

# SONOS 7500/5500

Using Acoustic Quantification



**PHILIPS**

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## Using Acoustic Quantification

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guidelines for setting controls  
that affect acoustic output and  
accuracy of clinical  
measurements.

The cautions explain potential  
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### Warning symbol used in the Text:

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## WARNING

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### Caution symbol used in the Text:

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## CAUTION

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Germany

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## Preface

This guide describes the acoustic quantification procedures for the Philips SONOS 7500 and SONOS 5500 ultrasound imaging systems.

Use this guide in conjunction with the following books:

- *System Basics*—Describes the basic operation of the Philips SONOS 7500 and SONOS 5500 systems.
- *Controls Reference*—Provides a detailed description of all system controls.
- *Safety and Standards Guide*—Provides information on safety issues.
- *Measurements and Calculations Reference*—Provides information on measurements and calculations that you can perform on your ultrasound system.
- *Transducer Reference*—Provides information on the operation, care, and cleaning of transducers.

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

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

### Conventions Used in This Guide

The following conventions are used in this guide:

- Touch-panel and rotary control names and settings appear in bold text. For example, **Acquire Loop**.
- Function keys appear in a box. For example, **Enter**.





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# Acoustic Quantification: Overview

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Philips Medical Systems Acoustic Quantification (AQ) technology automatically distinguishes between tissue and blood in an ultrasound image. The system then uses this distinction to superimpose borders at the intersections of blood and tissue, and to quantify blood area and volume changes in user-defined regions of interest. Color Kinesis (CK), uses the frame-to-frame border position information to overlay colors on the moving image. The colors, as they change during the cardiac cycle, facilitate visual review of the timing and displacement of endocardial borders.

This section covers general information about AQ and CK displays and controls. In it you will find:

- At-a-Glance pages which describe the AQ and CK screen formats and reports
- Brief control descriptions for both AQ and CK

Other sections in this book cover details of AQ and CK use.

## **More Information**

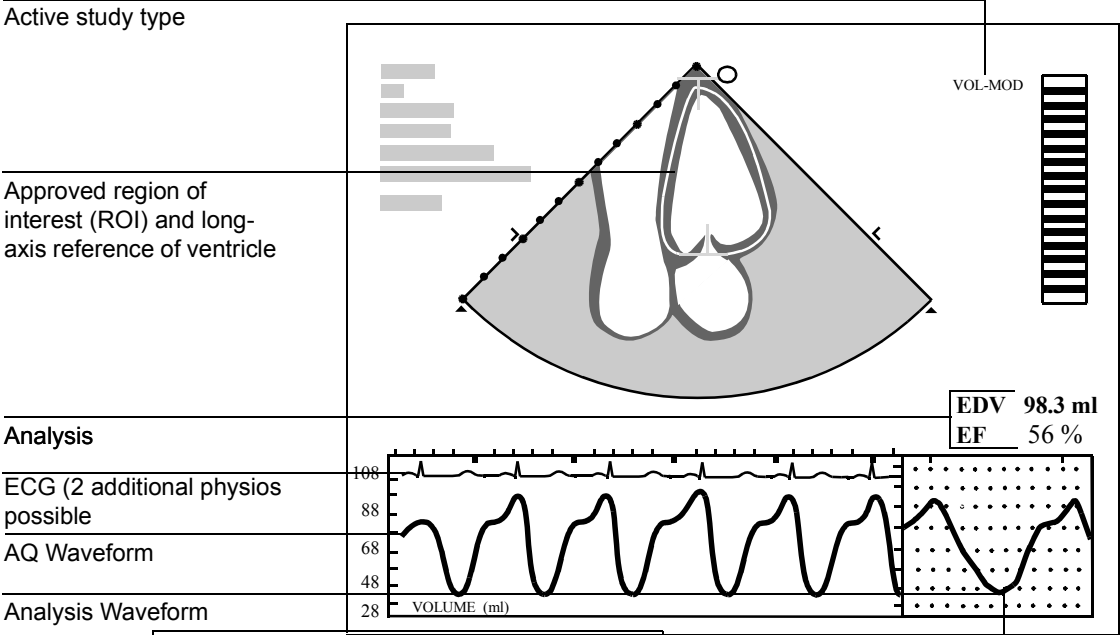
The controls are described in more detail in the *Controls Reference*.

