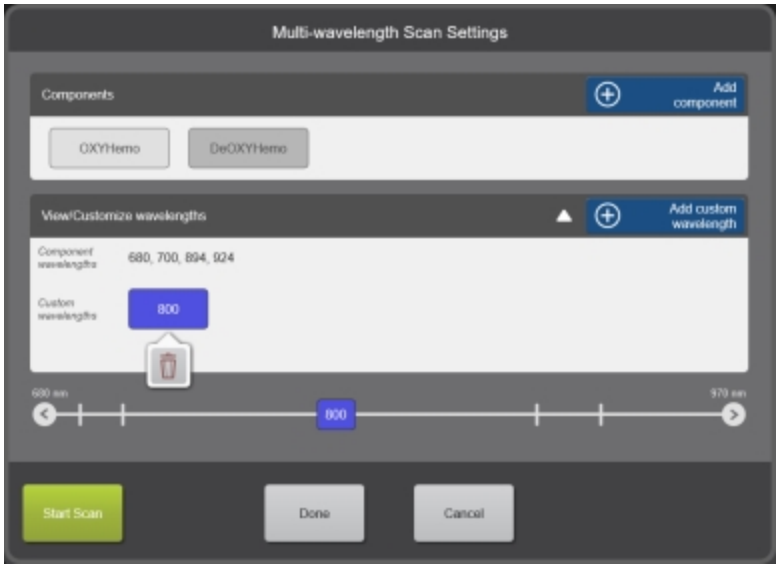
i. To add a wavelength, tap **Add custom wavelength**.





An empty wavelength text box and numerical keypad is displayed, see 1 above. Enter your wavelength and then tap **Add**. Your wavelength is added to the Custom wavelengths section and is displayed on the wavelength scale with a dark indicator (light indicators are default wavelengths that cannot be deleted), see 2. Continue to add additional wavelengths.

ii. To remove a custom wavelength, tap an existing custom wavelength button, then tap the delete icon.



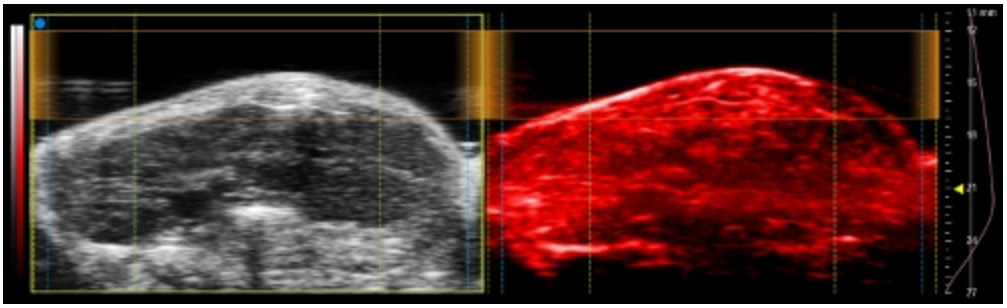
10 Tap **Start Scan** when your updates to the scan settings are complete.

The system will start scanning in PA-Mode (Multi-wavelength). The wavelength will be displayed on the image display above the image area and also listed in the acquisition parameters under Wavelength

The dual-window PA-Mode image area appears on the image display. The PA-Mode window is on the right, the B-Mode window is on the left. The system

begins storing data in the acquisition buffer, and live acquisition data appears in both windows.

(Optional) Change the Display Layout to either B-Mode Only, Both, PA Only or Side by Side.



11 Adjust the controls as needed. See "PA-Mode controls" on page 587. Also see "B-Mode controls" on page 420.

12 Adjust the PA-Mode gain using the gain slider.

13 When you adjust the PA-Mode gain, 5 TGC sliders will be displayed. Slide the control to the right to boost the signal and brighten the image data in that horizontal band, and left to attenuate the signal and darken that band.

14 Tap the PA-Mode **Stop** button to return to the B-Mode image with the PA-Mode box overlay or tap **Freeze** to stop scanning.

15 Tap **Save Clip** or **Save Frame** to save the image. See "Saving images" on page 690.

PA Guide

The PA Guide includes a Guide Area and Guide Line to help you position the transducer to the animal's skin line in order to optimize signal and achieve the highest quality PA-Mode data.

The Guide Line will be displayed at a defined (or specified) depth (the depth is different for each transducer).

The Guide Area includes a semi-transparent guide area and dashed vertical lines as optical fiber guides. The optical fiber guides represent the widths of the Vevo Optical Fibers and indicate the optimal imaging area. For more information on using transducers with the Vevo LAZR-X Imaging System see "Transducers" on page 85.

The PA Guide also includes an Auto ROI option when using the Vevo PA Phantom application. When the Auto ROI option is enabled, ROIs will be drawn along the Guide Line and the PA Region Analysis window will open automatically once acquisition is paused. The Guide Line and Auto ROI option are very useful when using the "Vevo Contrast Agent Phantom" on page 612.

Both the Guide Area and Guide Line are displayed on the image display and control panel (when enabled), see images below.

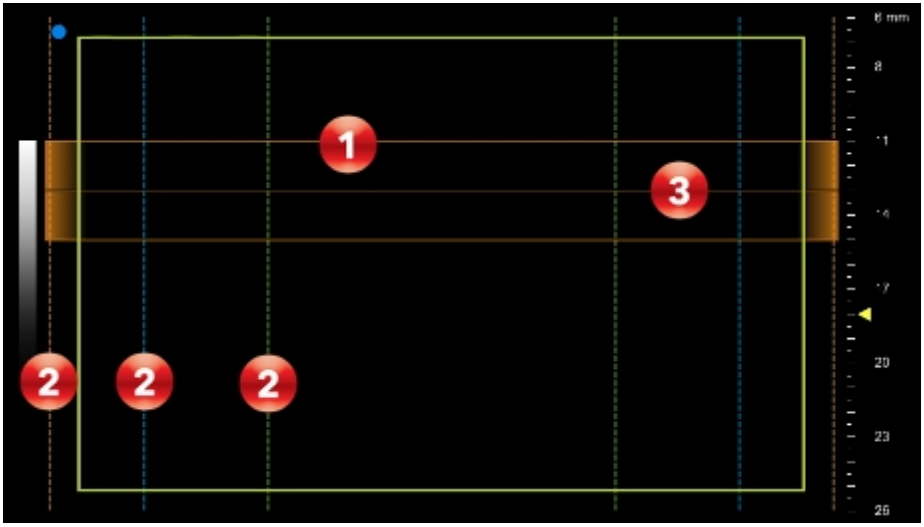
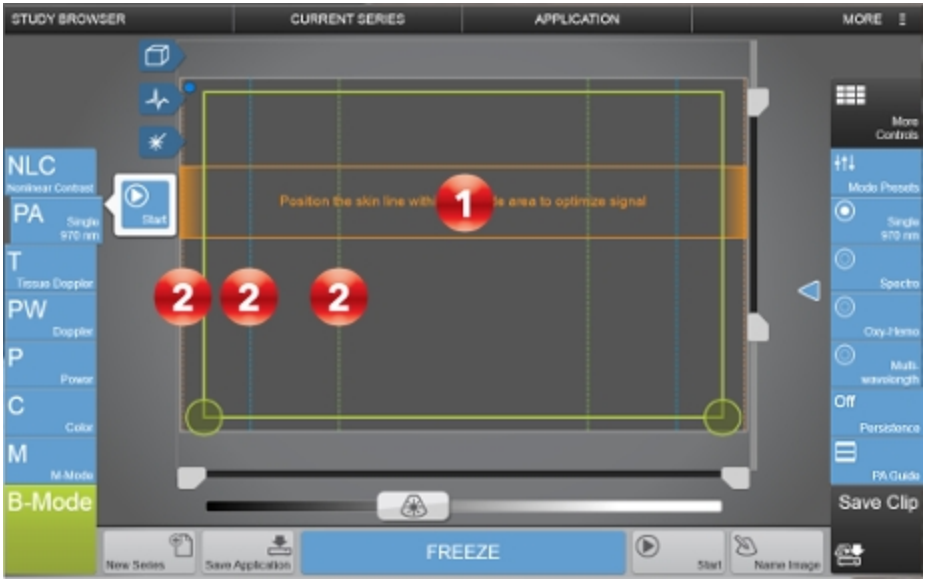


Image display with the Guide Area (semi-transparent guide area, see 1, optical fiber guides, see 2) and Guide Line (semi-transparent guide line, see 3) enabled.



Control panel with the Guide Area enabled (guide area, see 1 *and optical fiber guides, see* 2 *).*

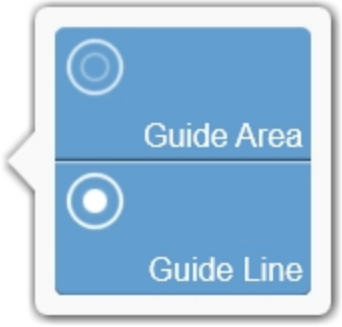
Note: The Guide Line (semi-transparent line inside of the Guide Area) is not displayed on the control panel.

To use the PA Guide

1 Tap **PA**.

2 Position the animal's skin line within the Guide Area (on by default).

3 (Optional) Enable the Guide Line (off by default) included in the flyout when you tap PA Guide.



4 Choose your PA-Mode sub-mode.

5 Tap **Start**.

Note: The PA Guide will not be saved with your image and will therefore not be visible when an image is paused, in review, for any 3D PA-Mode acquisition or on any export.

Using the PA Guide in the PA Vevo Phantom application

If using the Vevo Contrast Agent Phantom, select the PA Vevo Phantom application via the Application tab. A phantom guide and the optical fiber guide will automatically be displayed. The phantom guide will always be enabled.

Note: You cannot disable the Guide Line when imaging in the PA Vevo Phantom application.

For more information, see "Vevo Contrast Agent Phantom" on page 612.

Vevo Spectral Unmixing

Use Vevo Spectral Unmixing to separate wavelengths or components. The number of components that can be unmixed is either the number of wavelengths that were used during acquisition or 5 components, whichever is smaller.

Before using Vevo Spectral Unmixing, please keep the following in mind:

- Unmixing is not an acquisition sub-mode.
- Automatic Spectral Unmixing only applies to PA-Mode (Multi-wavelength) images.
- When a PA-Mode (Spectro) or PA-Mode (Multi-wavelength) image has manual unmixing applied, the software will automatically save the original data and a new PA-Mode (Unmixing) image.

To unmix PA-Mode (Spectro) data

1 Acquire or load a PA-Mode (Spectro) image.

Note: Spectral Unmixing of PA-Mode (Spectro) data will only be possible if the full range of wavelengths is acquired and the acquisition is not stopped prematurely.

2 Tap **Unmix**. The Spectral Unmixing panel will be displayed.

3 Tap components from the Select Components list on the left to show/hide the components on the graph to the right.

4 (Optional) Save a new preset, load an existing preset and/or manage custom presets.

a. Save a new preset. Make edits to existing layers or add additional wavelengths by dragging the wavelength to the panel on the left. Reorder the available layers, by tapping, dragging and releasing. Tap **Save Preset** and enter a name in the Save Preset text box. Tap **Save** when you are done.

b. Load a preset. To load an existing preset, tap the Presets drop down menu and tap to select a preset. Once loaded, you can edit the settings for each available layer within that preset by tapping **Edit Layer Settings**.

c. Manage Presets. Tap **Manage Presets** to view available custom presets. Tap a preset from the list on the left, then tap the delete icon.

5 Tap **Process**.

6 The original PA-Mode (Spectro) image will be saved, a new PA-Mode (Unmixing) image will be generated and the Multiplexer panel will automatically be displayed.

7 (Optional) Edit Layer Properties. Select a layer from the Layers panel on the left and perform either or all of the following:

- Tap the Show Layer checkbox to show/hide the layer.
- Select a color for the layer from the drop down color menu.

- Edit the Layer name, by tapping the text box and typing new text.

8 (Optional) Tap the Advanced Settings drop down menu to display additional Brightness, Contrast, Opacity and Threshold settings.

9 Tap **Done**.

To automatically unmix PA-Mode (Multi-wavelength) data

1 Go to the Photoacoustics page in System Settings, and tap the Enable automatic unmixing checkbox under the Automatic Spectral Unmixing section.

2 In the mode window, tap **Multi-wavelength**.

3 The Multi-wavelength Scan Settings will be displayed.

(Optional) Add additional components, delete existing components, view/customize wavelengths. For more details on this panel, see "PA-Mode (Multi-wavelength)" on page 552.

Tap **Start Scan**.

4 When the scan is complete, the original PA-Mode (Multi-wavelength) image will be saved, a new PA-Mode (Unmixing) image will be generated, the data will automatically multiplex and the Multiplexer panel will be displayed.

5 (Optional) Edit Layer Properties. Select a layer from the Layers panel on the left and perform either or all of the following:

- Tap the Show Layer checkbox to show/hide the layer.
- Select a color for the layer from the drop down color menu.
- Edit the Layer name, by tapping the text box and typing new text.

6 (Optional) Tap the Advanced Settings drop down menu to display additional Brightness, Contrast, Opacity and Threshold settings.

7 Tap **Done**.

To manually unmix PA-Mode (Multi-wavelength) data

1 Acquire or load a PA-Mode (Multi-wavelength) image.

2 Tap **Unmix**. The Spectral Unmixing panel will be displayed.

3 Tap components from the Select Components list on the left to show/hide the components on the graph to the right.

4 (Optional) Save a new preset, load an existing preset and/or manage custom presets.

a. Save a new preset. Make edits to existing layers or add additional wavelengths by dragging the wavelength to the panel on the left. Reorder the available layers, by tapping, dragging and releasing. Tap **Save Preset** and enter a name in the Save Preset text box. Tap **Save** when you are done.

b. Load a preset. To load an existing preset, tap the Presets drop down menu and tap to select a preset. Once loaded, you can edit the settings for each available layer within that preset by tapping **Edit Layer Settings**.

c. Manage Presets. Tap **Manage Presets** to view available custom presets. Tap a preset from the list on the left, then tap the delete icon.

5 Tap **Process**.

6 The original PA-Mode (Multi-wavelength) image will be saved, a new PA-Mode (Unmixing) image will be generated and the Multiplexer panel will automatically be displayed.

7 (Optional) Edit Layer Properties. Select a layer from the Layers panel on the left and perform either or all of the following:

- Tap the Show Layer checkbox to show/hide the layer.
- Select a color for the layer from the drop down color menu.
- Edit the Layer name, by tapping the text box and typing new text.

8 (Optional) Tap the Advanced Settings drop down menu to display additional Brightness, Contrast, Opacity and Threshold settings.

9 Tap **Done**.

Multiplex

Use the Multiplex control to combine groups/sets of wavelengths or components into a single frame. The wavelengths or components can be displayed on the frame in different layers. Up to five layers can be added and each layer can be customized (display map, brightness, contrast, opacity, threshold)—for instance, a 20 frame PA-Mode (Multi-wavelength) image acquired with 5 frames with each frame showing the data of all 5 wavelengths.

Depending on whether or not you have 'Unmixed' your data, the Multiplex button will be labeled as either Multiplex Components (unmixed) or Multiplex Wavelengths.

Available for PA-Mode (Spectro) and PA-Mode (Multi-wavelength).

Use Multiplex to:

- Add up to 5 layers to your image that you can view enable/disable.
- Apply unique colors to each layer so you can identify layers easily.
- Display or hide wavelengths as layers.
- Save a custom preset.

To Multiplex Wavelengths in PA-Mode images

1 Load or acquire a PA-Mode (Multi-wavelength) or PA-Mode (Spectro) image.

2 Tap **Multiplex Wavelengths**.

3 Tap **Settings**. The Multiplexer panel will be displayed. The minimum wavelength is displayed on the left, while all other wavelengths used during acquisition will be displayed in the Wavelengths panel on the right.

4 (Optional) Load an existing preset, save a new preset and/or manage custom presets.

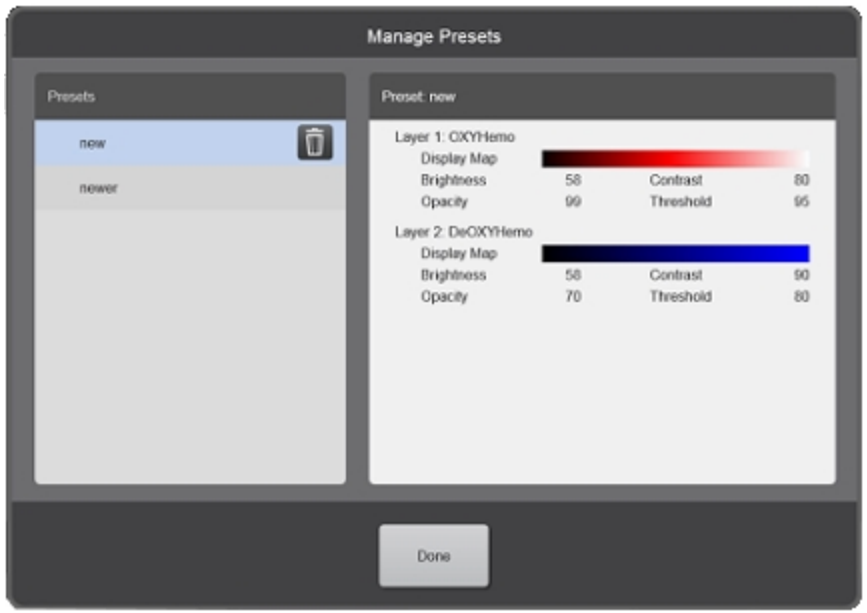
a. Load a preset. To load an existing preset, tap the Presets drop down menu and tap to select a preset. Once loaded, you can edit the settings for each available layer within that preset by tapping **Edit Layer Settings**.

> **Note:** Only those presets that can be applied to the image will be displayed–for instance, if the preset contains a wavelength that is not included in the data set, it will be hidden.

b. Save a new preset. Make edits to existing layers or add additional layers by dragging a wavelength from the Wavelength list on the right to the layers panel on the left. Reorder the available layers, by tapping, dragging and releasing. Tap **Save Preset** and enter a name in the Save Preset text box. Tap **Save** when you are done.

c. Manage Presets. Tap **Manage Presets** to view available custom presets. Tap a preset from the list on the left, then tap the delete icon.

> **Note:** All Multiplex presets will be shown in the Manage Presets panel, including those that cannot be applied to the image.



5 Reorder the layers in the Layers panel on the left by tapping and dragging them in the order that you want them to appear on your image. For example, the layer at the top of the list will be the top layer and therefore be more visible, a layer at the bottom of the list will be behind all of the other layers and therefore will be less visible.

6 Edit the layer settings for a Preset. Select a preset from the Presets drop down menu. Then tap **Edit Layer Settings**.

7 Within the Layer Properties section, you can perform the following:

- Tap the Show Layer checkbox to show/hide each layer.
- Select a color for the layer from the drop down color menu.
- Change the layer name by tapping the wavelength text box and entering a new name.
- Tap **Delete Layer** to remove the layer from the layers list–once removed, the layer will return to a wavelength in the Wavelength list on the right.

8 Tap the Advanced Settings drop down menu to display additional Brightness, Contrast, Opacity and Threshold settings.

9 (Optional) From the Edit Layer Settings panel, tap **Manage Layers** to return to the default Multiplexer panel.

10 Tap **Done** when your updates to the Multiplexer panel are complete. You will be returned to the mode window and the Multiplex Wavelengths button will be changed to the 'enabled' state.

To Multiplex Components in PA-Mode images

In order for the Multiplex Components button to be displayed, you must unmix your data first.

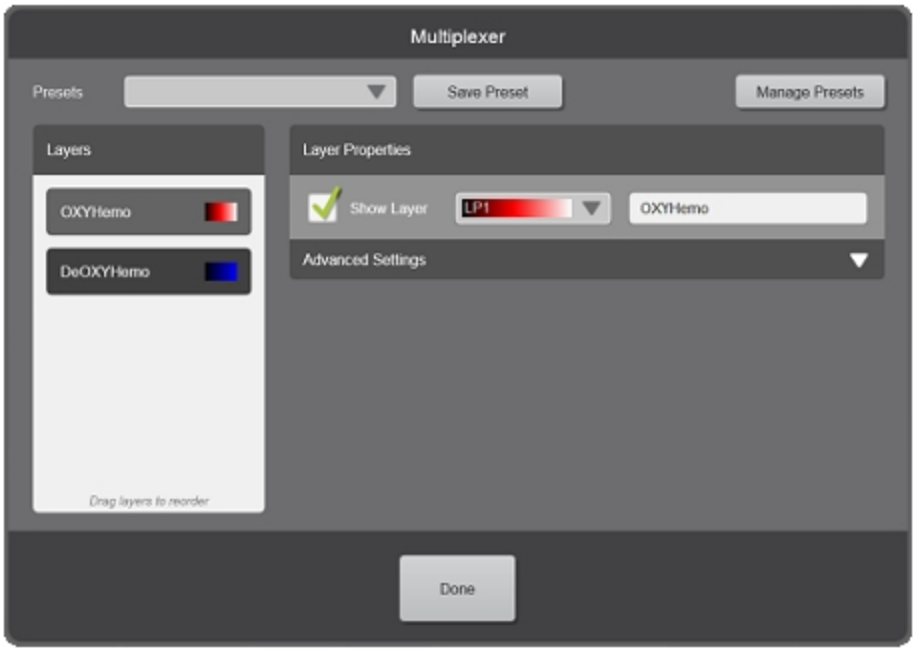
PA-Mode (Multi-wavelength) and PA-Mode (Spectro) data can be unmixed, see "Vevo Spectral Unmixing" on page 563

1 Load a PA-Mode (Unmixing) image into review.

2 Tap **Multiplex Components**.

Note: For PA-Mode (Multi-wavelength) images with Automatic Spectral Unmixing enabled, when acquisition is complete, the Multiplexer panel will be displayed automatically.

3 The Multiplexer panel will be displayed. Layers will be displayed in the Layers panel on the left and Layer Properties for the selected layer will be displayed on the right.



4 (Optional) Reorder the layers in the Layers panel on the left by tapping and dragging them in the order that you want them to appear on your image.

For example, the layer at the top of the list will be the top layer and therefore more visible, a layer at the bottom of the list will be behind all of the other layers and therefore may not be visible.

5 (Optional) Edit Layer Properties. Select a layer from the Layers panel on the left and perform either or all of the following:

- Tap the Show Layer checkbox to show/hide the layer.
- Select a color for the layer from the drop down color menu.
- Edit the Layer name, by tapping the text box and typing new text.

6 (Optional) Tap the Advanced Settings drop down menu to display additional Brightness, Contrast, Opacity and Threshold settings.

7 After you edit the layers, you can save your changes as a new preset. You can also load an existing preset and/or manage custom presets.

a. Save a new preset. Make edits to existing layers or add additional wavelengths by dragging the wavelength to the panel on the left. Reorder the available layers, by tapping, dragging and releasing. Tap **Save Preset** and enter a name in the Save Preset text box. Tap **Save** when you are done.

b. Load a preset. To load an existing preset, tap the Presets drop down menu and tap to select a preset. Once loaded, you can edit the settings for each available layer within that preset by tapping **Edit Layer Settings**.

c. Manage Presets. Tap **Manage Presets** to view available custom presets. Tap a preset from the list on the left, then tap the delete icon.

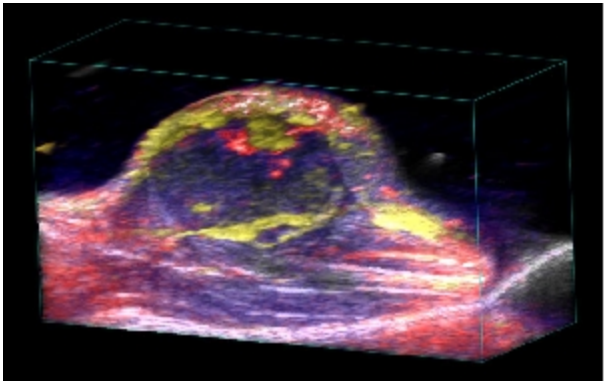
8 Tap **Done** when your updates to the Multiplexer panel are complete.

Photoacoustic Contrast Agents

Exogenous contrast agents are important tools in a variety of imaging modalities including fluorescence, PET/SPECT, CT, MRI and ultrasound. They are especially relevant for molecular imaging applications to visualize cellular functions and molecular processes non-invasively, *in vivo*. Furthermore, they can be used for diagnosis and treatment of a variety of diseases. Some of these agents are approved for clinical use and thus are ideal for translational research.

Photoacoustic contrast agents offer advantages over other imaging modalities due to the high resolution which can be achieved deeper within tissue, often at a lower cost and faster acquisition times. In addition, some can be used with other imaging modalities, making them truly multi-modal agents.

The Vevo LAZR-X Imaging System provides tools for characterizing photoacoustic contrast agents *in vitro* and *in vivo* for researchers designing or utilizing such agents for biomedical applications.



Photoacoustic contrast agents includes:

- Nanoparticles
- Optical dyes and NIR fluorophores

- Liposomes
- Melanin (tyrosinase)

Nanoparticles

Nanotechnology can be defined as manufactured materials and particles smaller than 100 nanometers in size.

With the ability to enter most cells, often without eliciting any immune response, nano-scale materials are designed to interact efficiently and precisely with biological materials. Their small size renders them able to enter areas of the body, such as the brain and individual cells, that have proved difficult to access with current technologies.

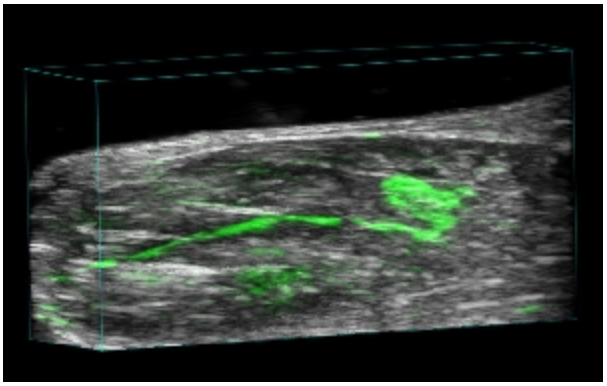
Nanoparticles provide the following:

- Light absorption in the near-infrared range (750 nm – 2500 nm).
- Biologically inactive for long *in vivo* circulation time.
- Polyethylene glycol-coated for increased biocompatibility.
- Gold nanorods for enhanced overall signal.
- Single-walled carbon nanotubes for targeted imaging.

Optical Dyes and Fluorophores

Small molecular dyes are used extensively for *in vivo* fluroescence imaging as well as in microscopy for identifying cellular and molecular processes. Since photoacoustic imaging with the Vevo LAZR-X Imaging System relies on optical absorption in the near-infrared part of the spectrum, dyes with excitation

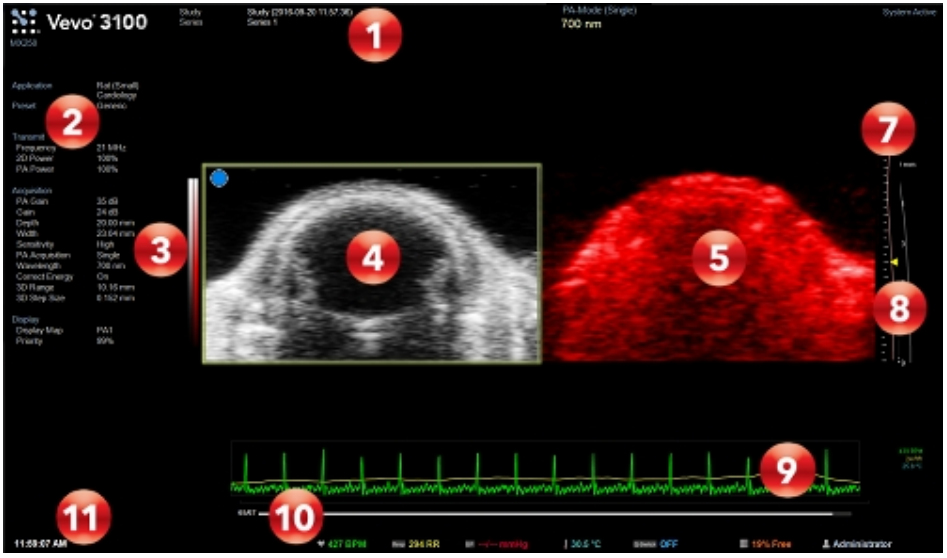
peaks in this range can be used as contrast agents. While higher doses are typically required for optical imaging, photoacoustic imaging can overcome limitations of optical modalities such as autofliorescence, resolution at depth and accurate quantification.



Photoacoustic compatible dyes include:

- Methylene blue, Evan's blue, Trypan blue, Patent blue
- Indocyanine Green (ICG)
- IRDye800CW
- DiR
- Cy7, Cy7.5
- Porphyrins

PA-Mode image display



PA-Mode image display:

1. Image status area
2. Mode settings panel
3. PA-Mode display map
4. PA-Mode image area
5. B-Mode image area
6. PA-Mode box
7. Image scale
8. B-Mode/PA-Mode TGC curve

9. Physiological data trace
10. Clip buffer
11. Status bar

Image status area

Displays information about the transducer, study/series information, image status, image number and total images in the series.

When acquiring data in PA-Mode additional information is displayed:

- PA-Mode (Single)—Displays the current wavelength.
- PA-Mode (Oxy-Hemo)—Both wavelengths are displayed—example '750/850 nm'.

  Note: PA-Mode (Oxy-Hemo) is not available when imaging with the Idler (1200-2000 nm).

- PA-Mode (Spectro)—Each wavelength is displayed one by one according to the Spectro Scan Settings for Step Size and Scan Method.
- PA-Mode (Multi-wavelength)—Each wavelength is displayed one by one according to the Multi-wavelength Scan Settings and will include both the Component wavelengths and Custom wavelengths.

After an image has been unmixed in PA-Mode, the following is displayed:

- PA-Mode (Unmixing)—The image will be labeled as Regenerated after the unmixing processing is complete. The wavelengths and/or components that were used to acquire the original image (before being unmixed) will be displayed under the Acquisition parameters.

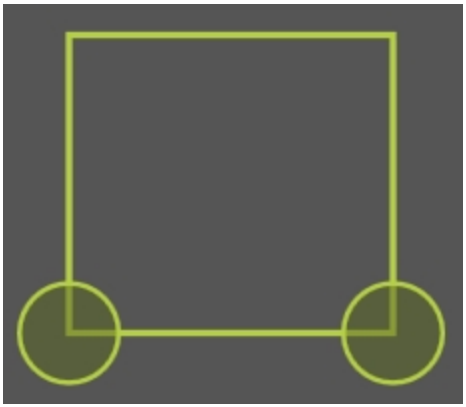
Mode settings panel

The following additional settings are displayed for PA-Mode acquisitions:

- PA Power—Displays the optical power and has a default value of 100 %.
- Wavelength Range—Displays the wavelength range used during acquisition (680-970 nm or 1200 - 2000 nm).
- PA Acquisition—Displays the PA-Mode submode (Single, Spectro, Oxy-Hemo or Multi-wavelength).
- Wavelength—Displays the wavelength(s) used during acquisition.
- PA Brightness/Contrast—Only displayed when acquisition is paused or in review.

PA-Mode box

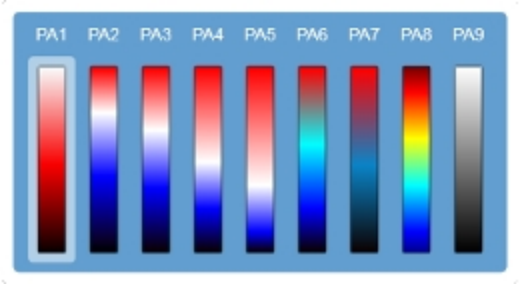
In PA-Mode, the system applies the colors only to the image data within the PA-Mode box. When the display layout is set to side by side, the PA-Mode box is displayed as an overlay on the B-Mode data. Move the entire box by tapping and dragging the box frame or tap and drag one of the handles on the left or right at the bottom of the box.



PA-Mode display map

Two display maps are shown to the left of the image while in PA-Mode on the image display. The left column is the B-Mode display map. The right column is the PA-Mode display map.

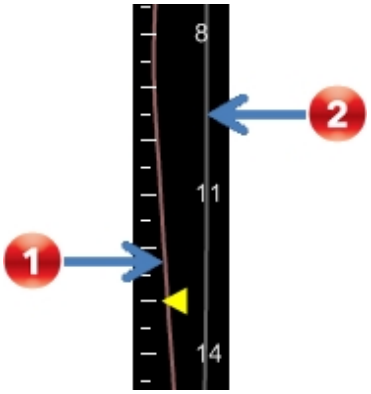
Default display map is PA1 for PA-Mode (Single), PA-Mode (Spectro) and PA-Mode (Multi-wavelength). When scanning on Oxy-Hemo, the default Display Map changes depending on your Display Type—OxyZated (PA2), HemoMeaZure (PA8).



B-Mode/PA-Mode TGC curve

Two TGC curves are displayed on the image display when imaging in PA-Mode; the red line represents the PA TGC curve (see 1 below), while the white line represents the B-Mode TGC curve (see 2 below).

Tap and hold, then drag the PA Gain slider left or right to display the five TGC sliders. Edit the B-Mode TGC curve before starting PA-Mode.



Note: You can save a PA-Mode TGC curve by saving a custom preset—tap **Save Mode Preset** once you have set your TGC sliders.

Status bar

Displays the following additional laser information:

- Status of the Q-Switch—OFF or ON. Toggle the Q-Switch via the Laser tab.

- Current energy of the laser is displayed as a laser energy bar. The laser energy bar will indicate if the energy is within 10% of the baseline energy value. If the laser energy bar turns white, the laser baseline must be performed again by Technical Support.

PA-Mode control panel

When imaging in PA-Mode, there are a number of controls on the control panel that you can manipulate to optimize your image.

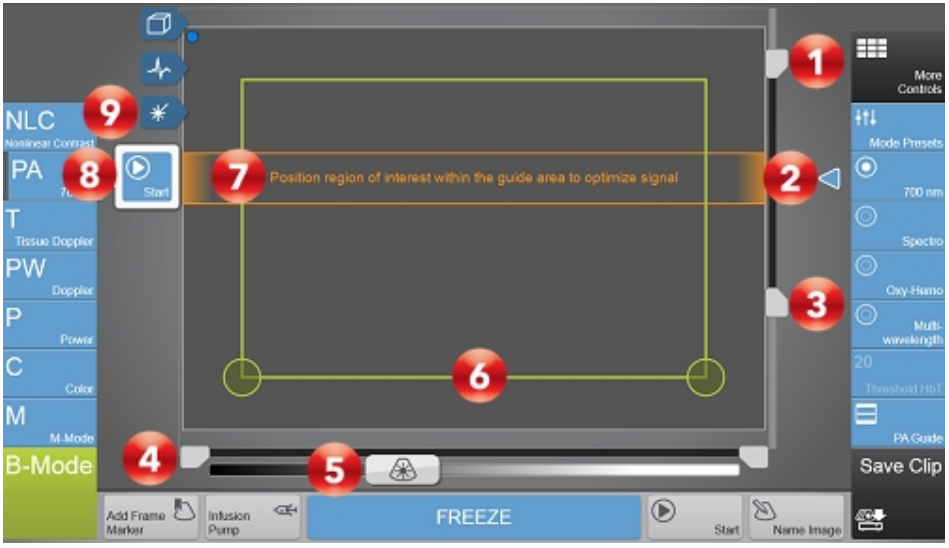


Image controls:

1. Image depth offset
2. Focal depth
3. Image depth

4. Image width
5. B-Mode/PA-Mode gain
6. PA-Mode box
7. PA Guide
8. PA-Mode Stop/Start flyout button
9. Laser tab

B-Mode/PA-Mode gain

Before PA-Mode acquisition begins (before the PA-Mode Start flyout button is tapped), adjust the B-Mode gain.

Once PA-Mode acquisition has begun, the B-Mode gain slider changes to the PA-Mode gain slider. During PA-Mode acquisition, you can only adjust PA gain.

Note: You can save a PA-Mode TGC curve by saving a custom preset—tap **Save Mode Preset** once you have set your TGC sliders.

To set the PA-Mode gain

Gain is the strength of the ultrasound signal in dB when it returns to the face of the transducer. PA-Mode gain is indicated with a PA on the gain control.

♦ Slide the gain control left or right to adjust the visual intensity of the signal when it returns to the face of the transducer. Slide right to add gain and brighten the mode data, slide left to reduce gain and darken the mode data.

As you adjust the PA-Mode gain, five Time Gain Compensation (TGC) controls are displayed. For more information, see "Gain and TGC controls" on page 418.

You can switch to the B-Mode gain by tapping the PA-Mode Stop flyout button; the gain slider will switch from the PA-Mode gain to B-Mode gain.

PA-Mode box

In PA-Mode, the region of interest is located within the green PA box overlay. The system applies the PA-Mode based colors only to the image data within this PA box.

To position and resize the PA-Mode box

1 Begin acquiring data in PA-Mode. See "PA-Mode" on page 540.

2 Resize the PA-Mode box by dragging one of the handles located on the bottom left and right corners of the PA-Mode box  .

3 Position the PA-Mode box by dragging it left, right, up or down on the control panel.

After you change the angle or position of the PA box, the system pauses briefly to apply the new settings and then starts acquiring data again.

PA Guide

The PA Guide includes a Guide Area and a Guide Line to help you know where to place your region of interest to achieve the highest quality PA-Mode data.

When the Guide Line is enabled, it is displayed on the image display not the control panel.

For more information see "PA Guide" on page 559.

PA-Mode Stop/Start flyout

When you tap the PA (Photoacoustics) button, the PA button changes to display the currently selected PA sub-mode. For example, if you are imaging in PA-Mode (Single), a single wavelength will be displayed on the button and for PA-Mode (Multi-wavelength), 'Multi' is displayed.

A Start or Stop button flyout will also be displayed. The Start button is displayed when you are not acquiring in PA-Mode and are in the 'staging' mode. The 'staging' mode is where you can set scan settings, parameters and your area of interest before acquisition begins. Once acquisition begins, the Start button will change to Stop. Tap the Stop button to stop acquiring PA-Mode data and to return to the 'staging' mode.

Laser tab

Tap this control to initialize and configure the laser. Calibration of the laser is a very important step to ensure the laser is running properly for optimal performance and image quality.

The calibration process is recommended to characterize the transmission efficiency of the Vevo Optical Fiber across the entire wavelength spectrum.

See "Laser Calibration" on page 608 for more details.

PA-Mode controls

In PA-Mode imaging, you can adjust the following controls in addition to most of the B-Mode controls.

If the listed control is not on the Controls bar, it will be in More Controls. You can customize which controls appear in the Controls bar, see "Customizing controls" on page 388.

Some controls appear only when the image is live or when the image is in review and some controls appear in both cases. Some additional controls are only available when acquiring in a specific PA-Mode sub-mode (Single, Spectro, Oxy-Hemo and Multi-wavelength) or before the PA-Mode Start button is tapped.

Accessing B-Mode controls

While imaging in another mode, certain B-Mode controls remain available.

The B-Mode controls can be accessed in three ways:

a. Tapping on the B-Mode image (the active overlay will become gray).

b. Tap **More Controls** and then tap on the B-Mode tab.

c. Tap on the handle of the PA-Mode box to switch.

PA-Mode controls

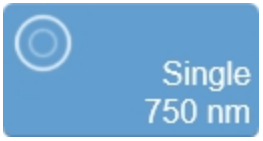
Control	Live	Review
Single	✓	
Annotation		✓
Brightness		✓
Clip Settings	✓	✓
Clip Sub-range		✓
Contrast		✓
Display Layout	✓	✓
Display Map	✓	✓
Display Type	✓	✓
Frame Delay	✓	
LAZR Port	✓	
Left/Right	✓	✓

PA-Mode controls

Control	Live	Review
Live Unmix	✓	
Load into 3D		✓
Magnify Scale		✓
Measurements		✓
Mode Presets	✓	
Multi-wavelength	✓	
Multiplex wavelengths		✓
Oxy-Hemo	✓	
PA Guide	✓	
Persistence	✓	
Priority	✓	
RF	✓	✓

PA-Mode controls

Control	Live	Review
Save Mode Preset	✓	✓
Sensitivity	✓	
Show Values and Labels		✓
Spectro	✓	
Spectro Settings	✓	
Threshold HbT		✓
Unmix		✓
Up/Down	✓	✓
Zoom	✓	✓



Use PA-Mode (Single) for acquiring images at one wavelength.

To change the wavelength, tap the PA-Mode (Single) button and select one of the default wavelengths, tap and drag the wavelength slider, or tap the up/down buttons (adjusts the wavelength in 1 nm increments) to the desired wavelength.

Change the default Single Wavelength Bookmarks in System Settings on the Photoacoustics page in the Single Wavelength Bookmarks section.

Note: If scanning in PA-Mode, the scan will restart a few seconds after editing the wavelength via the slider, up/down buttons, or the Single Wavelength Bookmarks.

Tap **Annotation** to add annotations to your acquired or stored image. Select the desired text from the annotation page or enter custom text. See "Annotations" on page 265.

Indicates the image brightness level. Tap the **Brightness** control on the PA-Mode tab and adjust the slider up or down to obtain the required setting. The setting is displayed on the button for easy reference and is stored with the image under the Mode Settings parameter PA Brightness.

Note: The Display Layout must be set to either **Both**, **PA Only** or **Side by Side** to be able to use the Brightness control.

Note: Brightness is not available for a PA-Mode (Oxy-Hemo) image or if your image has been multiplexed.

Tap the **Clip Settings** button to open the Clip Settings panel. You can set various options for saving a clip, including the clip length for each mode. See "Saving images" on page 690.

Allows an acquired, but unsaved clip to be cropped before saving. Also, for saved and unsaved clips, use this control to limit the playback of a clip to only a portion of the full clip length.

For an unsaved clip, tap **Clip Sub-range** and drag the sliders that appear on the Clip Slider to the desired position. Tap **Crop & Save**. Tap **Cancel** to remove the crop sliders.

For a saved clip, tap **Clip Sub-range** and drag the sliders that appear on the Clip Slider to the desired position. Tap **Cancel** to remove the crop sliders.

Note: PA-Mode (Multi-wavelength), PA-Mode (Spectro) and PA-Mode (Unmix) images do not have the Clip Sub-range functionality available.

Indicates the image contrast level. Tap the **Contrast** button on the PA-Mode tab and adjust the slider up or down to obtain the required setting. The setting is displayed on the button for easy reference and is stored with the image in the Mode Settings panel under PA Contrast.

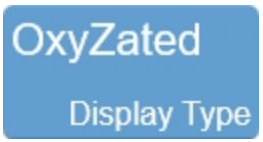
Note: The Display Layout must be set to either **Both**, **PA Only** or **Side by Side** to be able to use the Contrast control.

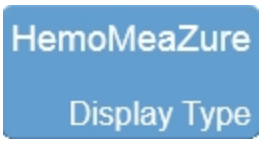
Note: Contrast is not available for a PA-Mode (Oxy-Hemo) image or if your image has been multiplexed.

Use this control to change which data are being shown on the image display. This does not affect the actual data collection and can be changed at any time during live scanning or review.

Tap the button and select of the available options: **B-Mode Only**, **Both**, **PA Only**, or **Side by Side**.

Allows a choice of predefined sets of overlays and image maps that you can apply any time during live scanning or review. Tap the Display Map control to see the available maps for the active imaging mode.





When you are analyzing an Oxy-Hemo sub-mode image, you can select specific regions of interest and precisely measure the percentage level of blood oxygenation in that region.

The Vevo LAZR-X Imaging System provides two display types for Oxy-Hemo acquisition. Choose the appropriate display before taking measurements:

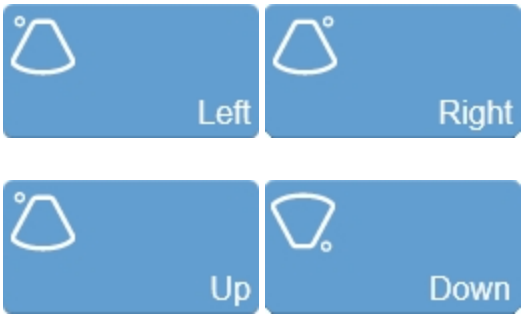
a. OxyZated Display Type. Helps to calculate and quantify oxygen saturation; also particularly useful for studying the hypoxic state of tumor microenvironment to predict disease burden, studying fetal/maternal physiology, and studying stroke/ischemia.

b. HemoMeaZure Display Type. Helps to measure and quantify hemoglobin content; also particularly useful for studying anemia.

Set a Frame Delay if you want to have a delay between sets of images during acquisition. For example, if you acquire a PA-Mode (Multi-wavelength) at 700 nm, 750 nm and 800 nm, the system will collect the first three wavelengths and then wait the specified Frame Delay to acquire the next three wavelengths.

Tap **Frame Delay**, then tap one of the delay time options—**Off**, **5 seconds**, **10 seconds**, **30 seconds** or **60 seconds**.

Tap the LAZR Port button and select either the 680-970 nm (Signal) or 1200-2000 nm (Idler) range. Insert the Vevo Optical Fiber into the corresponding port on the front of the laser and secure with the lever lock. The corresponding port wavelength range and default Single wavelength value will update and be displayed on the button.



Sets the image orientation, allowing you to align the image with the transducer. The blue dot in the corner of the control panel and image display corresponds to this setting.

Tap either of the orientation controls to toggle the orientation between the following options: **Left**, **Right**, **Up**, and **Down**.

Live unmixing allows you to automatically unmix components during acquisition.

The **Live Unmix** button is always available, however you cannot use Live Unmix until FUJIFILM VisualSonics activates this licensed feature for you. See "Appendices" on page 697.

Used to load a 3D Mode clip into the rendered 3D view. This control is only available in review when the clip was acquired in 3D Mode.

Use this control to change the magnification level of the area that is shown when a measurement or annotation is being placed.

Tap the **Magnify Scale** button and then tap the **Increase** or **Decrease** flyout buttons to select a magnification level between 2x and 8x.

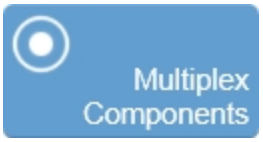
Tap **Mode Presets** to see the available presets and then select an appropriate set of optimized image acquisition settings. This button is active during image acquisition in every mode other than EKV Mode, 3D Mode and 4D-Mode.

The list of presets includes the factory default presets as well as any custom presets you have added to the system. All custom presets are mode, application, transducer, and user dependent where all default presets are only mode, application and transducer dependent.

You can customize the preset values to your specific application. See "Applications and Presets" on page 135.

Use PA-Mode (Multi-wavelength) for acquiring images at multiple wavelengths with the ability to multiplex and unmix the wavelengths used.

A Scan Settings panel will be displayed when you tap Multi-wavelength where you can add components, view/customize wavelengths and start scanning.



Use the Multiplex control to combine groups/sets of wavelengths or components into a single frame. The wavelengths or components can be displayed on the frame in different layers. Up to five layers can be added and each layer can be customized (display map, brightness, contrast, opacity, threshold)—for instance, a 20 frame PA-Mode (Multi-wavelength) image acquired with 5 frames with each frame showing the data of all 5 wavelengths.

Depending on whether or not you have 'Unmixed' your data, the Multiplex button will be labeled as either Multiplex Components (unmixed) or Multiplex Wavelengths.

Available for PA-Mode (Spectro) and PA-Mode (Multi-wavelength).

See "Multiplex" on page 567 for more information.

Use when you want to see an overlay of oxygenated (red) and deoxygenated (blue) blood on one image acquired by using two wavelengths (750 nm and 850 nm).

Note: PA-Mode (Oxy-Hemo) is not available for the Vevo LAZR-X Imaging System using the Idler (1200-2000 nm).

The PA Guide includes a Guide Area and Guide Line to help you position the transducer to the animal's skin line in order to optimize signal and achieve the highest quality PA-Mode data.

The Guide Line will be displayed at a defined (or specified) depth (the depth is different for each transducer).

The Guide Area includes a semi-transparent guide area and dashed vertical lines as optical fiber guides. The optical fiber guides represent the widths of the Vevo Optical Fibers and indicate the optimal imaging area. For more information on using transducers with the Vevo LAZR-X Imaging System see "Transducers" on page 85.

The PA Guide also includes an Auto ROI option when using the Vevo PA Phantom application. When the Auto ROI option is enabled, ROIs will be drawn along the Guide Line and the PA Region Analysis window will open automatically once acquisition is paused. The Guide Line and Auto ROI option are very useful when using the "Vevo Contrast Agent Phantom" on page 612.

Persistence applies a pixel averaging algorithm to the most recently acquired frames to produce a more uniform view of the faster moving tissue in the image data. Persistence reduces distracting artifacts such as shimmering and motion artifacts. This feature is most useful when you are imaging uniform tissues such as the liver, kidney, or prostate.

Tap the **Persistence** button and use the flyout buttons to select between the following:

- Off = 1 frame
- Low = 4 frames
- Med = 8 frames
- High = 12 frames
- Max = 20 frames

Adjusts the priority relationship between the overlay data and the background B-Mode data so you can eliminate false readings. Priority determines the threshold point on the gray scale above which the system does not apply color data. The red marker along the left side of the display map indicates the threshold point.

Tap the **Priority** button and use the **Up/Down** buttons to select the required value.

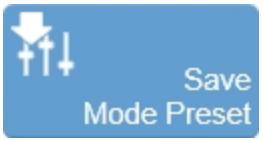
Note: Priority is only available in the **Both** display layout for PA-Mode.

Note: If the PA-Mode image is multiplexed, the **Priority** button will be disabled.

RF button in live imaging

RF button in review

The RF button is used to toggle the data collection and display of RF Mode. During live imaging, you can turn both the data collection, and the display, on and off. In review, the RF Display button will only be enabled for images that were captured with RF data. See "RF Mode " on page 683.



The **Save Mode Preset** button is used to save all of the parameters being used in the current mode. This allows you to apply these exact parameters again later using the **Mode Presets** button.

1 Tap the Photoacoustics button and enable the PA-Mode box. Adjust the controls to optimize your image.

Note: Before you tap the PA-Mode Start button and the PA-Mode box is active, any preset you load or save will apply to PA-Mode. You can save a B-Mode preset by tapping on the image area outside of the PA-Mode box– once the PA-Mode box is deactivated, any preset you load or save will apply to B-Mode.

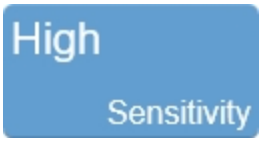
2 Tap **Save Mode Preset** to save the current settings as a preset.

3 Enter the name of your preset in the displayed field and tap **Done** to save the setting.

The new preset appears in the mode-specific flyout when you use the **Mode Presets** control.

Create your B-Mode presets first. B-Mode includes the largest number of controls that can be saved. Many other modes are based on B-Mode, including Color Doppler Mode, Nonlinear Contrast Mode and PA-Mode. These modes include fewer available settings. If your study protocol requires any of these B-Mode based modes you will still be able to use your B-Mode presets.

See "Applications and Presets" on page 135 for details on working with presets.



Adjusts the signal-to-noise ratio so that you can better:

- Identify weak-signal targets in the near field that are difficult to distinguish because they are very small.
- Identify large targets in the far field that are difficult to distinguish due to attenuation.

The higher you set the sensitivity level, the lower the system sets the frame rate.

Tap the **Sensitivity** button and use the **Up**/**Down** buttons to select either High/Standard.