AQ concepts and details can be found in the Acoustic Quantification training workbook and videotape.

Information on the AQ Dataport is in the *System Basics* guide.

Detailed information on accuracies, formulas, measurements and calculations used for AQ can be found in the *Measurements and Calculations Reference*.

AQ at a Glance



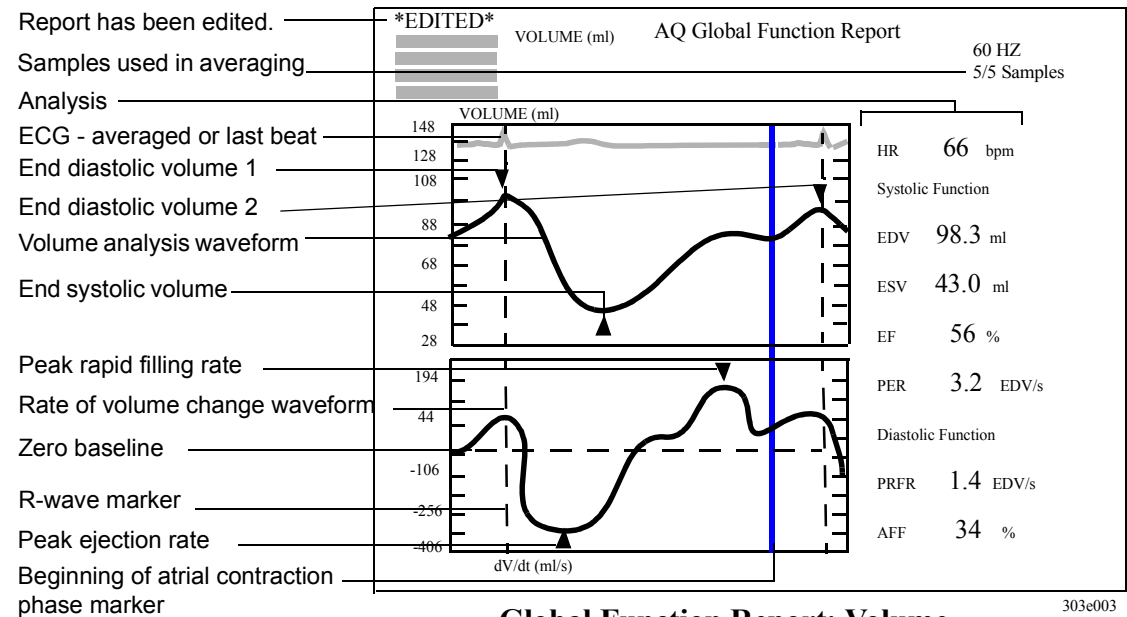
blue: Average off  
green: Consistent averaged data  
yellow: Marginally consistent averaged data  
red: Inconsistent averaged data

303e002

yellow: Marginally consistent averaged data red: Inconsistent averaged data		AQ			
		Secondary Controls	Waveforms	Zoom	
			LGC	Dys-kinesis	Border
		Harmonic Fusion	Clear ROI	ROI	Sweep 50
		Focal Zones			
		1			
		Frequency Fusion 3	Focus	Study VOL-MOD	Image ABD