Use this control to show or hide measurement values and labels on an image in review.

Spectro is a multiple-wavelength PA-Mode image acquisition sub-mode that acquires images at defined steps between a range of wavelengths; typically used to characterize components and contrast agents.

FUJIFILM VisualSonics provides a Vevo Contrast Agent Phantom (imaging chamber), tubing and system software to aid in the characterization of the photoacoustic spectra of contrast agents. See "Vevo Spectral Unmixing" on page 563.

Only available once the Spectro sub-mode button is tapped.

Set your Spectro scan preferences on the Spectro Scan Settings panel. Choose your Step Size (1 nm, 5 nm or 10 nm) and Scan Method (low to high scan or high to low scan).

Threshold HbT (Hemoglobin Concentration) is available when acquiring data in PA-Mode (Oxy-Hemo) with the OxyZated Display Type selected. Increase the Threshold HbT to display the stronger signals of oxygen saturated blood cells.

Tap **Threshold HbT**, then adjust the slider between 0 (no threshold) and 100 (high threshold) or tap **Default** to set the threshold to 20.

Use Unmix on PA-Mode (Spectro) and PA (Multi-wavelength) data.

Spectral unmixing is a process where the system will unmix the acquired image according to components that you select. The multiplexing process then creates layers for the chosen components when viewing the image in review so you can select/deselect those components according to your study requirements.

See "Vevo Spectral Unmixing" on page 563 for more information.

Use this control to zoom in on the image during scanning or in review.

Tap the **Zoom** button to activate the adjustable zoom control. Tap the **In** or **Out** button or drag the slider to activate the zoom function. The zoom factor is displayed within a range from 1.0x to 8.0x on the Zoom button.

You can also use a two finger spread gesture within the image area to zoom in; once activated, four arrows will be displayed indicating zoom is on. To zoom out, use a two finger pinch gesture.

To view other areas of the zoomed image, pan the image by dragging one finger in any direction within the image area.

A magnifier icon and location guide is shown in the image area on the image display. The location guide displays the original image area with a white inner area that represents the zoomed area.

You can save an image with the zoom state activated and if you load the image in review, you can zoom again using the same control.

If you wish to return to a 1.0x zoom factor, tap **Default** from the zoom controls.

Please note the following:

- The maximum zoom factor may be less depending on the image size and the minimum physical size of the image that can be displayed.
- If you change presets while in the zoom state, the zoom state will be turned off.
- If your image contains measurements and annotations, the text is not enlarged when zoom is activated.

PA-Mode generic measurements

PA-Mode provides several generic measurement tools. Use these tools when you want to add measurements to an image.

To access the generic measurements for PA-Mode

1 Do one of the following:

   a. If you are acquiring image data tap **Freeze**, **Measurements** and then select a measurement.

   b. If you are in the Study Browser open an image, tap **Freeze**, and then tap **Measurements** and select a measurement.

2 Placing a measurement will automatically save the image.

The following generic measurements are available for PA-Mode images:

- Angle
- Area

- Linear
- Ellipse
- Distance
- PA Region

Laser Calibration

The calibration process is recommended to characterize the transmission efficiency of the Vevo Optical Fiber across the entire wavelength spectrum. Calibration of the laser is a very important step to ensure multi-wavelength data is normalized to the same energy scale.

When calibrating the laser, please note the following:

- Once calibration has begun, it cannot be canceled.
- Calibration cannot be done during PA-Mode acquisition.
- When the laser is calibrating, a progress bar will be displayed.
- The date, time and who performed the last calibration will be displayed on the Laser Configuration panel.

To calibrate the laser

You must use an external energy sensor when calibrating the Vevo LAZR-X Imaging System laser.

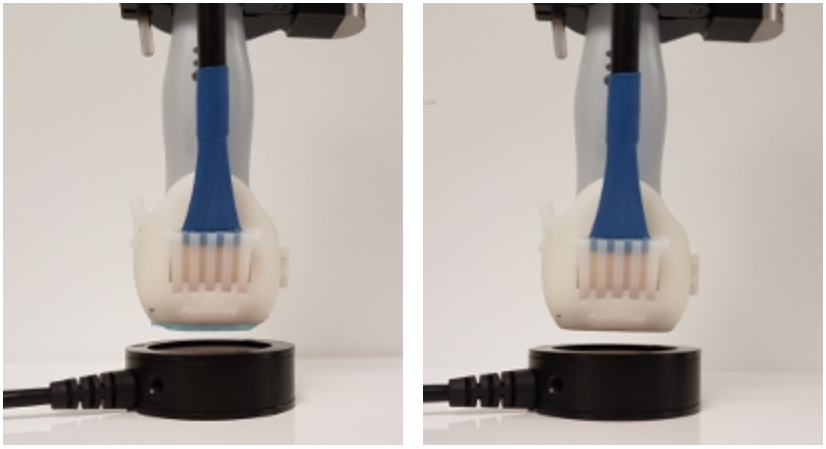
Before beginning calibration, connect the transducer to the system, see "Transducers" on page 85 and connect the external energy sensor to the external power meter connector located on the front of the laser.

1 Place the external energy sensor on the base of an imaging platform or on another flat, slightly elevated surface.

2 Affix the transducer so that it stands directly above the external energy sensor with a space of approximately 6 - 10 mm between the end of the transducer and the sensor. Gently wipe the output of the fibers with a damp cloth and clean. For the 1200 - 2000 nm wavelength range, do not use gel. For the 680 - 970 nm wavelength range, apply ultrasound gel so it completely

covers the output end of the fibers—ensure the gel does not touch the energy sensor.

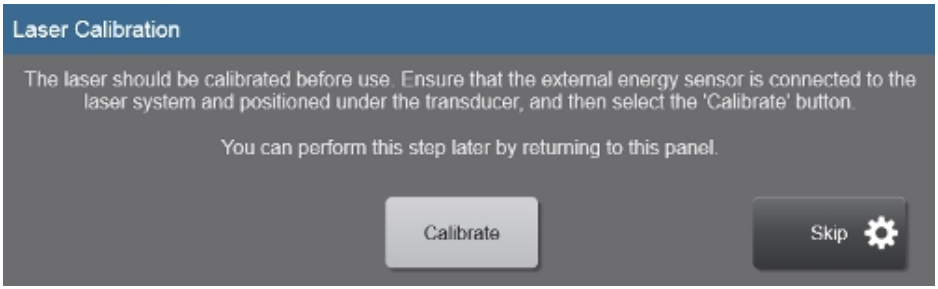
Note: Since imaging will be performed through gel, it is best to calibrate the 680 - 970 nm wavelength range through gel which will compensate for some attenuation of the light at longer wavelengths due to water absorption. Do not use gel when using the 1200 - 2000 nm wavelength range.



The transducer positioned above the external energy sensor. The transducer on th eleft has gel, suitable for 680 - 970 nm imaging. The transducer on the right has no gel, suitable for 1200 - 2000 nm imaging.

3 Tap **PA (Photoacoustics)**.

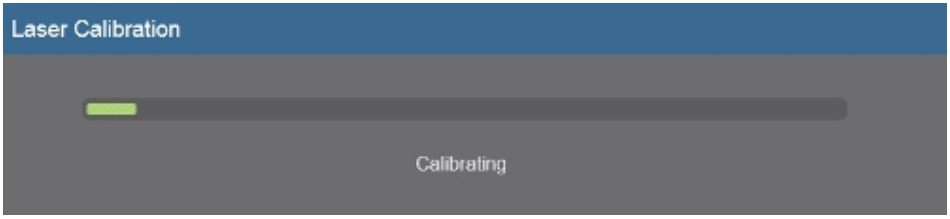
4 The Laser Calibration panel will appear with two options—Calibrate or Skip.



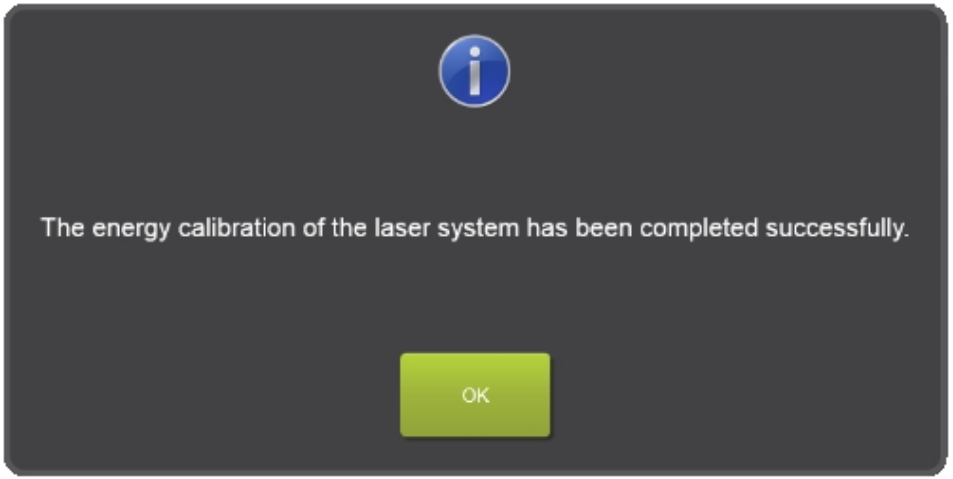
a. Tap **Calibrate** to begin the laser calibration process.

b. Tap **Skip** to delay the laser calibration process—this is a good idea if the laser isn't warm. It is best to allow the laser to fire for approximately 2-5 minutes prior to calibration. When Skip is tapped, the Laser Configuration panel is displayed. Dismiss the panel by tapping anywhere outside of the Laser Configuration panel.

5 Once calibration begins, a progress bar will be displayed.



6 When calibration is complete, a confirmation dialog will be displayed.



Important: The laser tab will change from blue to green to indicate that optimization of the laser needs to be done or that there is an error/issue. Tap the laser tab to display a dialog that will describe the issue.

If optimization is required, contact Technical Support.

Vevo Contrast Agent Phantom

The Vevo Contrast Agent Phantom is used for *in vitro* characterization of photoacoustic contrast agents when imaging in PA-Mode.

Vevo Contrast Agent Phantom

The Vevo Contrast Agent Phantom is an acrylic imaging chamber or 'dish' that can hold up to 11 polyurethane tubes. Secure the tubes in the grooves provided to keep them taut while imaging.

Vevo Contrast Agent Phantom Tubing

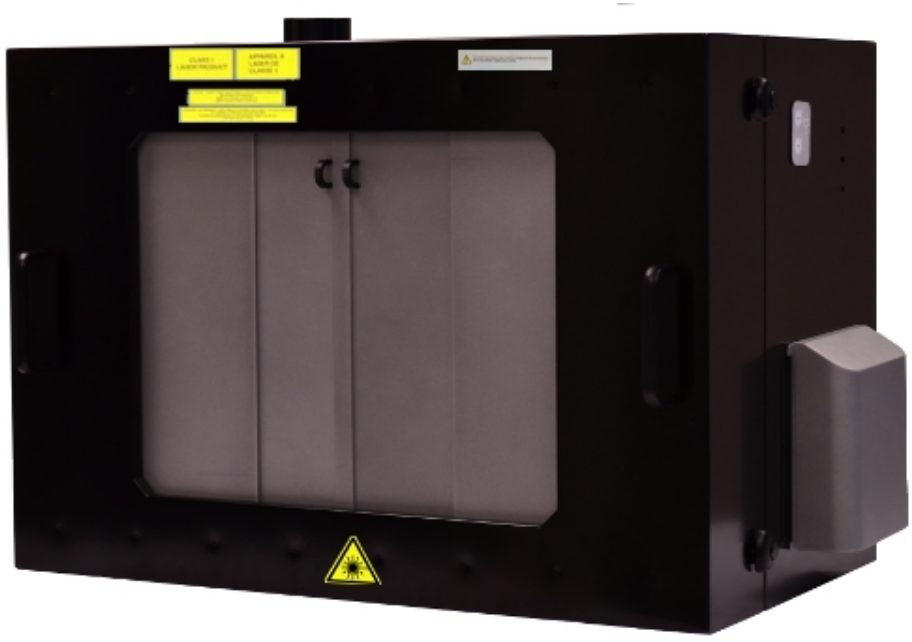
The Vevo Contrast Agent Phantom Tubing is specifically designed to work with the Vevo Contrast Agent Phantom.

The tubing is made of polyurethane into which photoacoustic contrast agents are injected with a 27 G needle. The tubing has an inner diameter of 0.015" and an outer diameter of 0.033".

For more information and instructions on using the Vevo Contrast Agent Phantom and Tubing, please refer to the *In Vitro Characterization of Photoacoustic Contrast Agents with the Vevo LAZR-X* imaging guide.

Vevo LAZRTight

The Vevo LAZRTight is a device for safe handling of laser light. Use the LAZRTight to complete lab studies that require the use of the Vevo LAZR-X Imaging System.



Laser radiation: Unauthorized personnel must not attempt to defeat the switches inside the side access ports and front sliding doors of the Vevo LAZRTight.

Warning: Only those who have been formally trained by VisualSonics to use this laser system may operate the Vevo LAZR-X Imaging System.

Warning: Do not use the Vevo LAZRTight if either of the front sliding doors is damaged.

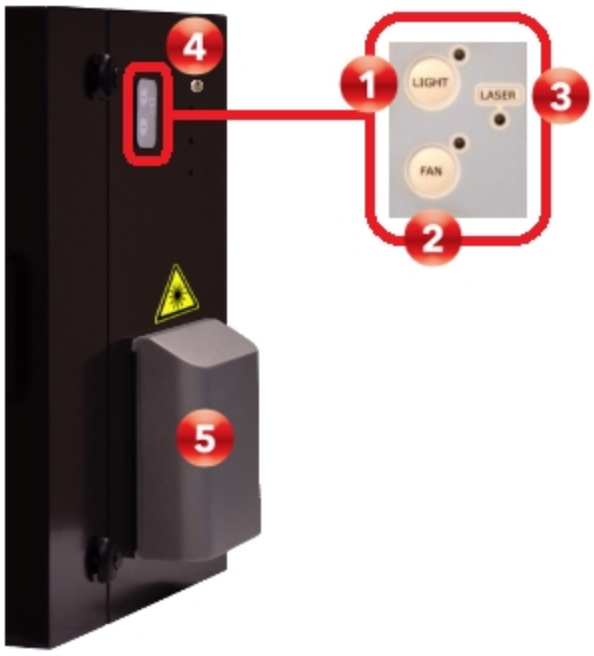
Important: Contact your facilities LSO (Laser Safety Officer) for additional information regarding safety and precautions. An LSO is a person who has the authority to monitor and enforce the control of laser hazards and effect the knowledgeable evaluation and control of laser hazards

Positioning the Vevo LAZRTight

Vevo LAZRTight can be set up on a table, or under a fume hood to thoroughly vent anesthetic gases.

Warning: Ensure that you orient the position of Vevo LAZRTight such that the laser fires in a direction away from any doorways.

Right side controls

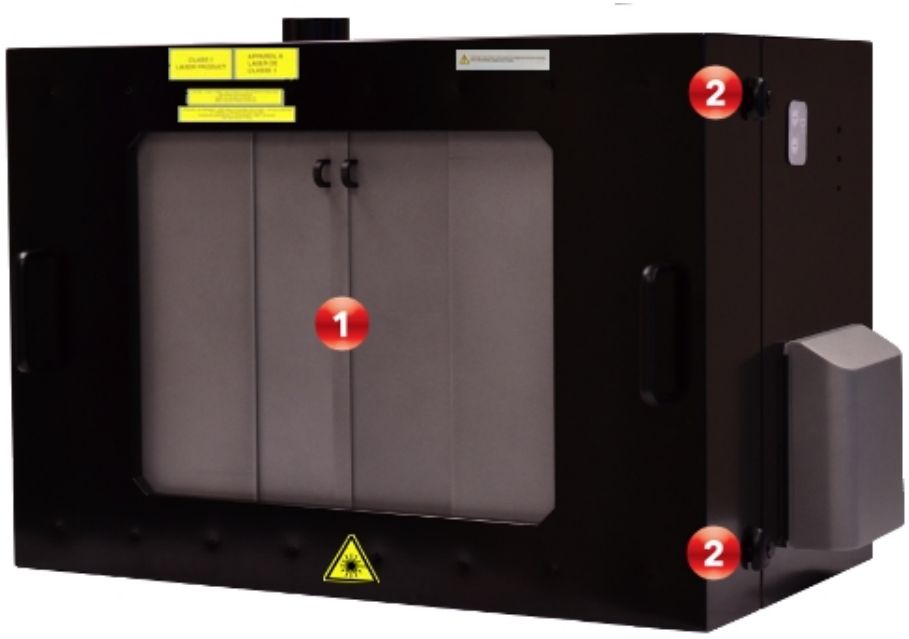


Area	Description
1	Interior light control. Press to cycle through options—on, low, medium, high and off.
2	Interior fan on/off toggle button. Illuminated light indicates that the fan is on.

Area	Description
3	Laser status light. The status light has three displays: • Illuminated light (blue) indicates that all the interlocks are engaged and you can operate the laser. • Light off indicates at least one interlock is open and the system prevents the laser from firing. • Blinking light indicates that one of the interlocks is not engaged and the system prevents the laser from firing.
4	12V power jack. Connects to the AC power cord for LAZRTight power.
5	Access port cover with interlock. Access ports on left and right provide an opening for extending cables and tubing into Vevo LAZRTight. To remove the cover, slide the cover up and out of the magnetic interlock. Interlocks here prevent the laser from firing until you slide both covers down to their base position.

Removable front panel

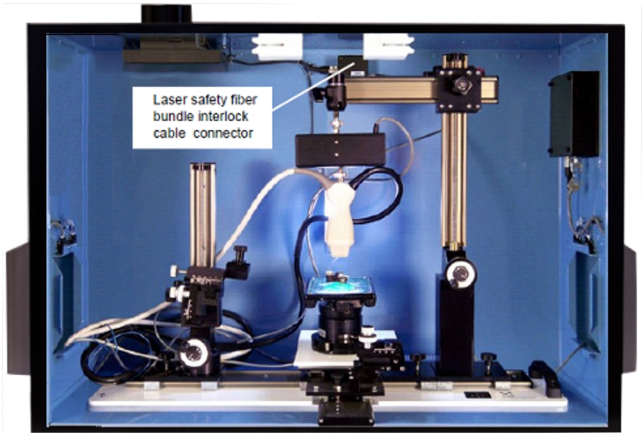
Removable front panel for installing and removing the rail system, and for when you are completing tasks that do not require the laser.



Warning: You must open the sliding front doors BEFORE you remove or replace the front panel. If you do not open the sliding doors, you can permanently damage the interlock assembly for the sliding doors.

Area	Description
1	Sliding doors with interlock. Interlocks here prevent the laser from firing until the doors are completely closed. Interlock also instantly stops the laser from firing if the doors are opened. When you shut the doors, pull the handles together carefully but firmly until the doors physically connect. A complete connection establishes the interlock.
2	Latches for removable front panel with interlock. To remove the front panel, unlatch the top and bottom latches on each side and then carefully remove it.

Interior



The laser safety fiber bundle interlock cable connector is located on the back panel of Vevo LAZRTight. The cable feeds out one of the side ports to connect to the delivery interlock connector on the laser cart. This laser safety fiber bundle interlock cable prevents users from operating the transducer outside the fully interlocked Vevo LAZRTight.

3D Mode

3D Mode provides a three-dimensional view of an area of interest from frame-based imaging modes.

The system acquires the 3D Mode data by creating a rapid series of B-Mode slices, and then combining these slices into a whole image. The 3D Mode data set can then be visualized and manipulated.

You can use the 3D Mode analysis tools to:

- View and render objects of interest. Targets (e.g. tumor, growth) can be segmented and volumetric measurements made (available on Vevo LAB).
- Segment objects on any plane or across planes (available on Vevo LAB).
- Measure lengths, areas and volume (area and volume measurements available on Vevo LAB).

3D Mode is available while you are acquiring data in B-Mode, Color Doppler Mode, Power Doppler Mode, Nonlinear Contrast Mode, PA-Mode (Single), PA-Mode (Oxy-Hemo), and PA-Mode (Multi-wavelength) images that are multiplexed.

Note: While in modes that do not support 3D Mode scanning, the Cube tab is still available to provide access to control of the motor position.

Caution: Do not disconnect the transducer connector when scanning, when the 3D motor is initializing or when the 3D motor is moving. If the transducer connector is disconnected, stop scanning and reconnect. A system restart my be required.

3D Mode hardware setup

This section describes how to set up the 3D motor and the transducer for a 3D Mode image acquisition session.

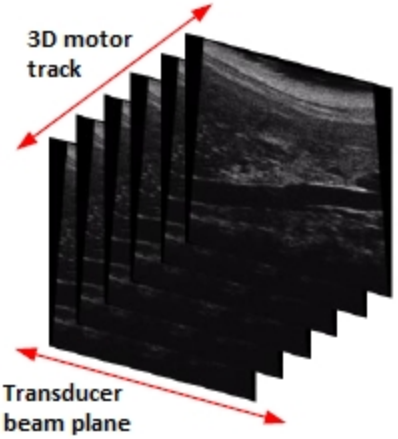
The Vevo Imaging Station is required for 3D Mode imaging. For detailed information refer to the Vevo Integrated Rail System III Operator Manual.

The transducer is mounted on a Vevo Imaging Station equipped with a 3D motor. The transducer connects to a clamp connected to the bottom of the 3D motor. The 3D motor connects to the mount on the Vevo Imaging Station.

Prepare your animal on the animal platform. For detailed information refer to the Vevo Integrated Rail System III Operator Manual.

Based on user-defined parameters, the 3D motor travels a set distance across the target object in a series of very small steps. The 3D motor, with the attached transducer, travels in a direction perpendicular to the imaging orientation.

At each step, the transducer acquires a two-dimensional slice of the image. The system compiles each two-dimensional image slice with the other acquired slices and renders them into a three-dimensional image.

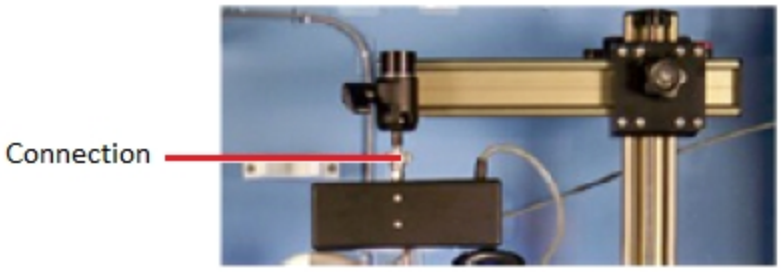


To connect the 3D motor to the Vevo Imaging System

The 3D motor features a Quick Release post on the top to connect to the Vevo Imaging Station, and a Quick Release mount on the bottom to affix the transducer.

Caution: During 3D Mode data acquisition, ensure that the animal under the transducer is flat in relation to the 3D Mode scan direction to prevent unintended contact with the animal when the transducer moves.

1 Connect the quick release post to the ball joint on the arm of the Vevo Imaging Station arm.



2 Carefully line up the holes on the post with the pins on the quick release mount.

3 Finger tighten the knob on the quick release mount.

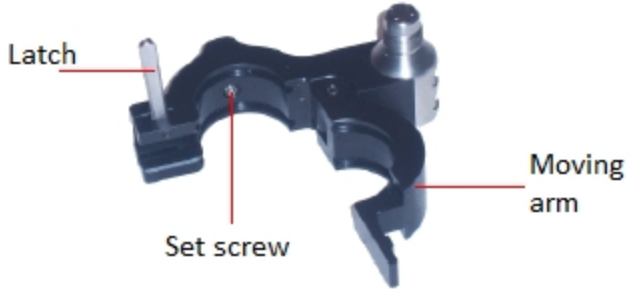
4 Connect the 3D motor cable to the 3D motor connector on the back of the Vevo Imaging System.

To connect a transducer to the 3D motor

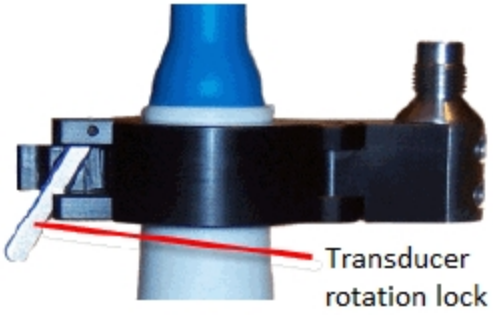
1 Insert and tighten the 3D motor transducer connector to the opening at the top of the transducer housing.

2 Tighten the quick-release mount until it is finger tight.

3 Lift the latch to open the clamp and then place the collar of the transducer in the clamp.

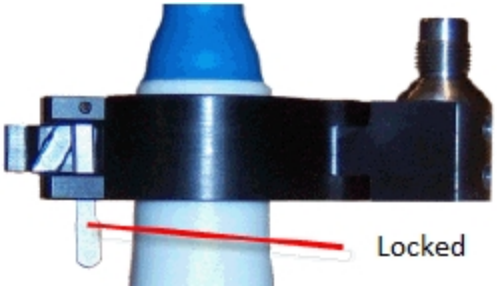


4 Close the moving arm of the clamp and then pull the latch down to the 45° notch. This transducer rotation lock setting holds the transducer but provides enough freedom for your to rotate it.



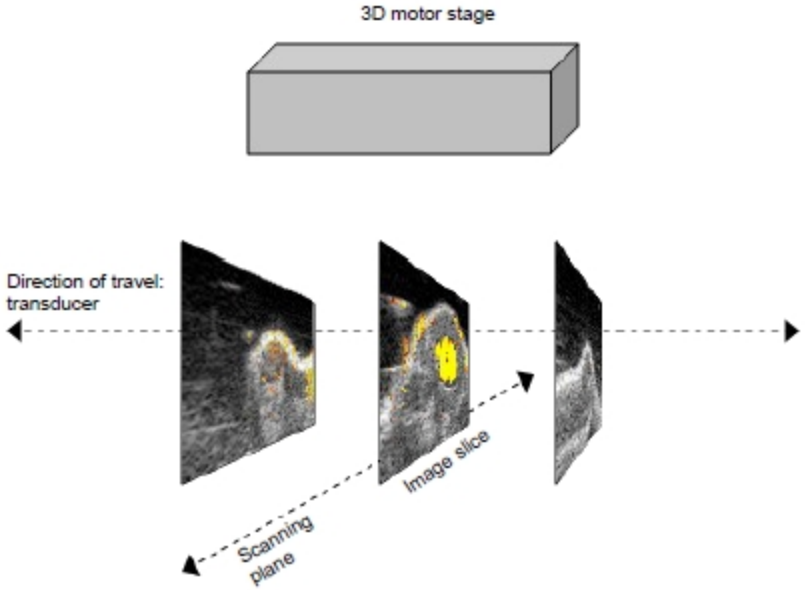
5 To set the transducer to the desired 90-degree angle in the clamp, turn the transducer until you feel the collar snap into position.

6 Close the clamp and push the latch down until it locks into place as shown in the following illustration.



To orient the transducer on the motor

As shown in the following illustration, the long axis of the 3D motor must be aligned in the direction that the transducer travels during data acquisition.



Warning: The 3D motor could cause a hazard to your fingers during a 3D Mode scan as the motor moves. Ensure that your fingers are well away from the 3D motor during a 3D Mode scan.

3D Mode image acquisition

Based on user-defined parameters, the 3D motor travels a set distance across the target object in a series of very small steps. The 3D motor, with the attached transducer, travels in a direction perpendicular to the imaging orientation.

At each step, the transducer acquires a two-dimensional slice of the image. The system compiles each two-dimensional image slice with the other acquired slices and renders them into a three-dimensional image.

The system acquires image slices across the motor track and combines them into a clip. Unlike a typical clip which contains slices along the same image plane over time, this clip contains a series of individual slices at different locations as the motor moves along its track.

Caution: Do not disconnect the transducer connector during scanning. If the transducer connector is disconnected during scanning, stop scanning and reconnect. A system restart may be required.

Acquiring a 3D Mode image

Use the control panel to remotely control the position of the transducer using the 3D motor. See "3D Mode hardware setup" on page 621.

The image acquisition process in 3D Mode is automated, so you must optimize your image acquisition settings before you begin your 3D Mode scan.

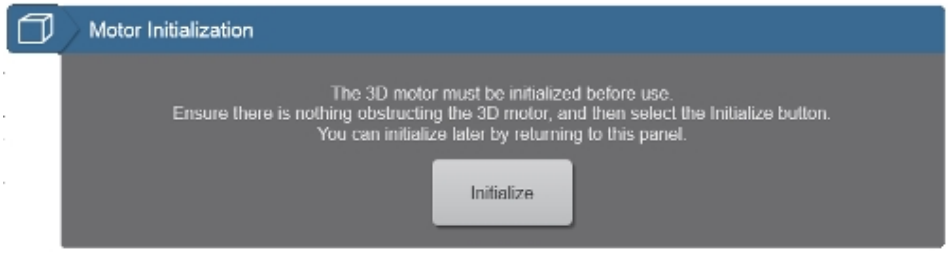
Note: You must connect the transducer to the 3D motor and connect the 3D motor to the Vevo Imaging Station.

To acquire a 3D Mode image

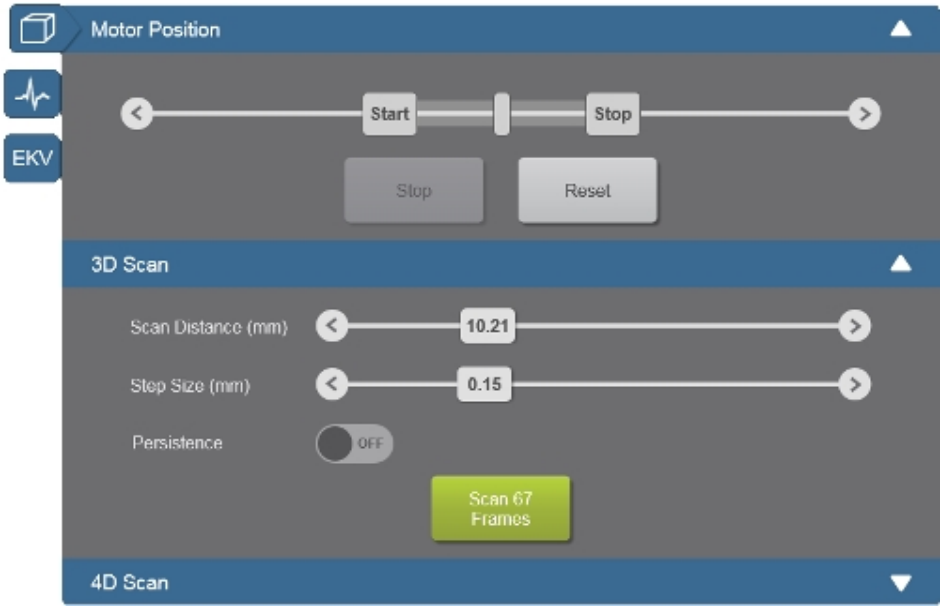
1 Begin acquiring data and tap the Cube tab to show the 3D Mode panel.

2 If the 3D motor has not been initialized previously, the system displays the 3D Motor initialization message. Tap **Initialize** to initialize the motor. You will be asked to confirm this decision. Ensure that nothing is obstructing the motor or the transducer if it is attached.

Caution: Ensure that the lateral movement of the 3D motor cannot injure the subject and damage the transducer.



3 Once the motor is initialized the setup panel is displayed. The 3D Scan section of the panel is only displayed if you are acquiring data in a mode that supports 3D Mode scanning. If you do not see the 3D Scan section, ensure you are scanning in B-Mode, Color Doppler Mode, Power Doppler Mode, PA-Mode (Single), PA-Mode (Oxy-Hemo), PA-Mode (Multi-wavelength) or Nonlinear Contrast Mode.



4 In the Motor Position portion of the panel, slide the **Start** and **Stop** indicators to locate the object of interest and center it as closely as possible relative to the transducer.

The motor only moves once you release the control, so, while it is moving, you can tap **Stop** to stop movement. Tap **Reset** to move the motor back to the center position

Caution: Ensure that the lateral movement of the 3D motor cannot injure the subject and damage the transducer.

5 In the Scan portion of the panel, set up your 3D Mode image parameters:

Parameter	Description
Scan Distance	Sets the distance (in millimeters) that the 3D motor will travel during the entire 3D Mode image acquisition. Scan distance ranges between 0.53 mm and 37.99 mm. Achievable scan distances will depend on the step size selection.
Step Size	Sets the distance that the 3D motor travels between each B-Mode slice. Step sizes ranges between 0.04 mm and 0.50 mm. Smaller step size produces more image slices which generates a more detailed 3D Mode image, typically useful for detailed evaluations of structures Higher step size produces fewer image slices which generates a less detailed 3D Mode image, but typically suitable for quick evaluations of structure volumes The default value of the step size is based on the resolution of the transducer array
Persistence	Tap this button to toggle Persistence on or off. This option is disabled if persistence was not enabled in the base imaging mode.
Scan 10* Frames	This button displays the total number of 3D Mode frames the system will acquire. Tap this button to begin the 3D Mode scan. Note: *The number of frames equals the Scan Distance value divided by the Step Size value.

6 (Optional) In the Physiological panel set up your ECG signal and select either one or two ECG triggers, see "ECG Trigger" on page 128.

If two ECG triggers are selected, the system will acquire two frames of data for every 3D motor position. While reviewing your acquired image in the 3D Mode view, you will be able to toggle between each ECG trigger set of 3D Mode slices—T1 (diastole) and T2 (systole) buttons are to the right of the frame slider on the control panel.

Note: Dual ECG trigger can only be enabled when imaging in 3D B-Mode and Nonlinear Contrast 3D Mode.

7 Tap the **Scan** button to begin scanning. The system acquires the specified number of frames across the specified scan distance and displays the progress at the bottom of the image display.

8 When the 3D motor finishes acquiring the 3D Mode slices, the system positions the transducer at the center of its range. The acquired frames load into a 2D view.

9 After reviewing your frames in the 2D view, tap the **Load into 3D** button. The 3D Mode data loads into the 3D Mode four pane view.

Note: The 2D clip will be auto saved when the **Load into 3D** button is tapped.

Note: PA-Mode 3D (Multi-wavelength) images must be multiplexed or unmixed before the **Load into 3D** button is enabled.

10 Manipulate your data using the 3D Mode controls, see "3D Mode controls" on page 641. For more 3D Mode analysis tools, export your data to Vevo LAB, see "Exporting from the Study Browser" on page 252.

11 To review your image data later, tap **Save Clip**. Once you have done this, two images are saved—a clip of the base mode frames and the 3D Mode data. Go to **Current Series** or the **Study Browser** to view the saved images.

To automate this task, in the Save tab of the **Clip Settings**, tap to select the checkbox **3D Scan Completion**. See "Saving images" on page 690.

Acquiring a Nonlinear Contrast 3D Mode image with Dual ECG Trigger

Note: Dual ECG trigger can only be enabled when imaging in 3D B-Mode and Nonlinear Contrast 3D Mode.

To acquire a Nonlinear Contrast 3D Mode image with Dual ECG Trigger

1 (Optional) In the Physiological panel set up your ECG signal and select either one or two ECG triggers, see "ECG Trigger" on page 128.

If two ECG triggers are selected, the system will acquire two frames of data for every 3D motor position. While reviewing your acquired image in the 3D Mode view, you will be able to toggle between each ECG trigger set of 3D Mode slices—**T1** (diastole) and **T2** (systole) buttons are to the right of the frame slider on the control panel.

2 Acquire a Nonlinear Contrast Mode scan data during a 3D Mode scan.

3 Run the burst scan at each step along the motor track using the **Burst Scan** button only available on the 3D Mode panel while in Nonlinear Contrast Mode.

4 Then run a 3D Mode scan to acquire post-burst image data. This allows you to reconstruct a volume that integrates the Nonlinear Contrast Mode data

with the surrounding B-Mode 3D volume. See "Nonlinear Contrast 3D Mode image acquisition" on page 518.

Acquiring a PA-Mode 3D image

You can acquire a PA-Mode 3D (Single), PA-Mode 3D (Oxy-Hemo) and PA-Mode 3D (Multi-wavelength) image.

To acquire a PA-Mode 3D image

1 Initialize the 3D motor.

2 Tap **PA**.

3 Choose your PA-Mode sub–mode—PA-Mode (Single), PA-Mode (Oxy-Hemo) or PA-Mode (Multi-wavelength).

4 Position your region of interest within the Guide Area displayed on the image display. The PA Guide is on by default.

5 Tap the Cube tab.

6 Set your Scan Distance and Step Size in the 3D Scan section as described in "3D Mode image acquisition" on page 626.

7 Tap the **PA 3D Scan** button to begin scanning. The system acquires the specified number of frames, scan distance and wavelengths and displays the progress at the bottom of the image display.

8 When the 3D motor finishes acquiring the 3D Mode slices, the system positions the transducer at the center of its range. The acquired frames load into a 2D view.

9 After reviewing your frames in the 2D view, tap the **Load into 3D** button. The 3D Mode data loads into the 3D Mode four pane view.

Note: PA-Mode 3D (Multi-wavelength) images must have Multiplex Wavelengths enabled before the Load into 3D button is enabled.

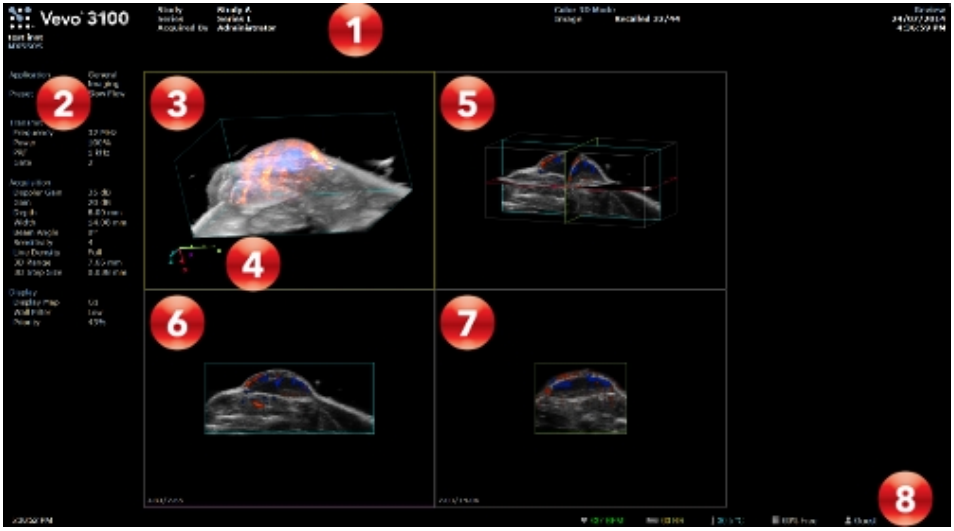
Note: The 2D clip will be auto saved when the **Load into 3D** button is tapped.

10 Manipulate your data using the 3D Mode controls, see "3D Mode controls" on page 641. For more 3D Mode analysis tools, export your data to Vevo LAB, see "Exporting from the Study Browser" on page 252.

11 To review your image data later, tap **Save Clip**. Once you have done this, two images are saved: a clip of the base mode frames, and the 3D Mode data. Go to **Current Series** or the **Study Browser** to view the saved images.

To automate this task, in the Save tab of the **Clip Settings**, tap to select the checkbox **3D Scan Completion**, see "Saving images" on page 690.

3D Mode image display



3D Mode image display:

1. Image status area
2. Mode settings panel
3. Cube view
4. Orientation indicator
5. Cross view
6. Transverse view
7. Sagittal view
8. Status bar

View panes area

The system defaults to four view panes (four pane view), but you can select two pane or one pane view by tapping the **View Panes** button. When you export a stored image and configure your export to send only the Image Area, this is the area of the window that the system exports.

Active pane selection

When you select a pane on the control panel, the corresponding pane on the image display will be outlined in yellow (see Cube view in the image above).

Each pane can be configured to show a different View Type. See "3D Mode controls" on page 641 for details.

Orientation indicator

In 3D Mode, when the cube view is active, an orientation indicator will be displayed. The indicator will rotate as the cube is rotated.

Image wireframe

Each image is surrounded by a wireframe that can be toggled on and off by tapping the **Wireframe** button.

3D Mode control panel

When the 3D Mode scan is complete, the data are shown in the 3D Mode view to review on the control panel.

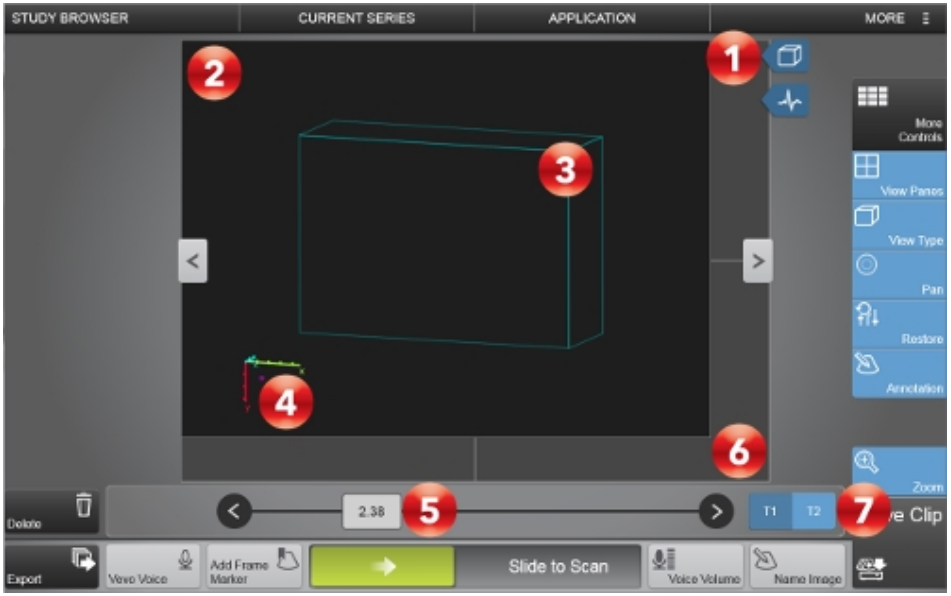


Image controls:

1. Cube tab
2. Active view pane
3. Cube wireframe
4. Orientation indicator
5. Frame slider
6. Inactive view pane
7. Dual ECG trigger

Cube tab

Access the 3D Mode panel by tapping the Cube tab.

The location of the Cube tab changes depending on whether you are in live or review mode.

- In acquisition, the tab is located on the left side of the control panel.
- In review, the tab is located on the right side of the control panel.

Dual ECG trigger

The T1 and T2 buttons are only available if both ECG signals were selected, see "ECG Trigger" on page 128.

The system acquires two frames of data for every 3D motor position—toggle between each ECG trigger set of 3D Mode slices by tapping the T1 and T2 buttons.

Note: Dual ECG trigger can only be enabled when imaging in 3D B-Mode and Nonlinear Contrast 3D Mode.

Using the pane view

You can choose how many panes to view at one time by tapping the **View Panes** button. Each pane can be configured to have a different View Type. When viewing more than one pane, only one pane will the be active pane.

The active pane will be highlighted in yellow on the image display and enlarged on the control panel, and will allow you to interact with the view in that pane. To switch the active pane, tap on a different pane on the control panel. The default view is four panes.

The view types you can choose from include:

- Cube View. Displays a three-dimensional view of the acquired data, constructed from the full set of image slices. The cube displays a blue wireframe by default.
- Cross View. Displays three single, image slice views presented on the x, y, and z planes. Each plane presents its own color outline.
    - Blue = x-y plane on the z axis
    - Green = y-z plane on the x axis
    - Red = x-z plane on the y axis
- Transverse View. Displays a straight-on perspective of the x-y plane image. This view is displayed on the Cross view as the plane outlined in blue.
- Sagittal View. Displays a straight-on perspective of the y-z plane image. This view is displayed on the Cross view as the plane outlined in green.
- Coronal View. Displays a straight-on perspective of the x-z plane image. This view is displayed on the Cross view as the plane outlined in red.

Working with 3D Mode images

When working with a 3D Mode image there are various ways to review the images using the control panel.

To step through image slices

You can step through each of the slices captured during the 3D Mode scan. Each slice corresponds to a frame.

You can step through an image in each view type.

1 In Cube and Cross views, touch the plane through which you want to move and drag along that plane. As you drag through the plane, the image in the image display updates to show the selected slice.

In Cross View the frame slider updates as you move through the image displaying the corresponding frame.

You can also step through the slices in these views using the frame slider.

2 In Transverse, Sagittal, and Coronal views, drag the frame slider.

To rotate an image

You can rotate an image when you are in Cube view and Cross view.

1 Tap a position outside the volume.

2 Drag in any direction.

To pan an image

You can pan an image in any view.

Note: While pan is on, you can not rotate the image. In Cube and Cross views when pan is on, you can only step though the slices using the frame slider.

1 Tap the **Pan** button.

2 Tap any position in the image area.

3 Drag in any direction.

4 Tap **Pan** again to turn panning off.

To zoom in on an image

You can zoom an image in all views. You can zoom when panning is on or off.

1 Tap a position anywhere in the image area and pinch outwards to zoom in.

2 Tap a position anywhere in the image area and pinch inwards to zoom out.

To move the 3D motor

In review, and in acquisition modes that do not support 3D Mode scans (i.e. non-frame based modes) the Motor Position panel can be used to move the motor.

- Tap the Cube tab to open the panel and do one of the following:

  a. Drag the Start or Stop controls to the required position for the next scan.

  b. Drag the motor position indicator to move the motor position.

  c. Tap the arrows at either end of the slider to move the motor position.

Note: To perform another 3D Mode scan, you must return to live scanning using the **Slide to Scan** slider.

3D Mode controls

The following table provides an overview of the controls that are available when reviewing a 3D Mode image.

If the listed control is not on the Imaging Controls bar, it will be in More Controls. You can customize which controls appear in the Controls bar, see "Customizing controls" on page 388.

3D Mode controls are only available while reviewing 3D Mode images after the 2D clip has been loaded into 3D by tapping the **Load into 3D** button. While many of the controls are the same regardless of the base mode, some controls only apply to a specific mode.

Some controls are related to generic measurements for this mode. See "3D Mode generic measurement" on page 649 for details.

3D Mode controls

Control
Annotation
Display Layout
Display Map
Optimize Render
Pan
Render Mode

3D Mode controls

Control
Restore
View Panes
View Type
Wireframe
Zoom

Tap **Annotation** to add annotations to your acquired or stored image. Select the desired text from the annotation page or enter custom text. See "Annotations" on page 265.

In 3D Mode, you can only add annotations to the cube view.

Use this control to change which data are being displayed on the image display. This does not affect the actual data collection and can be changed at any time during live scanning or review.

Tap the button and select one of the available options: **B-Mode Only**, **Both** or **Color/Contrast/PA Only**.

This control is not available in 3D B-Mode.

Allows a choice of predefined sets of overlays and image maps that you can apply any time during live scanning or review. Tap the **Display Map** control to see the available maps for the active imaging mode.

Use this control to adjust opacity and brightness of a rendered image.

This control will only be displayed if you tap **Render** after tapping the **Render Mode** button in **More Controls**.

To use this control, you must:

- Have the View Type set to Cube view in the active pane.
- Have the Render Mode set to Render for the cube view.

Tap **Optimize Render**, use the sliders, **Up/Down** or **50%** buttons to adjust the settings. The 50% button will reset the opacity and brightness slider back to their default values when tapped.

Note: In 3D B-Mode, PA-Mode 3D (Single), PA-Mode 3D (Oxy-Hemo), PA-Mode 3D (Multi-wavelength), Nonlinear Contrast 3D Mode, Color 3D Mode, Power 3D Mode and 4D-Mode the **Optimize Render** control is available in both the B-Mode tab and the tab for the overlay mode. The button in the B-Mode tab only affects the B-Mode data, the button in the overlay mode tab only affects the overlay mode data.

This control allows you to toggle the pan feature on and off. When enabled, you can drag the image data.

When pan is disabled, dragging has different effects depending on the view type. See "Working with 3D Mode images" on page 639.

Displays a list of rendering modes you can apply—Texture Mapping, Render, MIP (Max), MIP (Min).

Texture Mapping

Texture Mapping mode displays the surface texture of the 3D Mode image. Texture mapping mode is the default rendering mode for 3D Mode acquisition.

For 3D modes that apply color map overlays, the Threshold control becomes enabled.

Render

Render mode displays the full 3D Mode image in the Cube view. When you render the image the following occurs:

- The Cube view traces each line of the data, perpendicular to the display for the full image.
- The Optimize Render button becomes enabled.

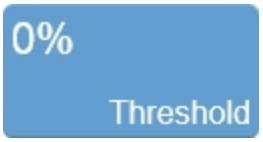
MIP (Max)

MIP (Max) (Maximum Intensity Persistence) enhances the contrast of an image by maximizing the brightest pixels in the image. Use this mode to better distinguish organs from their surrounding area when the organ objects are brighter than their surrounding structures.

MIP (Min)

MIP (Min) (Minimum Intensity Persistence) enhances the contrast of an image by minimizing the brightest pixels in the image. Use this mode to better distinguish organs from their surrounding area when the organ objects are darker than their surrounding structures.

Resets the original view of the 3D Mode image, including the orientation and zoom.



Threshold can be used to adjust the amount of color data that appears in images in the following modes: Color 3D Mode, Power Doppler 3D Mode, Nonlinear Contrast 3D Mode, PA-Mode 3D (Single), PA-Mode 3D (Oxy-Hemo) and PA-Mode 3D (Multi-wavelength).

Slide the control or use the **Up/Down** buttons to adjust the threshold. The color data on the 3D Mode image changes dynamically as you adjust the threshold level.

Note: Since the system calculates volumes based on the amount of color data in an area, thresholding affects the volume calculations. The higher you set the threshold, the lower the calculated area volume of color data will be. Volume measurements are only available in Vevo LAB; thresholding can also be changed on Vevo LAB.

Use this control to split the image display into one, two, or four viewing panes. This allows you to view multiple planes at the same time.

Use this control to change the type of view you are looking at in a particular pane. The options include **Cube**, **Cross**, **Transverse**, **Sagittal** and **Coronal**.

Toggles the appearance of the image outline on or off for the active pane (outlined in yellow).

Tap **Zoom**, then tap either **Zoom In** or **Zoom Out** . You can also use a two finger pinch gesture on the control panel to zoom in or a two finger spread action to zoom out.

3D Mode image analysis on Vevo LAB

These features are not available directly on the Vevo Imaging System. Your images need to be exported to Vevo LAB where you can use the following analysis tools, see "Vevo LAB" on page 100.

To create a Volume Measurement

In Cube view, the Volume Measurement accurately measures object volumes within an image. Volumes are created by segmenting a series of contours and calculating the volume within the contoured region.

You can create a Volume Measurement in B-Mode 3D (3D-Mode), Color 3D Mode, Power 3D Mode, PA-Mode 3D (Single), PA-Mode 3D (Oxy-Hemo), PA-Mode 3D (Multi-wavelength) using the Parallel and Rotational Method.

You can also create a Volume Measurement using the Multi-slice Method. On the Volume Measurement tab, choose either an Open (opened loop) or Closed (closed loop) style volume via the radio buttons, then click Start.

To sculpt an image

Use the Sculpting tool from the 3D Settings panel to cut away superfluous image data so you can view volumes of interest more easily. You can only use this tool when you are viewing a 3D Mode image in the Cube view.