# Global Function Report At A Glance: Volume



Global Function Report: Volume

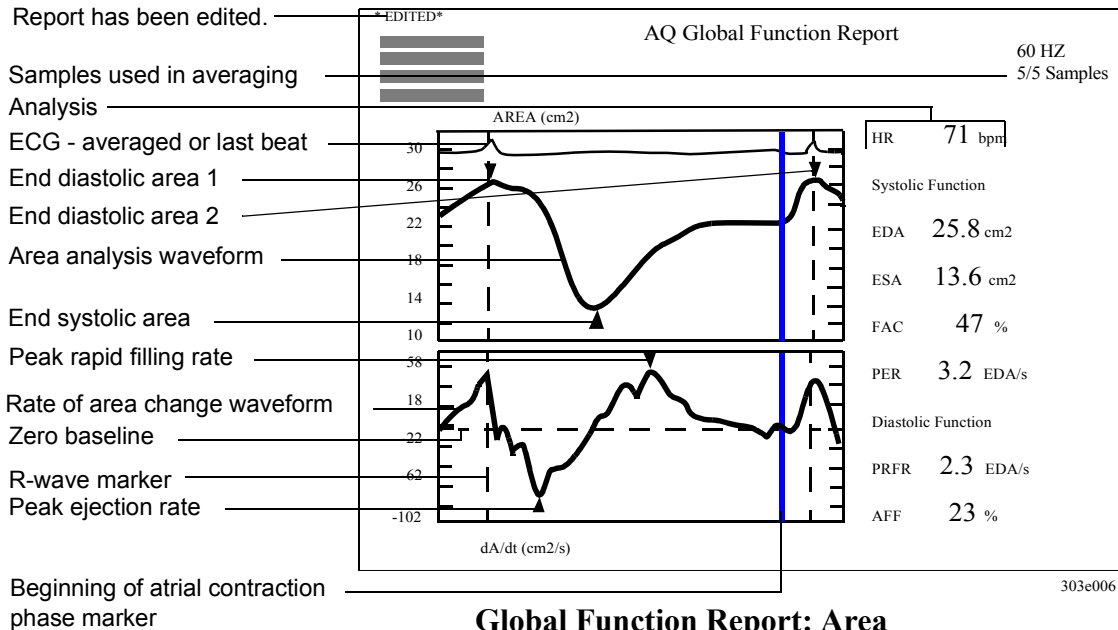
## Abbreviations

Abbreviation	Meaning	Units
HR	heart rate	beats per minute (bpm)
EDV	end diastolic volume	milliliters (ml)
ESV	end systolic volume	milliliters (ml)
EF	ejection fraction	percent (%)
PER	peak ejection rate	end diastolic volumes per second (EDV/s)
PRFR	peak rapid filling rate	end diastolic volumes per second (EDV/s)
AFF	atrial filling fraction	percent (%)
dV/dt	derivative of volume with respect to time	milliliters/second (ml/s)

## Meaning of analysis waveform colors

Color	Meaning
blue	Average off: unaveraged data
green	Average on: consistent averaged data
yellow	Average on: marginally consistent data
red	Average on: inconsistent data

## Global Function Report At A Glance: Area



### Global Function Report: Area

### Abbreviations

Abbreviation	Meaning	Units
HR	heart rate	beats per minute (bpm)
EDA	end diastolic area	centimeters squared (cm <sup>2</sup> )
ESA	end systolic area	centimeters squared
FAC	fractional area change	percent (%)
PER	peak ejection rate	end diastolic areas per second (EDA/s)
PRFR	peak rapid filling rate	end diastolic areas per second (EDA/s)
AFF	atrial filling fraction	percent (%)
dA/dt*	derivative of area with respect to time	centimeters squared per second (cm <sup>2</sup> /s)

### Meaning of analysis waveform colors

Color	Meaning
blue	Average off: unaveraged data
green	Average on: consistent averaged data
yellow	Average on: marginally consistent data
red	Average on: inconsistent data

# CK at a Glance

CK end time - ms after R-wave

CK color bar

Active study type

Approved region of interest (ROI) - optional in CK

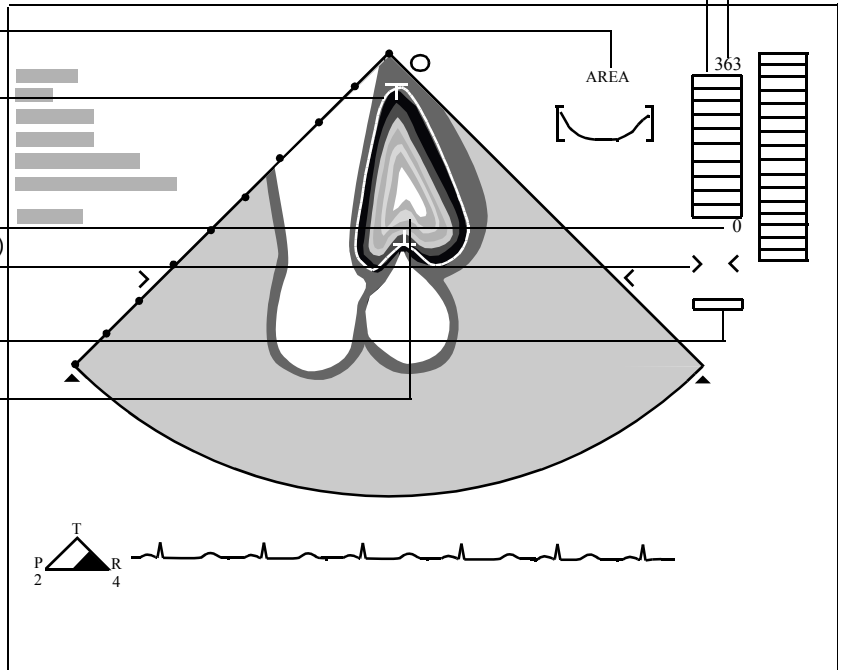
CK start time (ms after R-wave)