To record a 3D Mode analysis session

The Record tool creates a real-time AVI file of actions you perform on 3D Mode image data in the active pane.

3D Mode generic measurement

3D Mode provides a Linear generic measurement tool. Additional 3D Mode measurements and advanced 3D Mode analysis tools are available on Vevo LAB.

To access the generic measurement for 3D Mode

Do one of the following:

a. If you are acquiring image data, complete a 3D Mode scan, load into 3D view and then tap the **Linear** measurement.

b. If you are in the Study Browser, open an image and then tap the **Linear** measurement.

.

Placing a measurement will automatically save the image.

The following generic measurement is available for 3D Mode images:

- Linear

4D-Mode

4D-Mode is a three dimensional EKV Mode (ECG-based Kilohertz Visualization) image of one complete cardiac cycle synthesized from B-Mode image data acquired at a high frame rate.

The software acquires EKV acquisitions at different 3D motor positions. Each EKV acquisition is a complete heart cycle. Thus we end up with complete heart cycles for each motor position creating a 4D-Mode clip of the entire heart cycle.

4D-Mode settings are optimized to produce high quality renderings in as short a time as possible.

When scanning in 4D-Mode , please note the following:

- You can use the 4D-Mode analysis tools as you do the 3D Mode analysis tools, only in 4D-Mode, these can now be applied across points of time.
- 4D-Mode is only available while you are acquiring data in B-Mode.
- While in modes that do not support 4D-Mode scanning, the Cube tab is still available to provide access to control of the motor position and 3D Mode controls.
- An ECG signal is required to acquire 4D-Mode images. If during an acquisition, the ECG signal fails, the software will stop acquiring data and a warning will be displayed with the option to resume scanning.

  Note: If Respiration Gating is enabled during acquisition but fails, the software will behave in the same way as an ECG signal failure.

- Scanning will not be allowed and a warning displayed if there is less than 4 GB of storage space left.

4D-Mode image acquisition

4D-Mode acquisition uses the existing 3D motor. See "3D Mode hardware setup" on page 621 to set up the motor and transducer for your imaging session.

Based on user-defined parameters, the 3D motor travels a set distance across the target object in a series of very small steps. The 3D motor, with the attached transducer, travels in a direction perpendicular to the imaging orientation.

At each step, the transducer acquires EKV data. Each EKV acquisition is a complete heart cycle. The software compiles each heart cycle into a 4D-Mode clip of the entire heart cycle.

Acquiring a 4D-Mode image

Use the control panel to remotely control the position of the transducer using the 3D motor. See "3D Mode hardware setup" on page 621.

The image acquisition process in 4D-Mode is automated, so you must optimize your image acquisition settings before you begin your 4D-Mode scan.

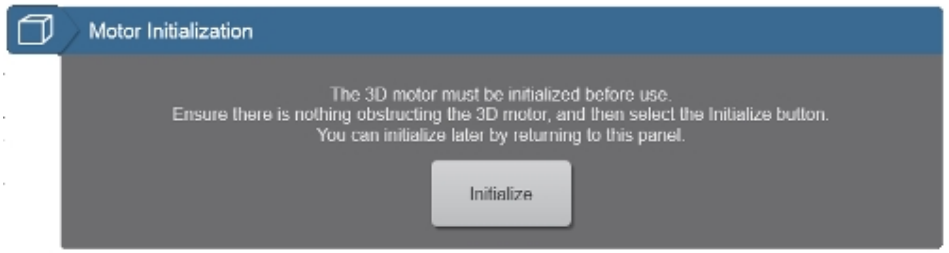
To acquire a 4D-Mode image

1 Ensure your ECG signal (between 200 BPM and 996 BPM) and Respiration signals (if using Respiration gating) are active and accurate. See "Physiological data sources" on page 117.

2 Begin acquiring data in B-Mode.

3 Tap the Cube tab to show the 4D Scan panel.

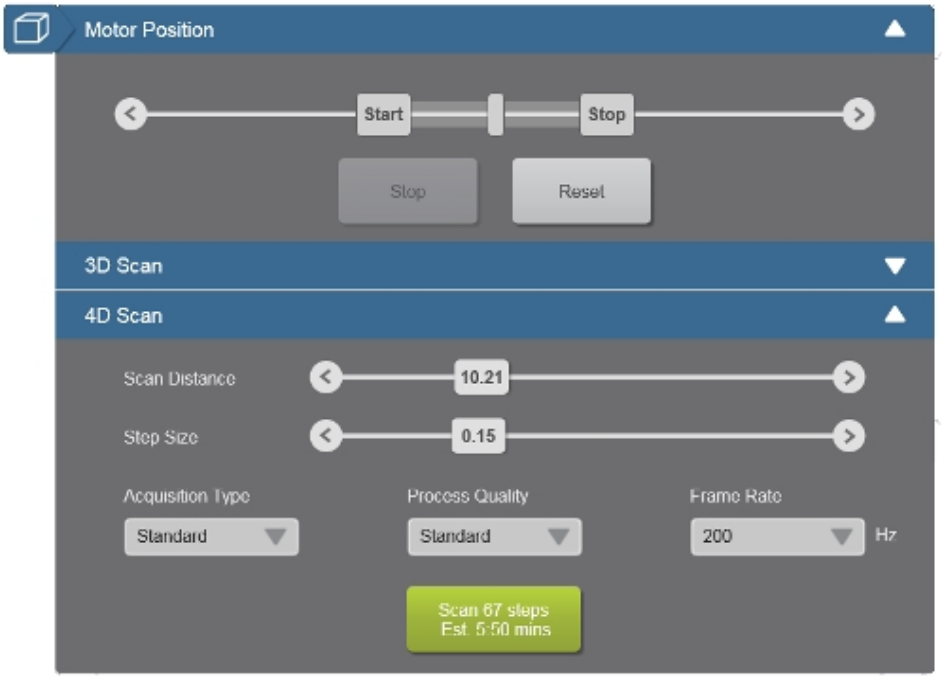
4 If the 3D motor has not been initialized previously, the system displays the 3D Motor initialization message. Ensure there is nothing obstructing the 3D motor, then tap **Initialize**.



A second message will be displayed to confirm initialization—tap **Initialize** or **Cancel**.

Caution: Ensure that the lateral movement of the 3D motor cannot injure the subject or damage the transducer.

5 Once the motor is initialized the setup panel is displayed.



6 In the Motor Position portion of the panel, slide the **Start** and **Stop** indicators to locate the object of interest and center it as closely as possible relative to the transducer.

- The motor only moves once you release the control, so, while it is moving, you can tap **Stop** to stop movement.
- Tap **Reset** to move the motor back to the center position.

7 In the 4D Scan portion of the panel, set your image parameters:

Parameter	Description
Scan Distance	Sets the distance (in millimeters) that the 3D motor will travel during the 4D-Mode image acquisition. Scan distance ranges between 0.53 mm and 37.99 mm. Achievable scan distances will depend on the step size selection.
Step Size	Sets the distance that the 3D motor travels between each EKV time point. Step sizes ranges between 0.04 mm and 0.50 mm. Smaller step size takes longer to acquire an image and produces more EKV time points which generates a more detailed 4D-Mode image (typically useful for detailed evaluations of structures). Higher step size produces fewer EKV time points which generates a less detailed 4D-Mode image, but typically suitable for quick evaluations of structure volumes. The default value of the step size is based on the resolution of the transducer array.
Acquisition Type*	Sets the acquisition type, select from Quick, Standard and Presentation.
Process Quality*	Sets the process, select from Sharp, Standard and Smooth
Frame Rate*	Sets the frame rate in Hz select from 100, 200 and 300.

Parameter	Description
Scan*	This button displays the total number of 4D steps and the estimated time it will take for the system to acquire them. Tap this button to begin the 4D-Mode scan. **Note:** *The number of steps equals the Scan Distance value divided by the Step Size value
**EKV Mode settings in 4D-Mode are different from EKV Mode settings in that they are optimized to produce high quality renderings in as short a time as possible.*	

8 Tap the **Scan** button to begin scanning. The system acquires the specified number of steps across the specified scan distance and displays the progress at the bottom of the image display.

Note: If you had multiple focal zones during your B-Mode scan before starting 4D-Mode, only a single average focal zone will be displayed on the image display.

9 When the 3D motor finishes acquiring the 4D-Mode images, the system positions the transducer at the center of its range.

10 The acquired 4D-Mode image is loaded into review and the Review Setup panel is shown, see "Saving EKV/4D data" on page 658. Select your post-processing tool settings.

An overlaid faded one cycle ECG trace will be displayed in the Physio panel on the image display—ECG will be the only trace displayed.

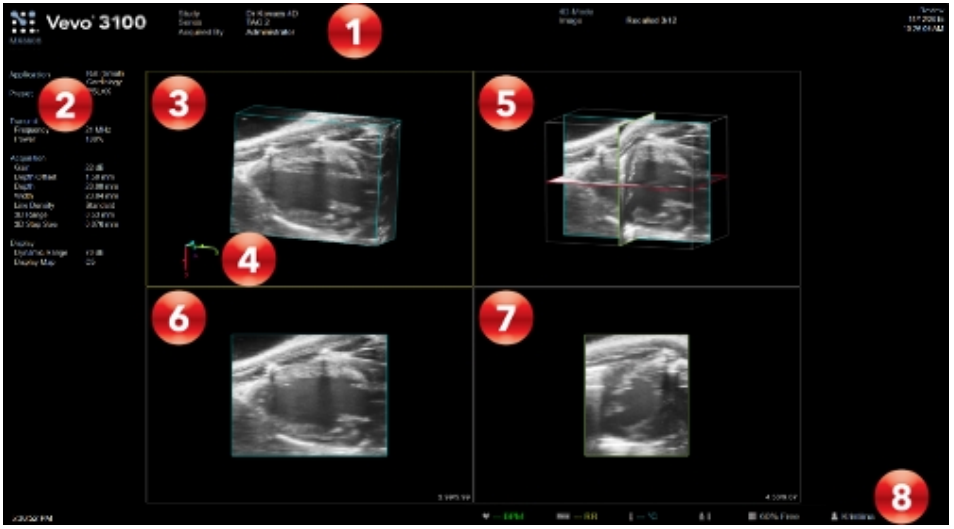
11 After processing and reviewing your frames in the 2D view, tap the **Load into 4D** button. The 4D-Mode image loads into the 4D-Mode four pane view.

Note: The 2D clip will be auto saved only when the **Load into 4D** button is tapped.

12 Manipulate your data using the 4D-Mode controls, see "4D-Mode controls" on page 666. For more 4D-Mode analysis tools, export your data to Vevo LAB, see "Exporting from the Study Browser" on page 252.

13 To review your image data later, tap **Save Clip**. Go to **Current Series** or the **Study Browser** to view the saved image.

4D-Mode image display



4D-Mode image display:

1. Image status area
2. Mode settings panel
3. Cube view

4. Orientation indicator
5. Cross view
6. Transverse view
7. Sagittal view
8. Status bar

View panes area

The system defaults to four view panes (four pane view), but you can select two pane or one pane view by tapping the **View Panes** button. When you export a stored image and configure your export to send only the Image Area, this is the area of the window that the system exports.

Active pane selection

When you select a pane on the control panel, the corresponding pane on the image display will be outlined in yellow (see Cube view in the image above).

Each pane can be configured to show a different View Type. See "4D-Mode controls" on page 666 for details.

Orientation indicator

In 4D-Mode, when the cube view is active, an orientation indicator will be displayed. The indicator will rotate as the cube is rotated.

Image wireframe

Each image is surrounded by a wireframe that can be toggled on and off by tapping the **Wireframe** button.

4D-Mode image review

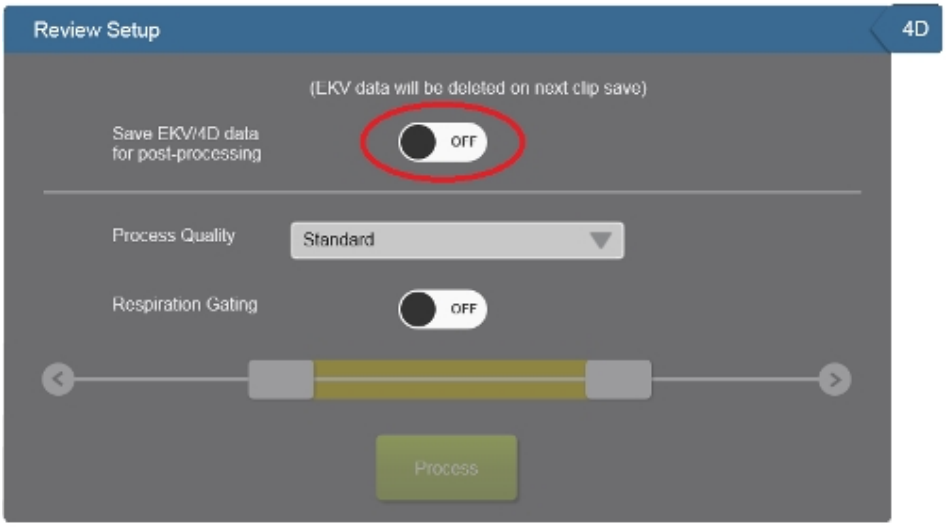
4D-Mode provides two image post-processing tools that help you refine your data:

- Process Quality
- Respiration Gating

Access these options through the 4D tab while reviewing a 4D-Mode image.

Saving EKV/4D data

If you have chosen to save the EKV/4D data, once you have optimized your clip, you can delete this extra data at any time. Open the image and enable the **Save EKV/4D data for post-processing** option on the Review Setup panel, accessed through the 4D tab in review. If this option is changed to off, the extraneous data will be deleted the next time you tap **Save Clip**.



To refine image detail quality

1 Acquire a 4D-Mode clip, or, from the Study Browser, open a 4D-Mode image.

2 Tap the **4D** tab to open the Review Setup panel.

3 Adjust the process quality as required using the **Process Quality** drop down.

Process Quality	Description
Sharp	Emphasizes quality of detail in each clip frame.
Standard	Emphasizes smoothness of movement through the clip.

Process Quality	Description
Smooth	Maximizes smoothness of movement through the clip.

4 Tap the **Process** button in the Review setup panel to re-process the 4D-Mode data.

To refine the image by adjusting the EKV respiration gate

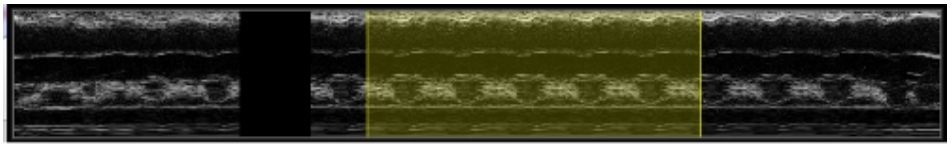
The natural act of respiration will affect the image slightly, as the position of the heart moves with the movement of the diaphragm and thoracic cavity.

Respiration Gating is an image processing tool you can use to reduce this effect. Based on the data acquired during a 4D-Mode scan, this gating tool gives you controls to select heart cycle data that is the least affected by respiration.

Typically, you do not need to directly adjust the respiration gating. For most acquisitions, it is sufficient to select the Process Quality settings in the 4D Scan panel during your scan setup. The refinement described in this section is most useful for complicated situations.

1 Tap the **4D** tab to open the Review Setup panel.

2 In the Respiration Gating section, enable the **Respiration Gating** option, if it is not already, and then adjust the slider handles. While adjusting the controls on the control panel, you will see the heart cycle data in the physiology data window to help guide the respiration gating. Slide the handles to move the window to cover the area where the effect of the movement of the thoracic cavity during respiration is minimized.



3 Tap the **Process** button in the Review Setup panel to re-process the 4D-Mode Data.

Adding generic 4D-Mode measurements

Measurements on a 4D-Mode image are the same as on a 3D Mode image. See "4D-Mode generic measurement" on page 672.

4D-Mode control panel

When the 4D-Mode scan is complete, the data are shown in the 4D-Mode view to review on the control panel.

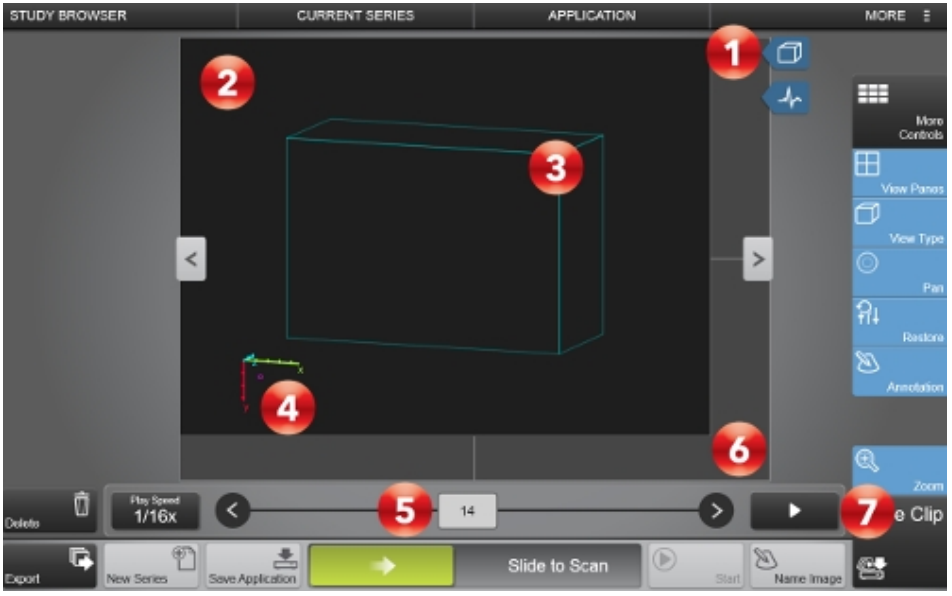


Image controls:

1. Cube tab
2. Active view pane
3. Cube wireframe
4. Orientation indicator
5. Frame slider
6. Inactive view pane
7. Play/Pause

To access the 4D-Mode panel

The location of the 4D-Mode tab changes depending on whether you are in live or review mode.

- In acquisition, the tab is located on the left side of the control panel.
- In review, the tab is located on the right side of the control panel.

Using the pane view

You can choose how many panes to view at one time using the View Panes button. Each pane can be configured to have a different View Type. When viewing more than one pane, only one pane will the be active pane. The active pane will be highlighted in yellow on the image display and enlarged on the control panel, and will allow you to interact with the view in that pane. To

switch the active pane, tap on a different pane on the control panel. The default view is four panes.

The view types you can choose from include:

- Cube View. Displays a three-dimensional view of the acquired data, constructed from the full set of image slices. The cube displays a blue wireframe by default.
- Cross View. Displays three single, image slice views presented on the x, y, and z planes. Each plane presents its own color outline.
    - Blue = x-y plane on the z axis
    - Green = y-z plane on the x axis
    - Red = x-z plane on the y axis
- Transverse View. Displays a straight-on perspective of the x-y plane image. This view is displayed on the Cross view as the plane outlined in blue.
- Sagittal View. Displays a straight-on perspective of the y-z plane image. This view is displayed on the Cross view as the plane outlined in green.
- Coronal View. Displays a straight-on perspective of the x-z plane image. This view is displayed on the Cross view as the plane outlined in red.

Working with 4D-Mode images

When working with a 4D-Mode image there are various ways to review the images using the control panel.

To step through a 4D-Mode image

You can step through each of the EKV time points captured during the 4D-Mode scan.

You can also step through the image in each view type.

1 In Cube and Cross views, touch the plane through which you want to move and drag along that plane. As you drag through the plane, the image in the image display updates to show the selected slice.

As you drag through the plane, the frame slider updates to display the corresponding frame.

Note: You can also step through the slices in these views using the frame slider.

2 In Transverse, Sagittal, and Coronal views, drag the frame slider.

To rotate an image

You can rotate an image when you are in Cube view and Cross view.

1 Tap a position outside the volume.

2 Drag in any direction.

To pan an image

You can pan an image in any view.

Note: While pan is on, you can not rotate the image. In Cube and Cross views, when pan is on, you can only step though the slices using the frame slider.

1 Tap the **Pan** button.

2 Tap any position in the image area.

3 Drag in any direction.

4 Tap **Pan** again to turn panning off.

To zoom in on an image

You can zoom an image in all views. You can zoom when panning is on or off.

1 Tap a position anywhere in the image area and pinch outwards to zoom in.

2 Tap a position anywhere in the image area and pinch inwards to zoom out.

To move the motor

In review, and in acquisition modes that do not support 4D-Mode scans (i.e. all except for B-Mode) the Motor Position panel can be used to move the motor.

- Tap the Cube tab to open the panel and do one of the following:

  a. Drag the Start or Stop controls to the required position for the next scan.

  b. Drag the motor position indicator to move the motor position.

  c. Tap the arrows at either end of the slider to move the motor position.

Note: To perform another 4D-Mode scan, you must return to live scanning using the **Slide to Scan** slider.

4D-Mode controls

The following table provides an overview of the controls that are available when reviewing a 4D-Mode image.

If the listed control is not on the Imaging Controls bar, it will be in More Controls. You can customize which controls appear in the Controls bar, see "Customizing controls" on page 388.

4D-Mode controls are only available while reviewing 4D-Mode images after the clip has been loaded into 4D-Mode view using the **Load into 4D** button.

Some controls are related to generic measurements for this mode. See "4D-Mode generic measurement" on page 672 for details.

4D Mode controls

Control
Annotation
Display Map
Optimize Render
Pan
Render Mode
Restore
View Panes

4D Mode controls

Control
View Type
Wireframe
Zoom

Tap **Annotation** to add annotations to your acquired or stored image. Select the desired text from the annotation page or enter custom text. See "Annotations" on page 265.

In 4D-Mode, you can only add annotations to the cube view.

Allows a choice of predefined sets of overlays and image maps that you can apply any time during live scanning or review. Tap the **Display Map** control to see the available maps for the active imaging mode.

Use this control to adjust opacity and brightness of a rendered image.

This control will only be displayed if you tap **Render** after tapping the **Render Mode** button in **More Controls**.

To use this control, you must:

- Have the View Type set to Cube view in the active pane.
- Have the Render Mode set to Render for the cube view.

Tap **Optimize Render**, use the sliders, **Up/Down** or **50%** buttons to adjust the settings. The 50% button will reset the opacity and brightness slider back to their default values when tapped.

This control allows you to toggle the pan feature on and off. When enabled, you can drag the image data.

When pan is disabled, dragging has different effects depending on the view type. See "Working with 4D-Mode images" on page 663.

Displays a list of rendering modes you can apply—Texture Mapping, Render, MIP (Max), MIP (Min).

Texture Mapping

Texture Mapping mode displays the surface texture of the 3D Mode image. Texture mapping mode is the default rendering mode for 3D Mode acquisition.

For 3D modes that apply color map overlays, the Threshold control becomes enabled.

Render

Render mode displays the full 3D Mode image in the Cube view. When you render the image the following occurs:

- The Cube view traces each line of the data, perpendicular to the display for the full image.
- The Optimize Render button becomes enabled.

MIP (Max)

MIP (Max) (Maximum Intensity Persistence) enhances the contrast of an image by maximizing the brightest pixels in the image. Use this mode to better distinguish organs from their surrounding area when the organ objects are brighter than their surrounding structures.

MIP (Min)

MIP (Min) (Minimum Intensity Persistence) enhances the contrast of an image by minimizing the brightest pixels in the image. Use this mode to better distinguish organs from their surrounding area when the organ objects are darker than their surrounding structures.

Resets the original view of the 4D-Mode image, including the orientation and zoom.

Use this control to split the image display into one, two, or four viewing panes. This allows you to view multiple planes at the same time.

Use this control to change the type of view you are looking at in a particular pane. The options include **Cube**, **Cross**, **Transverse**, **Sagittal**, and **Coronal**.

Toggles the appearance of the image outline on/off for all image views.

Tap **Zoom**, then tap either **Zoom In** or **Zoom Out** . You can also use a two finger pinch gesture on the control panel to zoom in or a two finger spread action to zoom out.

4D-Mode image analysis on Vevo LAB

Your images need to be exported to Vevo LAB to access the following analysis tools. See "Vevo LAB" on page 100.

To create 4D-Mode volume measurements

In Cube view, the 4D-Mode Volume tool accurately measures object volumes within an image. Volumes are created by segmenting a series of contours and calculating the volume within the contoured region.

To sculpt an image

Use the Sculpting tool in 4D-Mode to cut away superfluous image data so you can view volumes of interest more easily. You can only use this tool when you

are viewing a 4D-Mode image in the Cube view.

To record a 4D-Mode analysis session

The Record tool creates a real-time AVI file of actions you perform on 4D-Mode image data in the active pane.

An option to record a playback through different volumes will be available for 4D-Mode image data only.

4D-Mode generic measurement

4D-Mode provides a Linear generic measurement tool. Additional 4D-Mode measurements and advanced 4D-Mode analysis tools are available on Vevo LAB.

To access the generic measurement for 4D-Mode

Do one of the following:

a. If you are acquiring image data, complete a 4D-Mode scan, load into 4D-Mode view and then tap the **Linear** measurement.

b. If you are in the Study Browser, open an image and then tap the **Linear** measurement.

.

Placing a measurement will automatically save the image.

The following generic measurement is available for 4D-Mode images:

- Linear

EKV Mode

EKV Mode (ECG-based Kilohertz Visualization) is an image reconstruction process that produces a one-heart-cycle clip synthesized from B-Mode image data acquired at a high frame rate.

By acquiring data over multiple heart cycles and extracting data at specific time points, EKV-mode produces a clip that is representative of a typical heart cycle.

EKV Mode is not a source image acquisition mode. Rather, EKV Mode takes the data that you acquire in a source imaging mode and then processes it into the representative one-heart-cycle clip.

To analyze an EKV Mode image, you use the same analysis tools that you would use to analyze an image in B-Mode.

Note: EKV acquisition is only available from B-Mode.

EKV Mode image acquisition

You must have physiological data for this mode. For detailed information on installing and using the Vevo Imaging Station refer to the Vevo Integrated Rail System III Operator Manual. Also see the "Physiology" on page 116 section.

Note: If the respiration signal fails during EKV acquisition, the acquisition will stop and all data will be discarded. A warning message is displayed on the control panel with a **Resume Scanning** button; tapping **Resume Scanning** will begin acquisition in B-Mode.

Acquiring an EKV image

To acquire an EKV image

1 Ensure your ECG signal (between 200 BPM and 996 BPM) and Respiration signals are active and accurate. See "Physiological data sources" on page 117.

2 Tap **B-Mode** and adjust the controls as needed. See "B-Mode controls" on page 420.

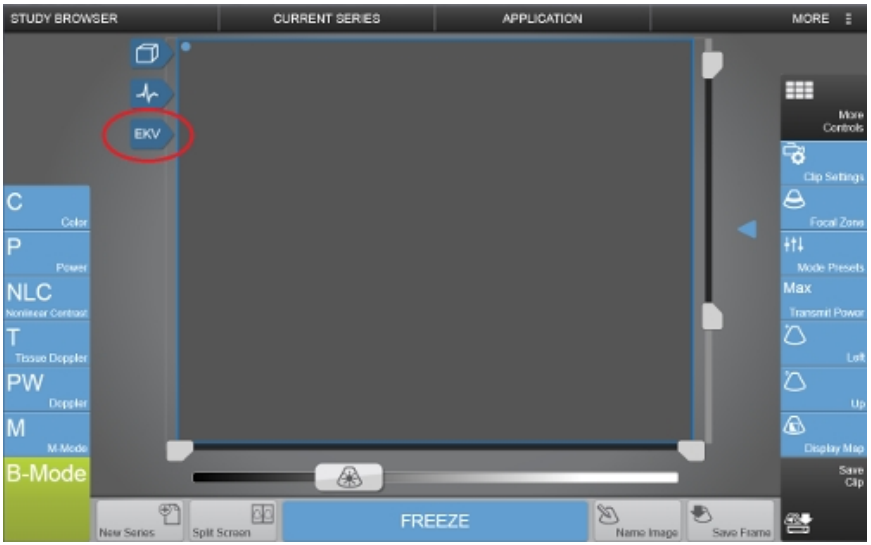
3 Tap **Clip Settings**, then tap one of the following on the Save tab:

a. Save EKV/4D data for post-processing. If this option is unchecked, the data will not be available for post-processing once the clip is saved. This is set to off by default, as the EKV data sets are very large.

b. EKV/4D Scan Completion. If this option is checked, the data will be saved as soon as the scan is complete. If the "Save EKV/4D data for post-processing" option is unchecked and the image is saved, you will not be able to post-process the data.

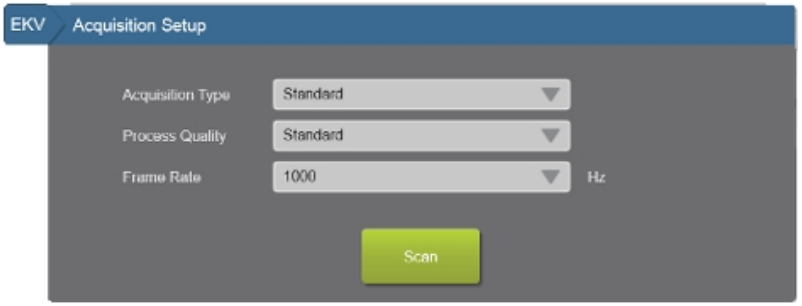
Note: The "Save EKV/4D data for post-processing" option is on by default. You can change this option for each individual acquisition in the EKV post-processing panel after the acquisition.

4 When you have completed your image optimizations and refinements tap the **EKV** tab.

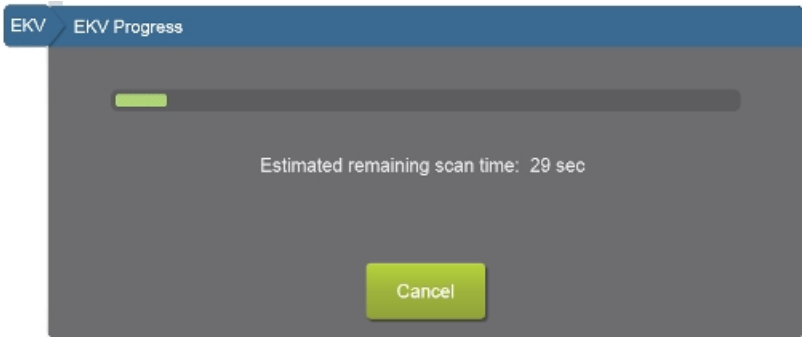


5 The EKV Acquisition Setup panel appears. Tap the tab to toggle the appearance of the panel. The following options are available:

Acquisition Type	Quick – Adjusts settings to produce a quality EKV image very quickly. Standard – Adjusts settings to produce a good quality EKV image at the default speed. Presentation – Adjusts settings to produce a high-quality EKV image as quickly as possible.
Process Quality	Sharp – Emphasizes quality of detail in each clip frame. Standard – Emphasizes smoothness of movement through the clip. Smooth – Maximizes smoothness of movement through the clip.



6 Tap the **Scan** button in the Acquisition Setup panel. The panel changes to the EKV Progress panel and a progress bar tracks the completion of the scan.

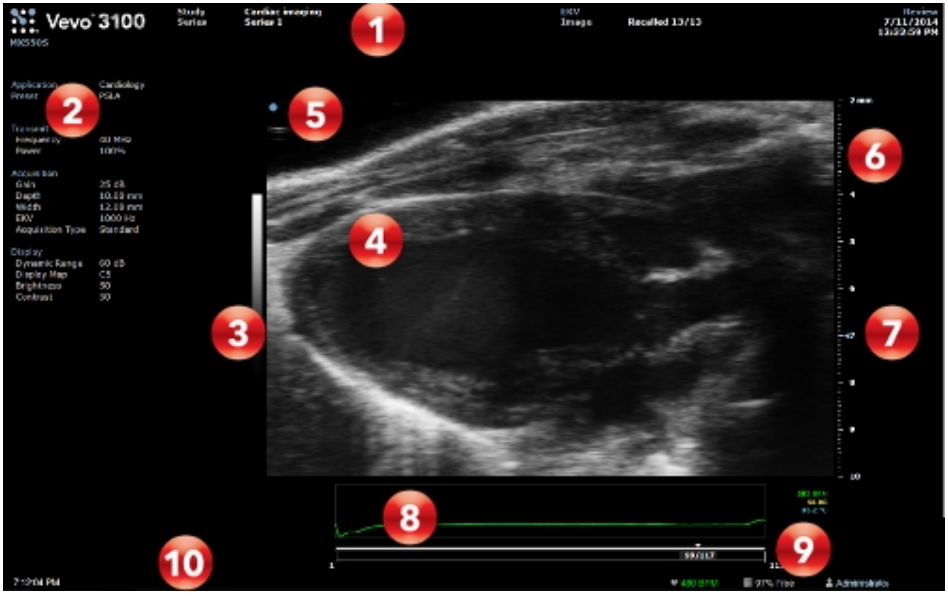


7 When the scan is done, the system completes the process of synthesizing all the images of the heart cycles into one heart cycle clip. During this process, a progress bar appears in the lower-left corner of the image display, as well as on the control panel.

Once the image processing is completed the system displays the EKV-averaged one-heart-cycle clip, in review mode. See "EKV Mode image review" on page 678.

8 If you are satisfied with the clip, store your data using **Save Clip**.

EKV Mode image display



EKV Mode image display:

1. Image status area
2. Mode settings panel
3. Display map
4. Image area
5. Transducer orientation indicator
6. Image scale
7. Focal zone indicator
8. Physiological data trace

9. Clip buffer
10. Status bar

Physiological data trace

When working in EKV, the image display is exactly as shown above, except that the physiological data trace will display the EKV-average over one-hear-cycle per clip.

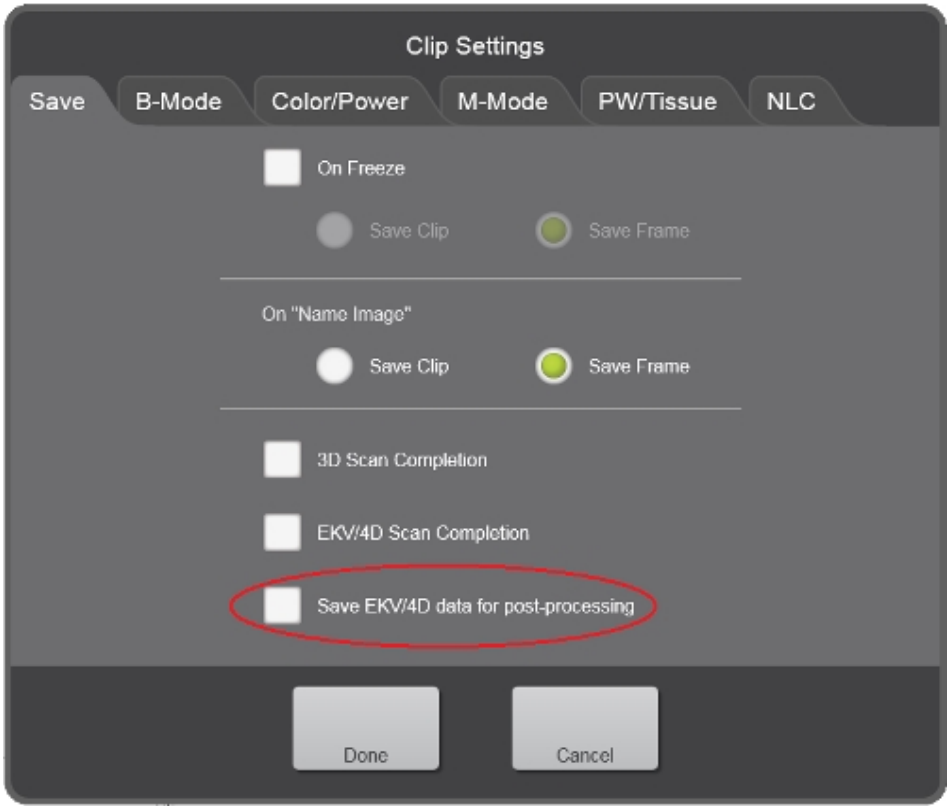
EKV Mode image review

EKV Mode provides two image post-processing tools that help you refine your data:

- EKV processing quality
- EKV respiration gate adjustment

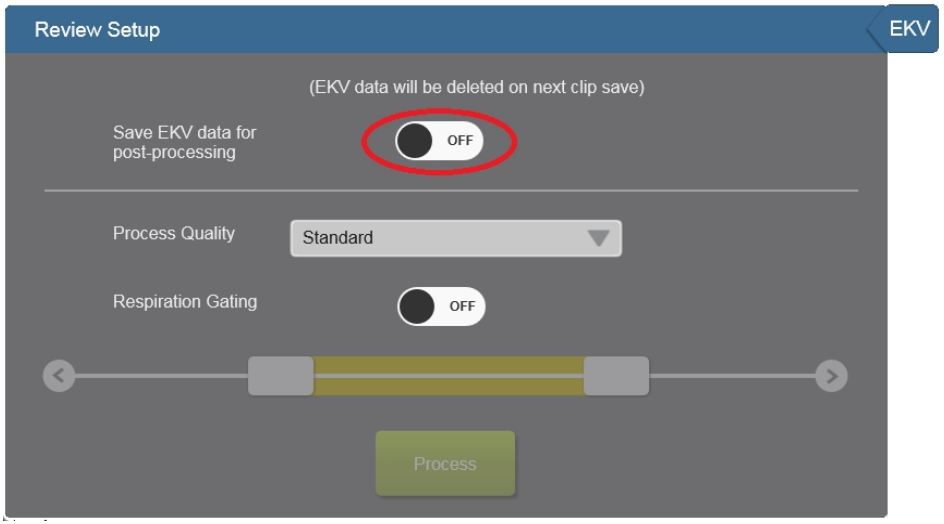
Access these options through the EKV tab while reviewing an EKV image.

Note: The EKV tab will not be available with the option for "Save EKV/4D data for post-processing" set to off in Clip Settings.



Saving EKV data

If you have chosen to save the EKV data, once you have optimized your clip, you can delete this extra data at any time. Open the image and enable the Save EKV data for post-processing option on the Review Setup panel, accessed through the EKV tab in review. If this option is changed to off, the extraneous data will be deleted the next time you tap Save Clip.



To refine image detail quality

1 Acquire an EKV clip, or, from the Study Browser, open an EKV image.

2 Tap the **EKV** tab to open the Review Setup panel.

3 Adjust the process quality as required using the **Process Quality** drop down.

Process Quality	Description
Sharp	Emphasizes quality of detail in each clip frame.
Standard	Emphasizes smoothness of movement through the clip.

Process Quality	Description
Smooth	Maximizes smoothness of movement through the clip.

4 Tap the **Process** button in the Review setup panel to re-process the EKV data.

To refine the image by adjusting the EKV respiration gate

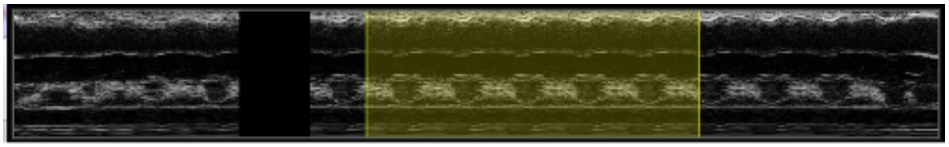
The natural act of respiration will affect the image slightly, as the position of the heart moves with the movement of the diaphragm and thoracic cavity.

The EKV respiration gate is an image processing tool you can use to reduce this effect. Based on the data acquired during an EKV Mode scan, this gating tool gives you controls to select heart cycle data that is the least affected by respiration.

Typically, you do not need to directly adjust the respiration gating. For most acquisitions, it is sufficient to select the Process Quality settings in the EKV Acquisition Setup panel during your scan setup. The refinement described in this section is most useful for complicated situations.

1 Tap the **EKV** tab to open the Review Setup panel.

2 In the Respiration Gating section, enable the **Respiration Gating** option, if it is not already, and then adjust the slider handles. While adjusting the controls on the control panel, you will see the heart cycle data in the physiology data window to help guide the respiration gating. Slide the handles to move the window to cover the area where the effect of the movement of the thoracic cavity during respiration is minimized.



3 Tap the **Process** button in the Review Setup panel to re-process the EKV Data.

Adding generic EKV measurements

Measurements on an EKV image are the same as on a B-Mode image. See "B-Mode generic measurements" on page 432.

RF Mode

Digital RF-Mode provides data in RF, Raw and IQ format for further analysis. Digital RF-Mode allows users to acquire, digitize and view the RF data from the high-frequency ultrasound signal.

The data can be envelope-detected and log-compressed to then be exported in a range of file formats, including a Raw data file. The envelope format is a useful way of storing raw data that correlates exactly to what is seen in the B-Mode image and is readily available for image processing applications.

RF-Mode data acquisition is available for all modes, except AM-Mode, EKV Mode and 4D-Mode.

RF Mode image acquisition

When RF-Mode is enabled, the image display shows the envelope signal from the gray scale data as an A-scan line appearing in yellow at the position in the image indicated by the red arrow at the top of the field of view.

Saturation of the image is evident in the A-scan line as a plateau in any of the peaks; saturation is also indicated on the image by a blue overlay. The overlay is displayed together with the A-scan line and can be disabled using the RF Display button.

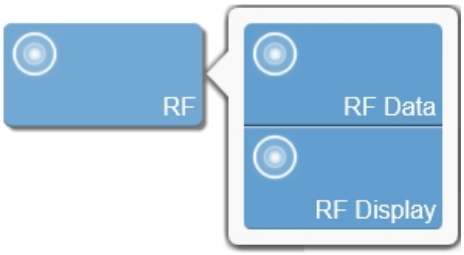
In the time-based modes, the A-scan line will be associated with the image in the B-Mode scout window, however the data in the B-Mode scout window is not saved as part of the RF data set.

The name of the active mode will be prefaced with 'RF' on the screen label to indicate that you are in RF-Mode.

To acquire an image in RF mode

1 Begin imaging in your required mode.

2 Tap the **RF** control, and then tap the **RF Data** flyout button. You can also tap the **RF Display** button if you want to see the envelope signal, A-scan line, and RF overlay.



Note: When reviewing images, only the **RF Display** button is available. It is only enabled when an image was acquired with RF data. The button acts as a toggle and allows the display of the RF data to be turned on or off.

3 Adjust your image settings for the mode you are imaging.

4 Save the image for later review by tapping **Save Clip**. See "Saving images" on page 690.

5 Tap the **RF Data** button to turn RF off or tap **Freeze**, to stop scanning.

Note: It is recommended that the RF data acquisition not be set to on at all times as the files size is significantly larger than the regular file size (approximately 3 times larger).

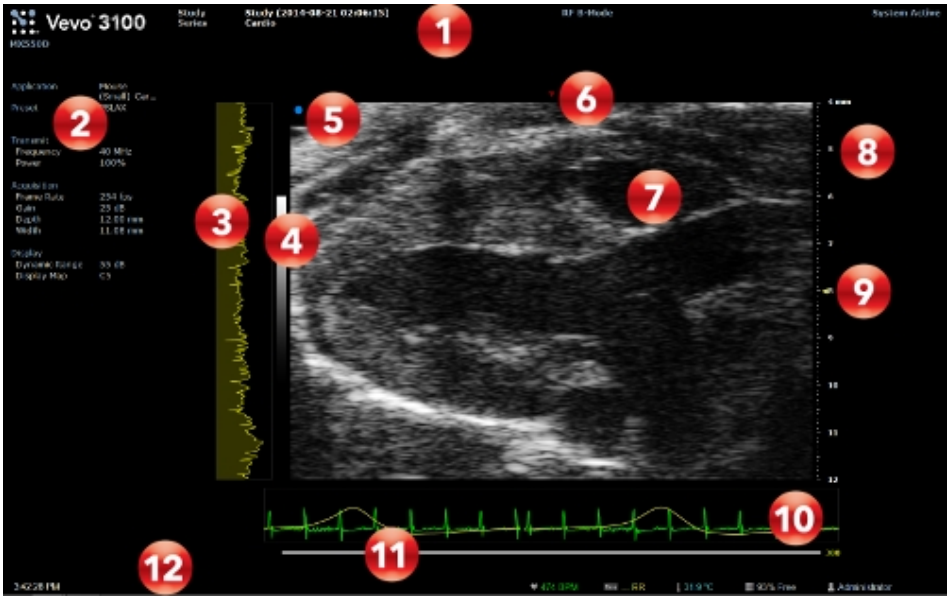
Acquiring RF data is similar to acquiring images without RF data, enter the mode of interest and ensure that RF-mode is enabled; the data are acquired

by using Scan/Freeze, and is saved by tapping the Save Clip or Save Frame buttons on the control panel.

The RF data are saved for all the data lines in the image, 512 lines when the Line Density is set to High, and 256 lines if the Line Density is set to Standard.

Reviewing images with RF is the same as reviewing the image in the base mode—meaning RF B-Mode is the same as B-Mode.

RF Mode image display



RF B-Mode image display:

1. Image status area
2. Mode settings panel
3. RF signal envelope

4. Display map
5. Transducer orientation indicator
6. A-Scan line indicator
7. Image area
8. Image scale
9. Focal zone indicator
10. Physiological data trace
11. Clip buffer
12. Status bar

When working in RF mode, the image display is exactly as shown in Scanning with the following exceptions:

RF signal envelope

The RF signal displays in the envelope signal from the gray scale data as an A-scan line appearing in yellow at the position in the image indicated by the red arrow at the top of the field of view. This information is only shown when the RF Display is enabled along with the RF Data.

A-scan line indicator

The A-scan line is indicated as a red arrow on the image display. This information is only shown when the RF Display is enabled along with the RF Data.

RF overlay

A blue overlay is displayed on the acquired image. Saturation is also indicated on the image by a blue overlay. This information is only shown when the RF Display is enabled along with the RF Data.

RF Mode image review

To review images acquired in RF Mode

Reviewing images with RF is the same as reviewing the image in the base mode (i.e RF B-Mode is the same as B-Mode).

The 'RF Display' button is available when reviewing images. It is only enabled when an image was acquired with RF data. The button acts as a toggle and allows the display of the RF data to be turned on or off.

RF Mode image export

RF data files can be exported from open images or directly from the Study Browser by tapping the **Export** button.

To export RF Mode data

1 On the Export page in the System Settings, select the desired RF data file format. Depending on the source mode that was acquiring data when you

began acquiring in RF Mode, the following file formats will be available:

- RAW data file (*.raw.xml). Data file used to display the log compressed data as gray scale.
- RF data file (*.rf.xml). Reconstructed RF data - most useful when the original frequency information is required.
- IQ data file (*.iq.xml). The IQ data format can be used for analysis as the most unprocessed data format. This format is required for Doppler processing and phase analysis. The IQ format also provides the highest bit resolution of the 3 data formats. The data are organized as 'IQ' pairs with the 'Q' value leading the 'I' value.

2 In the Study Browser, select the images you want to export.

3 Tap **Export**. The Export Image window appears.

4 Browse to, and then select, the folder that will contain the export.

5 (Optional) To add a subfolder, tap **New Folder**, name the folder and then tap **OK**.

6 Tap **Export**. The system exports the files to the folder you selected.

Freeze

Before performing certain tasks, such as viewing a clip or adding measurements, you need to stop live imaging by freezing the image.

To freeze the image

- Tap **FREEZE**.

The buttons on the controls bar will change. See "Customizing controls" on page 388.

To continue live imaging

- Drag or swipe the **Slide to Scan** slider to the right.

Saving images

You can save images as a frame or a clip. You can also save a frame from a clip.

When you save a frame or clip during live imaging, saving will happen in the background while the scanning will continue uninterrupted.

When the system saves the image, a message will be displayed at the bottom of the image display as follows:

Button	Message
Save Frame	Frame Stored.
Save Clip	Clip Stored.
Start Recording	Recording—displayed during the save. Clip Stored—displayed when save is complete. **Note:** Available for frame-based modes—B-Mode, Color Doppler Mode, Power Doppler Mode, Nonlinear Contrast Mode, PA-Mode (Single), PA-Mode (Oxy-Hemo) and PA-Mode (Multi-wavelength).

When the system saves the image, it will also provide an audible saving tone. When tapping **Save Frame** or **Save Clip**, only one audible saving tone is

heard. When tapping **Start Recording**, one audible saving tone is heard when the save begins and another when the save is complete. See "General" on page 171 to set your system sounds.

To review saved images for the current series, tap **Current Series**. For closed series, you must access the images from the **Study Browser**.

Saving frames or clips

An image can be saved during live scanning or from an acquired image by tapping **Save Frame** or **Save Clip**. The Save Clip control is permanently docked in the lower right corner of the control panel.

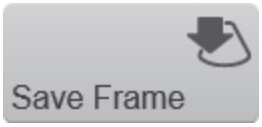
If the Save Frame button is not available, you can configure the system to display it. Tap **More Controls** and then tap the **General** tab. See "Customizing controls" on page 388.

You can also save a frame-based image—B-Mode, Color Doppler Mode, Power Doppler Mode, Nonlinear Contrast Mode, PA-Mode (Single), PA-Mode (Oxy-Hemo) and PA-Mode (Multi-wavelength)—by tapping **Start Recording**. If the Start Recording button is not available, it can also be found on the General tab in More Controls.

To save an image while scanning

Select one of the following options:

a. To save only the frame, tap **Save Frame**.



Save Frame can be used to save a frame from an acquired or saved clip, as well as saving a frame during imaging.

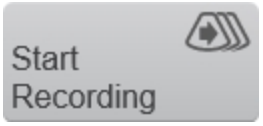
Note: **Save Frame** only saves a frame for frame-based modes and saves a clip for time-based modes.

b. To save a clip, tap **Save Clip**.

This button can be used to save a clip while scanning (including existing data in the buffer), save an acquired clip after tapping **Freeze**, and re-saving a clip with new parameters (i.e. changing the display map or brightness).

Note: Placing measurements or annotations on a clip automatically saves the clip.

c. To record a frame-based clip, tap **Start Recording**.



Tap **Start Recording** button to clear the buffer, record or acquire, then save the number of frames specified for that mode.

Tap **Stop Recording** to save the acquired truncated data. The system will continue to scan while saving.

To capture and save a clip

1 Ensure that clip settings are set as desired. See "Saving images" on page 690.

2 Tap **Freeze**.

3 (Optional) To trim the clip, tap **Clip Sub-range** and drag the sliders that appear on the Clip Slider to the desired position. Tap **Crop & Save**.