Contract/Expand Indicator

Dyskinesis color

Colors demonstrating border excursion

*\* NOTE: To perform contraction and expansion analysis, select CK Timing in AQ Setup.*



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AQ			
Secondary Controls	LGC	Dys-kinesis ROI	Border
Harmonic Fusion	Clear ROI		Sweep 50
Frequency Fusion 3	Focal Zones 1 Focus	Study Area	Image Systole



Set to Systole, Expand or Contract

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## AQ Controls

Adjust Phase	Moves the bar marking the beginning of atrial contraction, and changes any measurements or calculations which use this point.
AQ Report	Turns the AQ Global Function report on and off.
Average	Turns waveform averaging on and off.
Border	Turns the overlaid AQ border display on and off. Also turns the overlaid Color Kinesis display on and off.
Clear ROI	Removes the ROI (region of interest) trace.
Edit Phases	Allows adjustment of the atrial-contraction phase marker on the Global Function Report.
Focal Zones	Selects up to two possible transmit Focal Zones.
Focus	Repositions the acoustic depth of the 2D focal zone. Focus position is indicated by carets on the sides of the image.
Frequency Fusion	Optimizes frequencies for penetration, resolution or texture. Setting affects border tracking abilities. Decrease for greater penetration in hard-to-image patients.
Global Function	Displays the currently selected waveform and its first derivative waveform, reports the measurements and calculations results, and allows phase editing.
Harmonic Fusion	Turns Harmonic Fusion on and off. May increase ability to see borders in hard-to-image patients, but at the expense of frame rate.
Image ABD	Automated Border Detection shows the border between blood and tissue as an orange outline.
Image BLD	Shows the blood pool as a filled-in red area.



Position	Changes the position of the ROI, if one is defined. If none is defined, it positions the sector.
Rescale	Uses data from the last several beats to automatically adjust minimum (min) and increment (inc) values for the active waveform. Using <b>Rescale</b> will set the minimum value to zero and may change the value shown for the increment. (These values can also be set with the <b>Inc</b> and <b>Min</b> controls described in <a href="#">“AQ Secondary Controls” on page 8.</a> )
Restore Phases	Restores the system default phase marker. Appears only after a user-adjusted phase marker position has been entered.
ROI	(Region of Interest) Activates quick-ROI and manual tracing for defining the region of interest.
Size	Changes the size of the ROI, if one is defined. If no ROI is defined, sizes the sector.
Study Area	Activates the Area study type for determining blood or chamber area.
Study Vol-AL	Activates the Volume study type, using the area-length method to determine LV volume.
Study Vol-MOD	Activates the Volume study type, using the Method of Discs method to determine LV volume.
Sweep	Changes the sweep speed for AQ waveforms.
Threshold	Allows adjustment of light/dark levels, which change with injection of contrast fluid. (Available when Contrast is enabled.)
Waveform	Turns the AQ waveform display on and off. (Available after entering a valid ROI).
Zoom	Turns Zoom (magnification) on or off. To move the Zoom preview area, use the trackball.

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## AQ Secondary Controls

Area Inc	Changes the increments between the vertical markers on the Area waveform display.
Area Min	Changes the minimum value of the Area waveform display.
Power	Sets the upper limit (dB) for acoustic power output.
Reject	<b>[Off, Weak, Strong]</b> Eliminates aberrant heartbeats from waveform averaging. <b>Off</b> rejects no complexes from the average. <b>Strong</b> applies a relatively high standard for inclusion. <b>Weak</b> applies a relatively low standard for inclusion.
Samples	Selects the size of the sample set used in waveform averaging. The sample set is the maximum number of waveform complexes that will be averaged.
Vol Inc	Changes the increments between the vertical markers on the Volume waveform display.
Vol Min	Changes the minimum value for the Volume waveform display.