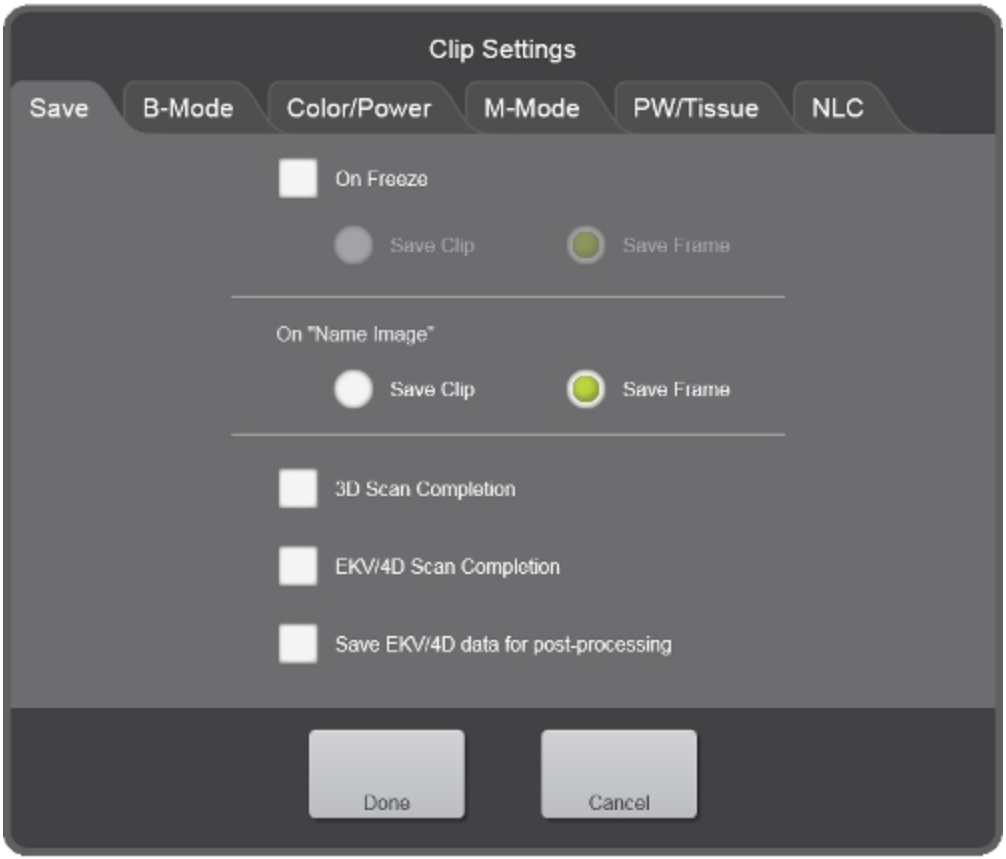
4 Tap **Save Clip**.

Configuring Clip Settings

To configure Clip Settings

1 Tap **Clip Settings**.

The Clip Settings control is available in the General controls as well as in each imaging mode. If this control is not on the Controls bar, tap **More Controls**. See "Customizing controls" on page 388.



2 Tap the Save tab and set the following as required:

Control	Description
On Freeze	Select either a Clip or Frame to be automatically saved when you use the Freeze button.
On "Name Image"	Select either a Clip or Frame to be saved when you name your image. Use the Name Image button during scanning or in review. **Note:** This will not affect time based imaging modes.
3D Scan Completion	If this option is selected, 3D clips are saved once all frames/steps have been acquired.
EKV/4D Scan Completion	Automatically saves an EKV/4D scan upon completion if this option is selected and the Save EKV data for post-processing option is off.
Save EKV/4D data for post-processing	Sets the default for this option in the Review Setup EKV/4D panel. If this option is not selected and EKV/4D Scan Completion is selected, you will not be able to adjust your EKV/4D data once the scan is complete.

3 Tap any of the mode tabs in the Clip Settings panel to see the available options.

For frame-based modes you have the following options:

- Specify a number of **Frames** (up to 100).
- Save **Maximum Frames**. If you select the **Maximum Frames** option, then the system will save the highest number of frames possible. The number of frames depends on the imaging parameters.

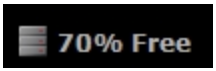
For the time-based modes you have the following option:

- Specify the length of your clip (in seconds).

4 Tap **Done** to save your changes and close the panel.

Managing internal storage space

The space available icon, located in the system status area at the bottom of the image display shows the percentage of space available in internal storage.



If you try to save an image when space is low, the system alerts you that internal storage is low and prompts you to delete data from the system.

Appendices

This section contains product safety information, specifications and the specific details that are required by regulatory agencies. Additionally some basic troubleshooting information and Technical Support information is provided in these appendices.

Vevo 3100 Imaging System safety

Note: This product has been tested to the safety requirements of CAN/CSA-C22.2 No. 61010-1-12, EN 61010-1:2010, ANSI/ISA-61010-1 (82.02.01), and UL 61010-1.

This section contains information required by regulatory agencies, including information about the ALARA (as low as reasonably achievable) principle, the output display standard, acoustic power and intensity tables, and other safety information. The information applies to the ultrasound system, transducer, accessories, and peripherals for a Vevo 3100 Imaging System.

Please read the safety information before using the Vevo 3100 Imaging System. The following information applies to the Vevo 3100 Imaging System and supporting equipment.

This equipment is intended to be used by qualified research scientists.

Read all warnings and cautionary notes carefully before you use this equipment.

Warning: The safety information in this section applies to the Vevo LAZR-X Imaging System as it uses a Vevo 3100 Imaging System with a Class 4 laser. However, you are also required to read the safety section for the Vevo LAZR-X Imaging System in the section for "Vevo LAZR-X Imaging System safety" on page 709 before you begin acquiring data with the Vevo LAZR-X Imaging System.

Product safety and electrical testing

FUJIFILM VisualSonics products tested

The following equipment has been tested:

- Vevo 3100 Imaging System
- FUJIFILM VisualSonics transducers: MX201, MX250, MX250S, MX400, MX550D, MX550S, MX700
- 3D Motor
- 3-Step Foot Pedal

Electrical safety testing

The system complies with the following laboratory equipment standards related to electrical safety as follows:

- CAN/CSA-C22.2 No. 61010-1-12
- EN 61010-1:2010 (3rd Edition)
- ANSI/ISA-61010-1 (82.02.01)
- UL 61010-1 (3rd Edition)

Electromagnetic compatibility

The system complies with the electromagnetic compatibility (EMC) limits as per the following standards:

- IEC 61326-1:2012 / EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use - electromagnetic compatibility
- EN 55011:2009/A1:2010, CISPR 11:2003/A1:2004, Class A Group 1 - Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
- ICES-003:2004 – Digital Apparatus, Spectrum Management and Telecommunications Policy
- Interference-Causing Equipment Standard (Canada)
- FCC Part 15 Subpart B:2012

Test laboratories

CSA Group
178 Rexdale Blvd.
Toronto, Ontario, Canada M9W 1R3
Tel: +1 (416) 747-4000
Toll-Free: +1 (800) 463-6727

Inquiries

Send any questions to:

Product Safety and Testing
Quality Assurance and Regulatory Affairs
FUJIFILM VisualSonics, Inc.
3080 Yonge Street, Suite 6100, Box 66
Toronto, Ontario, Canada, M4N 3N1
Tel: +1 (416) 484-5000

Toll-Free: 1-866-416-4636 (North America)
Fax: +1 (416) 484-5001
www.visualsonics.com/support/scientific-support
www.visualsonics.com/support/technical-support

Authorized representative

Europe

Atlantic Bridge Limited
Atlantic House
PO Box 4800
Earley, Reading, Berkshire
RG5 4GB, England
Tel :+44 (0) 118.969.7047
Fax: +44 (0) 118 901 4411
Website: www.atlanticbridge.co.uk

Contact: Mr. Phillip Wicks

E-mail: phwbusiness@btconnect.com

Compliance

The Vevo 3100 complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. The Vevo 3100 Class A digital apparatus complies with Canadian ICES-003.

Warnings

Warning: THIS EQUIPMENT IS NOT APPROVED FOR USE ON HUMANS. The Vevo 3100 Imaging System has been designed and tested for use on laboratory research animals. This equipment must not be used on any living human being.

Warning: Where available, always use the lowest power settings necessary to obtain diagnostically acceptable images.

High levels of transmitted ultrasound energy can damage tissue. Never tamper with or alter the Vevo 3100 Imaging System in any way such that the acoustic power level is increased.

Warning: Use ONLY FUJIFILM VisualSonics MX series transducers with the Vevo 3100 Imaging System. The use of other transducers may affect safety and system performance.

Electric shock

Warning: Before connecting the Vevo 3100 Imaging System to the mains, verify that the specified voltage on the safety label matches the power source voltage.

An incorrect power source voltage could cause an electrical hazard and could cause serious damage to the equipment.

Warning: Before connecting the Vevo 3100 Imaging System to the mains, always check that the mains cable is undamaged.

Warning: Do not remove any panels from the Vevo 3100 Imaging System. Do not remove the outer transducer housing.

Service to the system is to be performed by qualified personnel only. No user-serviceable parts are located inside the system.

Any internal adjustments, replacements or modifications to the Vevo Imaging System electronics or to the transducers should be made only by qualified FUJIFILM VisualSonics Technical Support Representatives.

Warning: If the system is not properly grounded or earthed, it becomes a possible electrical shock hazard. Protection against electrical shock has been provided through an isolation transformer and chassis grounding via a plug to an appropriate power source.

DO NOT remove the ground wires from any part of the Vevo 3100 Imaging System for any reason.

Warning: Ensure that all power sources, whether a UPC or a wall outlet, are properly grounded or earthed.

Warning: Disconnect the system from the power source before cleaning the system or performing any maintenance operations.

Warning: Connection of equipment not authorized by FUJIFILM VisualSonics to the Vevo 3100 Imaging System isolation transformer could result in an electrical hazard.

Warning: Do not immerse the transducer in coupling medium beyond the lowest ring on the transducer housing.

The housing of the transducer is not watertight. If the transducer is immersed beyond the lowest ring on the transducer housing, the electrical safety features may be compromised.

Warning: DO NOT spray or drip any liquid onto the system as this could affect reliable operation and electrical safety.

Warning: Before connecting the system ensure the voltage is correct. Ensure the power cable is undamaged before plugging the system directly into the wall outlet. Do not connect the system's power supply to an MPSO or extension cord.

Electromagnetic interference

Warning: The Vevo 3100 Imaging System should never be used where safety could be affected by the malfunction of medical devices.

The Vevo 3100 Imaging System is designed for use in preclinical laboratories and is not cleared for use with or in the vicinity of active medical devices. High levels of electromagnetic energy may interfere with the operation of the Vevo 3100 Imaging System. Furthermore, the Vevo 3100 Imaging System could affect the safe operation of sensitive medical devices.

Warning: The Vevo 3100 Imaging System system has been found to temporarily lose touch screen functionality during 430 kHz~2 MHz common-mode noise injection on the AC mains. FUJIFILM VisualSonics recognizes system's sensitivity to this kind of noise and assures users that such a loss of the touch screen capability doesn't affect core ultrasound imaging functionality of the system. This phenomenon is qualified as permissible loss of performance for the Conducted Immunity test as per IEC 61326-1:2012, Table 1.

Caution: To avoid the risk of increased electromagnetic emissions or decreased immunity, use only accessories and peripherals recommended by FUJIFILM VisualSonics. Connection of accessories and peripherals not recommended by FUJIFILM VisualSonics could cause your ultrasound system to malfunction or cause other medical electrical devices in the area to malfunction.

Caution: The use of accessories, transducers and cables other than those specified (with the exception of transducers and cables sold by FUJIFILM VisualSonics as replacement parts for internal components) may result in increased emissions or decreased immunity of the Vevo 3100 Imaging System.

Chemicals

Warning: If any part of the Vevo 3100 Imaging System is in contact with hazardous chemicals or biological materials, appropriate precautions must be taken by all who come into contact with the Vevo 3100 Imaging System until the device is declared completely free of harmful contamination.

Cart movement

Warning: The Vevo 3100 Imaging System is both delicate and heavy.

Careless moving and rough handling can damage the system and cause injury to others (e.g., rolling over feet, colliding with people or walls). Never use the system if there is damage to the cart, cables or accessories.

Warning: Do not position the cart and its accessories in a way that makes it difficult to disconnect the plug from the socket.

Warning: To avoid possible injury from an unexpected image display collapse during system transport, collapse the image display before system transport.

HDMI video output

Warning: FUJIFILM VisualSonics recommends against using a monitor other than the image display provided by FUJIFILM VisualSonics. Only the images presented on the image display are validated for the intended use of the device.

Warning: For added protection, use an isolation transformer between the connecting device and AC power.

Ergonomics

Warning: The height of the Vevo 3100 Imaging System is not adjustable. Users who find standing at the system uncomfortable may require an adjustable chair or stool.

Warning: Users may find hand-scanning with the MX series transducers uncomfortable if scanning uninterrupted for long periods of time. Users are recommend to use the transducer mounting system if they experience discomfort. Contact FUJIFILM VisualSonics for more information.

Cautionary notes

This manual includes a broad range of cautionary notes.

Radiation

Caution: The use of controls or adjustments or performance of procedures in ways other than those specified in this manual may result in hazardous radiation exposure.

Vevo 3100 Imaging System Safety labels

The following table describes the safety symbols used on the system cart.

Symbol	Publication	Description
	IEC 60417 - 5031	Alternating current
	IEC 60417 - 5019	Protective earth (ground)
	IEC 60417 - 5007	On (supply)
	IEC 60417 - 5008	Off (supply)
	ISO 7000 - 0434	Caution, consult accompanying documents

Symbol	Publication	Description
	WEEE directive 2012/19/EU	European Union WEEE (Waste Electrical and Electronic Equipment) Directive. Identifies the directive on waste electrical and electronic equipment.

Physical hazards

Caution: Watch out for strained and twisted cables.

Some of the optional accessories have long cables. Take care when working around the cables.

Caution: FUJIFILM VisualSonics recommends that the Vevo 3100 Imaging System be pushed by one person from behind and guided by another person in front, using the handles. Please use caution when going up or down ramps. Keep the system upright during transport.

Ensure that the castors are locked when the Vevo 3100 Imaging System is not being transported.

Never lift the system using the handles

Caution: Watch out for pinching from the adjustable monitors. Both the control panel and image display monitors can be adjusted. When moving the system, or adjusting these monitors, take care near these moving parts to ensure safety.

Magnetic field sensitivity

Caution: DO NOT situate the Vevo 3100 Imaging System close to large clinical magnets as the magnetic fields may affect the performance of the Vevo 3100 Imaging System and cause distortion in the acquired image.

Labeling and verification

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference; and
- This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

Caution: Changes or modifications not expressly approved by FUJIFILM VisualSonics could void the user's authority to operate the equipment.

Vevo LAZR-X Imaging System safety

The Vevo LAZR-X Imaging System includes a Class 4 laser, this is the highest and most dangerous classification. When working in a room with a laser, take precautions to reduce the possible exposure to both direct and reflected beams.

Diffuse and specular beam reflections can cause severe eye and skin damage. Infrared radiation can pass easily through the cornea, which focuses it onto the retina, where it can cause instant and permanent damage or even blindness. Even small doses of exposure to scattered radiation can be harmful.

For a complete listing of laser safety standards, FUJIFILM VisualSonics recommends reading the *American National Standard for the Safe Use of Lasers* and implement necessary precautions (ANSI Z136.1-1986). Contact the Laser Institute of America for more information.

Warning: If the laser is altered for any reason, you assume the risk that is associated with a Class 4 laser. Maintenance is only allowed to be performed by a FUJIFILM VisualSonics Service Technician. See "Technical Support" on page 732.

Laser safety precautions

Laser radiation: Wear laser protective eyewear of sufficient optical density and suitable wavelength to protect the eyes from the maximum energy produced. Direct eye contact with the laser beam can cause permanent eye damage.

Laser radiation: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Warning: Never look directly into a laser beam or its reflection. Visual alignment of these sources shall not be attempted while the power supply is energized. Permanent damage to the eye can occur.

Caution: This laser must be located in a locked area with access only to authorized personnel.

Caution: If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Caution: Keep all unnecessary personnel out of the work area. Remove all shiny reflective surfaces (including rings, watch bands, metal pencils etc.) and all flammable materials with their containers from the work area.

Caution: The area must be marked by well-defined warning signs and off limits to unauthorized personnel.

Caution: Operate lasers under the supervision of qualified personnel only. When not in use, shut down laser completely.

Caution: Keep the laser firing area well lit so that the pupils of worker's eyes will be normally constricted. This reduces the amount of light entering the eye and lessens the chance of eye damage.

Caution: A fire-resistant background should be in place behind target areas. The surrounding areas should be coated with a material that absorbs any scattered radiation that might occur.

Caution: Tracking of individuals, vehicular traffic, aircraft or any airborne objects by means of laser radiation is prohibited.

Caution: Never leave the laser running unattended.

Caution: Be sure that there are no volatile substances in the lab that the laser could ignite.

Product safety

Government and industry regulations

The Vevo LAZR-X Imaging System laser has been designed to meet 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50 dated 06/24/07 published by the U.S. Department of Health & Human Services Center for Devices & Radiological Health, and EN 60825-1: (current Edition) Safety of Laser Products - Part 1.

CDRH declaration of conformity

The Vevo LAZR-X Imaging System laser has been designed to meet 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50 dated 07/26/01 the radiation safety product report has been filed with CDRH. An accession number will be provided to the end user upon request.

Electrical safety testing

The Vevo LAZR-X Imaging System complies with the following Class 4 laser device and laboratory standards related to electrical safety as follows:

- EN 61010-1:2010 (General requirements)
- EN 60825-1 (Safety of laser products - Equipment classification and requirements)
- EN 61326-1:2013 (EMC General requirements)

- EN 61000-3-2 (Harmonics)
- EN 61000-3-3 (Flicker)
- EN 61000-4-2 (ESD)
- EN 61000-4-3 (RF Immunity)
- EN 61000-4-4 (EFT)
- EN 61000-4-5 (Surge)
- EN 61000-4-6 (Conducted Immunity)
- EN 61000-4-11 (Voltage Dips and Interruptions)

Optical Safety

Laser radiation: Eye safety is the greatest concern. Be aware at all times that this is a Class 4 laser, the highest and most dangerous classification. Specular reflections from the main beam off a polished surface can cause sever eye damage. The Laser Safety Officer (LSO) will use the following information to provide the required protection.

Wavelength (nm)	Nominal Optical Diameter (µm)	Maximum Permissible Exposure	Nominal Ocular Hazard Distance
1064	6.1	50 mJ/m^2	15.17 km
532	6.8	41.4 J/m^2	210 m

Laser radiation: Be sure that the light from the flashlamp is obscured from the eye as it is damaging if viewed directly.

Laser radiation: Be sure that there are no volatile substances in the imaging room which the laser could ignite.

Laser radiation: Mark the imaging room well with warning signs when the laser is operating and provide interlocks for all doors.

Electrical safety

Warning: To prevent accidents from electrical shock, ensure that the capacitors are completely discharged and the power is turned off before performing any cleaning or disinfecting to the laser. Electric shock and burns resulting from input power or capacitor discharge can cause serious injury or death.

Warning: Be aware that high voltages are present in the laser heads once AC power is turned on.

Caution: Ensure the ambient temperature around the laser (which may be higher than the room temperature) is within the limit specified for the laser.

Caution: Ensure there is sufficient airflow around the laser.

Caution: Ensure electrical circuits are not overloaded; consider the nameplate rating of all the connected equipment and make sure you have over current protection.

Caution: Ensure the equipment is properly grounded.

Caution: Ensure no objects are placed on top of the laser.

Safety features

Dangerous laser radiation and high voltage is present when the Vevo LAZR-X Imaging System is active. There are covers that need to be in place to protect the operator from stray radiation and electrical high voltages. These safety features should not be defeated except by trained Service Technicians in a controlled environment.

Interlocks

The laser has interlock switches which stop it from firing when:

- laser head (rod) temperature is too high.
- laser head cover is open.
- cooling water flow is too low.
- external interlock (if installed) is open.

All interlocks must be OK before the laser will fire. If any interlock is tripped, including the external interlock, the amber INTERLOCK LED will light and laser firing will stop. The interlock must be reset before the laser can be restarted.

You may also wire your laser so that opening a door to the laser imaging room (or opening any other switch) will shut off the laser.

Laser covers

The LAZR-X laser has a safety cover over the optics area. This cover must be in place during normal operation.

Shutters

An intracavity shutter is present that interrupts the beam and prevents lasing.

There is also a shutter at each of the two fiber ports to block the laser radiation when a fiber is not plugged in. Never try to open them if a fiber is not plugged in.

Beam dump

There is a beam dump at each side of the laser. They must be in place to block invisible and visible laser radiation.

Safety labels

The following table describes the safety symbols used on the laser.

Symbol	Publication	Description
	IEC 60417 - 5007	On (supply).
	IEC 60417 - 5008	Off (supply).
	EN 61010-1:2010 EN 61000-4-5 EN 61000-4-6 EN 61000-4-11	Indicates the presence of high voltage which may pose a danger to the user or equipment. disconnect the power supply before servicing the system.

Symbol	Publication	Description
	IEC 60825-1	Class 4 lasers are hazardous under both intrabeam and diffuse reflection viewing conditions. They may cause also skin injuries and are potential fire hazards.
	IEC 60825-1	Caution, possible laser radiation exposure.
	ISO 7000 - 1641	Caution, consult accompanying documents.
	WEEE directive 2012/19/EU	European Union WEEE (Waste Electrical and Electronic Equipment) Directive. Identifies the directive on waste electrical and electronic equipment.

Vevo 3100 Imaging System specifications

This section describes the specifications of the three major components of the system that are most relevant to users and facility managers.

Environmental specifications

The Vevo Imaging System operating environment should be free of fumes, dirt, and electrical interference.

Specifications	Value
Temperature	10° to 40° C (50° to 104° F)
Relative humidity	15% to 80% non-condensing
Altitude	Up to 2000 m

Physical dimensions

Specifications	Value
Height (with monitor folded)	122 cm (48 in)
Width	54 cm (21 in)
Depth	68 cm (27 in)
Weight	95.44 kg (210 lbs)

Ensure that sufficient clearance is available around the system for adequate airflow and cooling. Do not block the air vents or air filters.

Electrical specifications

FUJIFILM VisualSonics manufactures the Vevo Imaging System to operate with AC line voltages of 100 V, 120 V, and 240 V. The electrical configuration of the system is noted on the safety label.

- 100 V~, 50/60 Hz, 6 A
- 120 V~, 50/60 Hz, 5 A
- 240 V~, 50/60 Hz, 2.5 A

Warning: Before having the system installed, ensure that the electrical service in the facility is adequate. Do not modify the attachment plug or use an adapter. Doing so may cause an electrical hazard.

Warning: Use only power cords provided by FUJIFILM VisualSonics with the Vevo LAZR-X Imaging System.

Vevo LAZR-X Imaging System specifications

This section describes the specifications of the three major components of the system that are most relevant to users and facility managers.

Environmental specifications

The Vevo LAZR-X Imaging System laser has been tested for temperatures in the range of 18-28° C (64.4-82.4°F).

The operating environment should be free of fumes, dirt, and electrical interference.

Physical dimensions

Specifications	Value
Height	78.5 cm (30.9 in)
Width	29.5 cm (11.6 in)
Depth	56.3 cm (22.2 in) not including handle 63.4 cm (25 in) including handle
Weight	79.4 kg (175 lbs)

Ensure that sufficient clearance is available around the system for adequate airflow and cooling. Do not block the air vents or air filters.

Electrical specifications

- 100 V~, 50/60 Hz, 18 A
- 120 V~, 50/60 Hz, 15 A
- 200-240 V~, 50/60 Hz, 8 A

Warning: Before having the system installed, ensure that the electrical service in the facility is adequate. Do not modify the attachment plug or use an adapter. Doing so may cause an electrical hazard.

Warning: Use only power cords provided by FUJIFILM VisualSonics with the Vevo Imaging System: 10 A rating for 100 V/120 V/240 V supply voltage

Laser emission classification

The LAZR-X is a Class 4 Laser.

Vevo LAZR-X Imaging System laser specification

Description		Specification
Repetition rate		20 Hz
Signal	Tuning range	680 - 970 nm
	Energy	≥ 50 mJ @ 750 nm ≥ 36 mJ @ 680 - 970 nm
	Pulse-pulse stability	≤ 5% RMS
	Pulse width	≤ 10 ns
Idler	Tuning range	1200 - 2000 nm
	Energy	≥ 10 mJ @ 1200 - 2000 nm
	Pulse width	≤ 10 ns

Troubleshooting

If a problem is encountered when using the Vevo Imaging System, try the solutions described in this appendix. If none of the solutions solve the problem, contact a FUJIFILM VisualSonics Technical Support Representative. See "Technical Support" on page 732.

Performing maintenance procedures not described in the user manual may void the product warranty.

System troubleshooting	
Problem	Solution
System does not power up	• Ensure that the main power cable for the system is properly connected to the Vevo Imaging System. • Ensure that the system is plugged into a grounded/earthed wall outlet. Turn the main power switch on. • If you still cannot power on the system, the fuses will need to be replaced. Contact FUJIFILM VisualSonics to schedule a service technician.

System troubleshooting	
Problem	Solution
No audio	• For keyboard and saving tones, adjust their slider controls in the General page in System Settings. • For PW Doppler Mode, adjust the volume level by using the **Volume** control found on the PW Doppler Mode controls page found in **More Controls**. You can also adjust any PW Doppler settings (such as the PW Doppler angle, the Doppler Gain, the Sample Volume Position) to increase the strength of the PW Doppler signal. • Ensure there is nothing connected to the headphone jack on the side of the image display. When the headphone jack is used, the internal speakers and HDMI audio will be disabled.

Laser troubleshooting	
Problem	Solution
Laser does not power up	• Use only the plug that was sent with laser and ensure it is plugged into a dedicated, interference-free grounded/earthed wall outlet. • Ensure the voltage of the wall outlet is correct for the laser. • Do not plug the power cord into an MPSO or extension cord. • Ensure the main power switch beside the power cord connector is in the on position. • Ensure the key switch is in the Enable position. • Press the laser power on button (confirm that the laser panel 'Power on' LED is lit).
Laser energy low	• A laser energy bar is displayed at the bottom of the image display. When the energy bar turns white, the laser will need to be optimized. This process is done by Technical Support.
Laser does not fire	• If using a LAZRTight and the transducer interlock cable, you must ensure that the LAZRTight doors are properly closed.

LAZRTight troubleshooting	
Problem	Solution
Laser light on side panel is blinking/off	• One of the interlocks is open and/or not engaged. Check that the doors are closed properly, baffles are secure and t he transducer interlock cable is attached.

Study Browser troubleshooting	
Problem	Solution
Unable to create new studies	• Ensure that a transducer is connected to the front panel of the Vevo Imaging System, and ensure that it has been initialized.
Unable to commit a study session	• Ensure that a user has been specified.
Unable to delete an study/series/image	• The study/series/image could be pending or in process of being background data transferred. To stop Background Data Transfer, go to Export in System settings and turn Background Data transfer off.

B-Mode and M-Mode troubleshooting	
Problem	Solution
Lack of penetration or sensitivity	• Ensure that there is adequate coupling medium (for example, ultrasound gel) between the transducer and the animal. • Adjust the position of the TGC sliders. • Ensure the appropriate transducer is being used.

EKV Mode troubleshooting	
Problem	Solution
EKV acquisition stops	• Check your ECG signal to see if the signal is still valid. • If you have enabled Respiration Gating during acquisition, check if the Respiration signal is still valid.

PW Doppler and PW Tissue Doppler Mode troubleshooting	
Problem	Solution
Aliasing in the PW Doppler Mode acquisition	• Decrease the Doppler Angle. • Adjust the Baseline setting.
Signal appears to be low intensity	• Adjust the Doppler Gain setting.

PW Doppler and PW Tissue Doppler Mode troubleshooting	
Problem	Solution
Signal exhibits saturation	• Lower the Doppler Gain setting.
Low frequency noise level in PW Doppler acquisition is high	• Increase the Wall Filter* setting.
Noise appears in the image	• Adjust the Sample Volume size and position such that it includes tissue only.
**Not available in PW Tissue Doppler*	

3D Mode troubleshooting	
Problem	Solution
Can't initialize the motor	• Ensure that the cable for the 3D motor stage is connected to the rear panel. • Ensure that the motor is positioned such that there are no objects obstructing the path of the transducer during initialization.

3D Mode troubleshooting	
Problem	Solution
Expected data are not acquired	• Ensure the transducer is oriented correctly, with the arm of the transducer moving perpendicular to the direction of travel of the 3D motor. • Ensure that the Range and Step Size settings are adequate for acquiring the desired amount of data. • Ensure that the transducer is tightly connected to the port on the front of the cart.

4D-Mode troubleshooting	
Problem	Solution
EKV acquisition stops	• Check your ECG signal to see if the signal is still valid. • If you have enabled Respiration Gating during acquisition, check if the Respiration signal is still valid.
Can't initialize the motor	• Ensure that the cable for the 3D motor stage is connected to the rear panel. • Ensure that the motor is positioned such that there are no objects obstructing the path of the transducer during initialization.

4D-Mode troubleshooting	
Problem	Solution
Expected data are not acquired	• Ensure the transducer is oriented correctly, with the arm of the transducer moving perpendicular to the direction of travel of the 3D motor. • Ensure that the Range and Step Size settings are adequate for acquiring the desired amount of data. • Ensure that the transducer is tightly connected to the port on the front of the cart.

Color and Power Doppler Mode troubleshooting	
Problem	Solution
Color bands in the image	• Enable Respiration Gating. • Adjust Wall Filter setting. • Adjust the Priority settings.
Respiration artifacts in the image	• Enable Respiration Gating. • Adjust Wall Filter setting.
Lack of sensitivity	• Ensure the anatomy being studied is in the focal zone for the transducer.

Color and Power Doppler Mode troubleshooting	
Problem	Solution
Lack of penetration or sensitivity	• Ensure that there is adequate coupling medium (for example, ultrasound gel) between the transducer and the animal. • Adjust the position of the TGC sliders. • Increase the Transmit Power. • Ensure the appropriate transducer is being used.

PA-Mode troubleshooting	
Problem	Solution
No PA signal	• Check all connections from the system to the laser as follows: System / Laser Trig Out / Q Trig In Trig In / Lamp Sync Out USB / RS232/Remote

PA-Mode troubleshooting	
Problem	Solution
PA signal is poor	• Select the appropriate port for your imaging session (Signal 680-970 nm, Idler 1200-2000 nm). • Select the appropriate Vevo Fiber Jacket and Vevo Optical fiber for your transducer. See "Transducers" on page 85. • Ensure the transducer fiber optic ferrule is pushed into the port as far as it can and that the lever lock is down. • Adjust the PA Gain and TGC sliders.
PA-Mode (Oxy-Hemo) button is disabled	• PA-Mode (Oxy-Hemo) is not available when using the Idler (1200-2000 nm) laser port.

Physiological Data troubleshooting	
Problem	Solution
No ECG signal is displayed	• Ensure the ECG cable is connected to the physiological monitoring and control system, and the keyed end of the cable is connected to the Vevo cart.
ECG signal appears flatlined	• Ensure that the ECG monitor is producing a strong, consistent signal.

Physiological Data troubleshooting	
Problem	Solution
ECG signal is poor	• Ensure that all of the animal's limbs are secured to the ECG pads on animal platform. • Ensure that no gel has leaked onto any of the contacts on the animal platform. • Ensure that there is no 50/60 Hz noise source near the animal platform (for example a lamp or a power cable).
Blood pressure signal is not accurate	• Calibrate the blood pressure signal. • Check calibration in Physiology panel. • Check positioning and operation of blood pressure catheter.

Customer Support

Scientific Support

General information, product details, application support, operator instructions or training:

Phone	+1.416.484.5000 +31 20 808 2913 (Europe)
Toll-free	+1.866.416.4636 +800 0751 2020 (Europe)
Email	www.visualsonics.com/support/scientific-support
Email (training)	www.visualsonics.com/support/contact-sales/training-request

Technical Support

Performing maintenance procedures not described in the user manual may void the product warranty.

TheTechnical Support Representative can help you troubleshoot the situation by phone or by email. For more complex problems, FUJIFILM VisualSonics may:

- Send a Technical Support Representative to the location to evaluate the problem.

- Request that the equipment be transported to the FUJIFILM VisualSonics service department.

Phone	+1.416.484.5000
Toll-free	+1.866.416.4636
Email	www.visualsonics.com/support/technical-support
Website	www.visualsonics.com
Europe service center	FUJIFILM SonoSite - Amsterdam Joop Geesinkweg 140 1114 AB Amsterdam The Netherlands Tel (Main): +31 20 808 2913 Tel (Toll-free): +800 0751 2020

Remote assistance

After contacting FUJIFILM VisualSonics Technical Support, you may be asked to participate in a remote assistance session with support personnel. A list of available Customer Service Representatives will be listed in the *Representatives* section in the Vevo Imaging System's Help in the Technical Support section. Launch the remote assistance tool by tapping the name that support personnel sent you.

System maintenance

The Vevo 3100 Imaging System and Vevo LAZR-X Imaging System require proper care and cleaning. Use the recommendations in this document when

cleaning or disinfecting the ultrasound system. See "Cleaning and disinfecting" on page 736 for more information.

FUJIFILM VisualSonics requires that service technicians clean the Vevo Imaging System air filters once every three months. Contact a FUJIFILM VisualSonics Technical Support Representative for more information. See "Technical Support" on page 732.

Performing maintenance procedures not described in the user guide may void the product warranty. Please contact "Technical Support" on page 732 should you have any questions or concerns with the maintenance of your system.

Moving the system

Move the system carefully. Be especially alert when you move the system along inclined passages.

Warning: Before you complete the following step(s), ensure that the main power is Off and that there is no connection to any AC outlet for both the Vevo 3100 Imaging System and laser (if applicable).

Use the following precautions when you move the system

- Turn the system/laser off and disconnect the power cord and any other cords. Secure loose cables.
- Disconnect the transducers, remove any fiber jacket/optical fibers, remove the transducer connector from the transducer connector storage and store them in the supplied packaging.
- Unlock the castors.
- Use the handles to move the system/laser.

- Do not use the handles to lift the system/laser.
- Do not allow the system/laser to strike walls or door frames.
- Use care when moving the system/laser off ramps or elevators.
- Lock the castors when the system/laser is to remain stationary.

Caution: Care should also be taken when handling heavy items, as it is easy to crush limbs when lifting or moving them.

Disposal

This equipment must be disposed of in accordance with current local regulations.

Should there be any queries about any of the substances within, or the disposal of, the Vevo 3100 Imaging System or the Vevo LAZR-X Imaging System, please contact FUJIFILM VisualSonics. See "Technical Support" on page 732.

Cleaning and disinfecting

The system, laser, transducer and accessories must be cleaned and disinfected after each imaging session. It is important to follow these cleaning and disinfecting instructions without skipping any steps.

Note: Please be aware that you must perform both a cleaning as well as a disinfection for each component.

System	Laser	Transducer
		

Before getting started

- **Inspect** the system, laser, transducer and accessories to determine they are free of any unacceptable deterioration, such as corrosion, discoloration, pitting, or cracked seals. If damage is evident, discontinue use, and contact FUJIFILM VisualSonics or your local representative.
- **Confirm** that cleaning and disinfecting materials are appropriate for your facility's use. FUJIFILM VisualSonics tests disinfectants and disinfectant devices for use with the system, laser, transducers and accessories.

- **Verify** expiration dates, concentration, and efficacy of chemicals (for example, a chemical strip test). Disinfectants and cleaning methods listed are recommended by FUJIFILM VisualSonics for efficacy and material compatibility with our products.
- **Ensure** that the disinfectant type, solution strength and duration are appropriate for the equipment.
- **Follow** manufacturer recommendations and local regulations, when preparing, using, and disposing of chemicals.
- **Follow** the disinfectant manufacturer's recommendations regarding appropriate personal protective equipment (PPE), such as protective eye wear and gloves.

Warning: Ensure that cleaning and disinfecting solutions and wipes are not expired.

Some cleaners and disinfectants can cause an allergic reaction to some individuals.

Caution: Do not allow cleaning solution or disinfectant into the system, laser, transducer or accessory connectors.

Do not use strong solvents such as thinner or benzene, or abrasive cleansers, since these will damage the exterior surfaces. Use only FUJIFILM VisualSonics recommended cleaners or disinfectants.

Cleaning and disinfecting the Vevo 3100 Imaging System

The ultrasound system includes the cart, monitor, control panel, transducer/gel holding cups and cable hooks.

Warning: Disconnect the system from the power before cleaning to avoid electrical shock.

Wear the appropriate personal protective equipment (PPE) recommended by the chemical manufacturer, such as eyewear and gloves.

Caution: Do not spray cleaners and disinfectants directly on surfaces or on the connectors of the system—doing so may cause solutions to leak into the system, damaging it and voiding the warranty.

Do not scratch the image display.

Do not attempt to disinfect the system using a method or chemical that is not included here. This can damage the system and void the warranty.

Use only FUJIFILM VisualSonics recommended disinfectants. Using a non-recommended disinfecting solution or incorrect solution strength can damage the system and void the warranty. Follow the disinfectant manufacturer's recommendations.

Start

Cleaning and disinfection of the Vevo 3100 Imaging System

> Caution: If you are using a Vevo LAZR-X Imaging System (includes a Vevo 3100 Imaging System and laser), disconnect all cables connecting the laser to the system.

1 **Put on** gloves, for protection from cleaning and disinfecting materials. Change gloves as needed throughout the procedure.

2 **Turn off** the system by pressing the **Power** button.

3 **Turn off** the main power switch located on the bottom of the system near the back, where the power cord connects.

4 **Unplug** the power cord from the outlet.

5 **Unplug** the network cable, if applicable.

6 **Disconnect** and remove the transducer from the system.

7 **Obtain** a compatible cleaner. Compatible cleaning materials are listed in the table "Compatible cleaners and disinfectants" on page 752.

> Caution: Make sure the solution does not get into any of the connector ports.
>
> Apply the disinfectant solution to the cloth rather than applying it directly to surfaces if not using a wipe.

> Caution: Do not wipe the transducer connector.

8 **Clean** the system to remove any visible gel, debris or animal fluids.

♦ **Wipe** from clean areas to the soiled areas to avoid cross-contamination.

9 **Verify** that all gel, debris and animal fluids have been removed from the system. If necessary, repeat Steps 8, with a new wipe.

10 Obtain a compatible disinfectant. Compatible disinfectant materials are listed in the table for "Compatible cleaners and disinfectants" on page 752.

Caution: Make sure the solution does not get into any of the connector ports.

Apply the disinfectant solution to the cloth rather than applying it directly to surfaces if not using a wipe.

11 Disinfect the system by wiping all surfaces including:

- image display (upper monitor)
- control panel (lower monitor)
- transducer and gel holders
- cable hooks
- handles
- all surfaces that may have been touched and/or contaminated

12 Ensure the system stays wet with the disinfectant for the wet contact time listed in the table for "Compatible cleaners and disinfectants" on page 752. This may require reapplication to achieve the required wet time.

♦ For example, if you are using Sanicloth Bleach it has a wet contact time of 4 minutes. Wipe the entire system until thoroughly wet. If the system starts to dry before the 4 minutes is reached, use a new wipe and re-wet the system. Continue the process of re-wetting with a new wipe until a total wet time of 4 minutes is reached.

13 Allow the system to air dry in a clean, well ventilated space. Do not dry with a cloth.

Done

Cleaning and disinfecting the transducer

The transducer includes the connector, cable and scanhead.

Warning: Disconnect the transducer from the system before cleaning to avoid electrical shock.

Wear the appropriate personal protective equipment (PPE) recommended by the chemical manufacturer, such as eyewear and gloves.

Caution: Do not spray cleaners and disinfectants directly on surfaces or on the connector of the transducer—doing so may cause solutions to leak into the transducer, causing damage and voiding the warranty.

Do not attempt to disinfect a transducer using a method or chemical that is not included here. This can damage the transducer and void the warranty.

Use only FUJIFILM VisualSonics recommended disinfectants. Using a non-recommended disinfecting solution or incorrect solution strength can damage the transducer and void the warranty. Follow the disinfectant manufacturer's recommendations.

Start

1 **Put on** gloves, for protection from cleaning and disinfecting materials. Change gloves as needed throughout the procedure.

2 **Disconnect** and remove the transducer from the system.

3 **Remove** the Vevo Fiber Jacket and Vevo Optical Fiber from the transducer (if applicable).

4 **Obtain** a compatible cleaner. Compatible cleaning materials are listed in the table for "Compatible cleaners and disinfectants" on page 752.

5 **Clean** the transducer cable and transducer body to remove any visible gel, debris or bodily fluids.

♦ Starting from the transducer connector end, clean the transducer cable and transducer body in a downward motion toward the scanhead. Wipe from clean areas to the soiled areas to avoid cross-contamination.

Caution: Make sure that the solution does not get into the transducer connector.

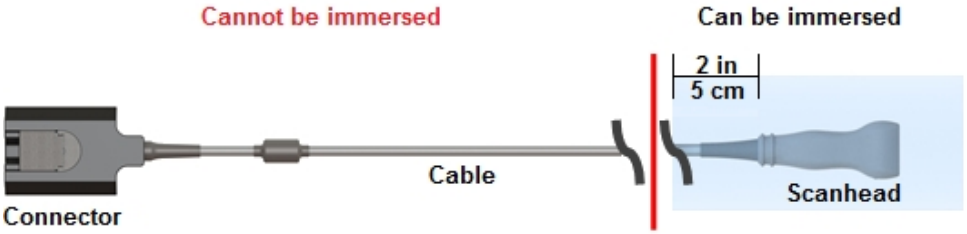
Apply the disinfectant solution to the cloth rather than applying it directly to surfaces, if not using a wipe.

6 **Verify** that all gel, debris, and bodily fluids have been removed from the transducer. If necessary, repeat Step 4, with a new wipe.

7 **Obtain** a compatible disinfectant. Compatible disinfectant materials are listed in the table "Compatible cleaners and disinfectants" on page 752.

8 **Follow** the information in the table "Compatible cleaners and disinfectants" on page 752 for solution strengths and soak times. Refer to the disinfectant manufacturer's instructions for additional information.

9 **Immerse** the transducer into the high-level disinfectant solution. Refer to the table "Compatible cleaners and disinfectants" on page 752 for soak times. Ensure that the transducer connector remains out of the fluid. Ensure that the scanhead and only 2 in (5 cm) are immersed. Refer to the figure below.



10 **Rinse** by soaking the area that was immersed, in sterile or clean water, according to the disinfectant manufacturer's instructions. See the table "Compatible cleaners and disinfectants" on page 752 for a list of clean water soak times.

11 **Dry** with a clean lint-free cloth, or allow to air dry completely.

12 **Examine** the transducer and cable for damage, such as cracks or splitting where fluid can enter. If damage is evident, discontinue use of the transducer, and contact FUJIFILM VisualSonics or your local representative.

Stop

Cleaning and disinfecting the laser

Warning: Disconnect the laser from the power before cleaning to avoid electrical shock.

Wear the appropriate personal protective equipment (PPE) recommended by the chemical manufacturer, such as eyewear and gloves.

Caution: Do not spray cleaners and disinfectants directly on surfaces or in the ports of the laser—doing so may cause solutions to leak into the laser, causing damage and voiding the warranty.

Do not attempt to disinfect the laser using a method or chemical that is not included here. This can damage the laser and void the warranty.

Use only FUJIFILM VisualSonics recommended disinfectants. Using a non-recommended disinfecting solution or incorrect solution strength can damage the laser and void the warranty. Follow the disinfectant manufacturer's recommendations.

Start

1 **Put on** gloves, for protection from cleaning and disinfecting materials. Change gloves as needed throughout the procedure.

2 **Turn off** the laser by pressing the **Power** button.

3 **Turn off** the main power switch located on the bottom of the laser near the back, where the power cord connects.

4 **Unplug** the power cord from the outlet.

5 **Disconnect** all cables from the laser to the transducer and Vevo Imaging System.

6 **Obtain** a compatible cleaner. Compatible cleaning materials are listed in the table "Compatible cleaners and disinfectants" on page 752.

Caution: Make sure the solution does not get into any of the laser ports.

Apply the disinfectant solution to the cloth rather than applying it directly to surfaces if not using a wipe.

7 Clean the laser to remove any visible gel, debris or animal fluids.

♦ Wipe from clean areas to the soiled areas to avoid cross-contamination.

8 Verify that all gel, debris and animal fluids have been removed from the laser. If necessary, repeat Steps 8, with a new wipe.

9 Obtain a compatible disinfectant. Compatible disinfectant materials listed in the table for "Compatible cleaners and disinfectants" on page 752.

Caution: Make sure the solution does not get into any of the laser ports.

Apply the disinfectant solution to the cloth rather than applying it directly to surfaces if not using a wipe.

10 Disinfect the laser by wiping all surfaces that may have been touched and/or contaminated.

11 Ensure the laser stays wet with the disinfectant for the wet contact time listed in the table "Compatible cleaners and disinfectants" on page 752. This may require re-application to achieve the required wet time.

♦ For example, if you are using Sanicloth Bleach it has a wet contact time of 4 minutes. Wipe the entire system until thoroughly wet. If the system starts to dry before the 4 minutes is reached, use a new wipe and re-wet the system. Continue the process of re-wetting with a new wipe until a total wet time of 4 minutes is reached.

12 Allow the laser to air dry in a clean, well ventilated space. Do not dry with a cloth.

Stop

Cleaning and disinfecting accessories

Accessories must be cleaned and disinfected after each exam. It is important to follow these cleaning and disinfecting instructions without skipping any steps.

Accessories included are:

- Vevo Fiber Jacket
- Vevo Optical Fiber
- Vevo Phantom
- Vevo LAZRTight
- Foot pedal
- 3D motor system
- Transducer mounting system
- Integrated rail base
- Mouse Handling Table
- Rat Handling Table
- Vevo Stereotactic frame
- Vevo Monitor
- THM-150 Advanced Physiological Monitoring Unit
- Vevo Infusion Pump
- Rectal probe

Caution: To avoid damaging the foot pedal, Vevo Monitor, Vevo Infusion Pump or Vevo Optical Fiber, do not sterilize.

Before getting started

Before cleaning and disinfecting:

- **Inspect** the accessory to determine that it is free of any unacceptable deterioration, such as corrosion, discoloration, pitting, or cracked seals. If damage is evident, discontinue use, and contact FUJIFILM VisualSonics or your local representative.
- **Confirm** that cleaning and disinfecting materials are appropriate for your facility's use. FUJIFILM VisualSonics tests disinfectants and disinfectant devices for use with the accessory.
- **Verify** expiration dates, concentration, and efficacy of chemicals (for example, a chemical strip test). Disinfectants and cleaning methods listed are recommended by FUJIFILM VisualSonics for efficacy and material compatibility with our products.
- **Ensure** that the disinfectant type and the solution strength and duration are appropriate for the equipment.
- **Follow** manufacturer recommendations and local regulations, when preparing, using, and disposing of chemicals.
- **Follow** the disinfectant manufacturer's recommendations regarding appropriate personal protective equipment (PPE), such as protective eye wear and gloves.

Warning: Ensure that cleaning and disinfecting solutions and wipes are not expired.

Some cleaners and disinfectants can cause an allergic reaction to some individuals.

Warning: Disconnect the system from the power before cleaning to avoid electrical shock.

Wear the appropriate personal protective equipment (PPE) recommended by the chemical manufacturer, such as eye wear and gloves.

Caution: Do not allow cleaning solution or disinfectant into the foot pedal, Vevo Monitor, THM-150 or Vevo Infusion Pump connectors.

Do not use strong solvents such as thinner or benzene, or abrasive cleansers, since these will damage the exterior surfaces. Use only FUJIFILM VisualSonics recommended cleaners or disinfectants.

Caution: Do not spray cleaners or disinfectants directly on surfaces or on the connectors of any accessory—doing so may cause solutions to leak into the accessory, damaging it and voiding the warranty.

Do not attempt to disinfect the foot pedal, Vevo Monitor, THM-150, Vevo Infusion Pump or Vevo Optical Fiber using a method or chemical that is not included here. This can damage the foot pedal and void the warranty.

Use only FUJIFILM VisualSonics recommended disinfectants. Using a non-recommended disinfecting solution or incorrect solution strength can damage the foot pedal and void the warranty. Follow the disinfectant manufacturer's recommendations.

Start

1 **Put on** gloves, for protection from cleaning and disinfecting materials. Change gloves as needed throughout the procedure.

2 **Unplug** the accessory from the system or its power source (if applicable).

3 **Obtain** a compatible cleaner. Compatible cleaning materials are listed in "Compatible cleaners and disinfectants" on page 752.

Caution: Make sure the solution does not get into any of the connector ports or control panels.

Apply the disinfectant solution to the cloth rather than applying it directly to surfaces if not using a wipe.

4 **Clean** the accessory and cable(s) (if applicable) to remove any visible gel, debris or animal fluids.

- **Wipe** from clean areas to the soiled areas to avoid cross-contamination.

Caution: Do not wipe any connectors on accessory cables.

5 **Verify** that all gel, debris and bodily fluids have been removed from the accessory and cable(s). If necessary, repeat Steps 4, with a new wipe.

6 **Obtain** a compatible disinfectant. Compatible disinfectant materials listed in "Compatible cleaners and disinfectants" on page 752.

Caution: Make sure that the solution does not get into any of the foot pedals, Vevo Monitor, THM-150 or Vevo Infusion Pump.

Apply the disinfectant solution to the cloth rather than applying it directly to surfaces, if not using a wipe.

7 **Disinfect** the accessory by wiping all surfaces (except any connector or plug).

8 **Ensure** the accessory stays wet with the disinfectant for the wet contact time listed in "Compatible cleaners and disinfectants" on the next page. **This may require reapplication to achieve the required wet time**.

- For example, if you are using Sani-Cloth Bleach it has a wet contact time of 4 minutes. Wipe the entire system until thoroughly wet. If the system starts to dry before the 4 minutes is reached, use a new wipe and re-wet the system. Continue the process of re-wetting with a new wipe until a total wet time of 4 minutes is reached.

9 **Allow** the accessory to air dry in a clean, well ventilated space. Do not dry with a cloth.

10 **Examine** the accessory, control panel (if applicable), connector(s) and cable(s) for damage, such as cracks or splitting where fluid can enter. **If damage** is evident, do not use the accessory and contact FUJIFILM VisualSonics or your local representative.

Stop

Compatible cleaners and disinfectants

Follow the manufacturer's instructions when using cleaners and disinfectants. The materials listed in the table below are chemically compatible with the system and transducer. Confirm that cleaning and disinfecting materials are appropriate for your facility's use.

Compatible cleaners and disinfectants

Product	System	Transducers	Laser	Wet Contact Time
Tristel Sporicidal Wipes	✓	✗	✗	30 seconds
Microbac Tissues	✗	✓	✗	1 minutes
Cleanisept wipes	✓	✓	✗	2 minutes
Sani-Cloth AF3 (grey top)*	✓	✗	✓	3 minutes
Sani-Cloth Bleach (orange top)*	✓	✓	✓	4 minutes
Sani-Cloth HB (green top)	✓	✓	✓	10 minutes
PI-Spray II	✓	✓	✗	10 minutes

*Qualified for use as an intermediate-level disinfectant for mycobacteria

Warning: Disconnect the system, laser, transducer(s) and accessories from the power before cleaning to avoid electrical shock.

Wear the appropriate personal protective equipment (PPE) recommended by the chemical manufacturer, such as eyewear and gloves.

Caution: Do not spray cleaners and disinfectants directly on surfaces or in the ports of the system, laser, transducer(s) or accessories doing so may cause solutions to leak into the system, laser, transducer(s) or accessories, causing damage and voiding the warranty.

Do not attempt to disinfect the system, laser, transducer(s) or accessories using a method or chemical that is not included here. This can cause damage and void the warranty.

Use only FUJIFILM VisualSonics recommended disinfectants. Using a non-recommended disinfecting solution or incorrect solution strength can cause damage and void the warranty. Follow the disinfectant manufacturer's recommendations.

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