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## Color Kinesis Controls

**Image Contract, Image Expand, CK Start, and CK Dur.** are accessible only if **CK Timing** has been activated in AQ Setup. These controls provide access to functions that may interest only those clinicians doing advanced research studies.

Dyskinesis	Turns dyskinesis detection on and off.
Image Contract	Displays endocardial contraction over a user-specified interval.
Image Expand	Displays endocardial expansion over a user-specified interval.
Image Systole	Displays the endocardial contraction pattern during the systolic interval.

## Color Kinesis Secondary Controls

CK Dur.	Adjusts the duration of the contraction or expansion display pattern.
CK Start	Adjusts the start time for the contraction or expansion display pattern.
Power	Sets the upper limit (dB) for acoustic power output.

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## AQ and CK Setup Controls

To display physios in AQ, Physios must also be configured on in Physio Setup mode. See your *System Basics* guide for more information.

CK Timing	Activates the Color Kinesis expansion and contraction functions (Image Expand, Image Contract), and the start time and duration functions ( <b>CK Start</b> and <b>CK Dur.</b> ).
Physio1	Sets Physio choice of <b>Resp</b> , <b>Heartsnd</b> , <b>Pulse</b> , or <b>None</b> for the first of the two selectable Physio channels in AQ waveform mode. (ECG is automatically displayed).
Physio2	Sets Physio choice of <b>Resp</b> , <b>Heartsnd</b> , <b>Pulse</b> , or <b>None</b> for the second of the two selectable Physio channels in AQ waveform mode. (ECG is automatically displayed).
Real-time Readout	Displays and removes a running digital display of the blood volume or area inside the currently approved ROI.

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# Using Acoustic Quantification

In this section you will find information about:

- Setting up Physios
- Obtaining an AQ border
- Defining the ROI by two-point, three-point, and manual methods.
- Displaying a real-time area or volume readout
- Editing or deleting the ROI
- Displaying and adjusting waveforms
- Displaying and editing reports
- Creating a custom preset

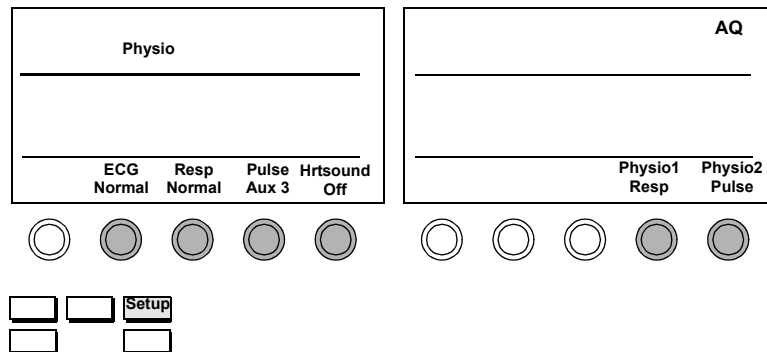
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## Setting up Physios

A connected ECG is required before you can obtain AQ data. You can display up to two additional physios in AQ waveform mode and one additional physio (Pulse) on the Global Function Report. You will find full details of system physio setup, including cable connection, in your *System Basics* guide.

After you have connected the proper cables for the physios you want to display, follow these instructions to setup physio display in AQ:

- 1 Touch **Setup**, and on the left touch panel, touch **Physio**.



- 2 Turn the rotary controls to select the desired sources for the physios you want to view.
  - a. Set ECG to Normal if you are using the system ECG.
  - b. Set ECG to Aux1 if you are using an external ECG source.
  - c. Be sure to set a source for any other physios you will want to use in AQ.

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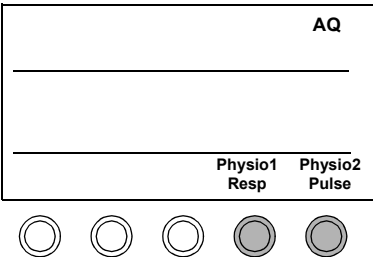
### NOTE

These are the physios that are available for all modes, not just AQ. Any physio turned off here will not be available in any mode.

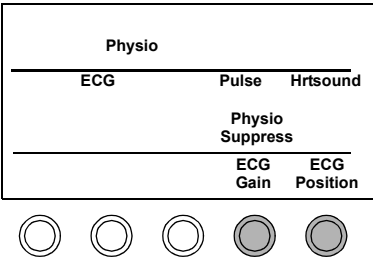
- 3 On the right touch panel, touch **AQ**.

- 4 Turn the **Physio1** and **Physio2** rotary controls to select the waveforms you want to display *in addition* to the ECG on the real-time waveform.

If you select a Pulse physio as one of your choices, it will also display on the Global Function Report, in addition to the ECG. Other physios will not display on the Global Function Report.





- 5 Press **Setup** to exit Setup mode.
- 6 When you begin to display the physios during your study, use the Physio controls on the left touch panel to adjust the waveforms' position and gain. Touch the waveform you want to adjust, then use the related rotaries to change the Gain and Position.

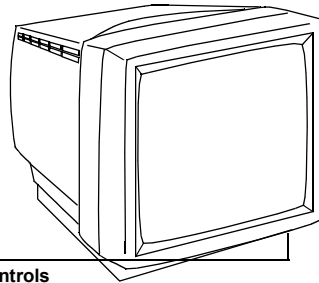


- 7 Be sure the **Physio Suppress** control is not active. If Physio Suppress is turned on, no physios will display.

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## Obtaining an AQ Border

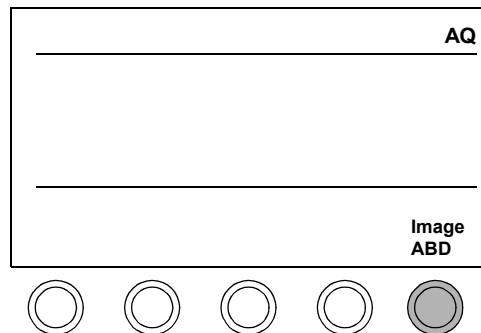
- 1 Adjust  and  for the ambient light. For details, see "Calibrating the Monitor" in the first chapter of your *System Basics* guide.



Brightness and contrast controls

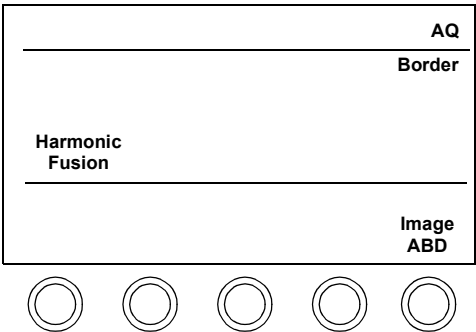
6apc0158

- 2 Make sure you have a sector transducer installed. AQ does not work with linear, curved linear or non-imaging transducers.
- 3 Optimize the 2D Image. For details, see "2D Imaging" in the Imaging Modalities chapter of your *System Basics* guide.
- 4 Touch **AQ** on the right touch panel.
- 5 Turn the **Image** control to choose the display format you want to see. (Unless you change the format, the system automatically uses the format chosen the last time AQ was used.)





- 6 Optimize border tracking by optimizing the imaging controls and touching the **Border** control to turn borders on and off. This allows you to compare the overlaid border outlines with the actual endocardial borders. You can then make additional imaging adjustments until the overlaid borders match the endocardial borders.



NOTE

Turning on **Harmonic Fusion** may increase your ability to see borders in hard-to-image patients. However, you should be aware that when **Harmonic Fusion** is turned on, frame rate decreases.

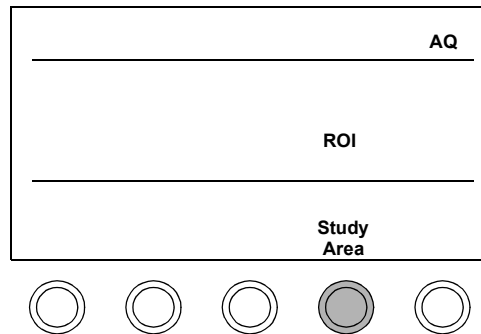
You are now ready to define the region of interest (ROI) you want to use for AQ measurements or to define the Color Kinesis area.

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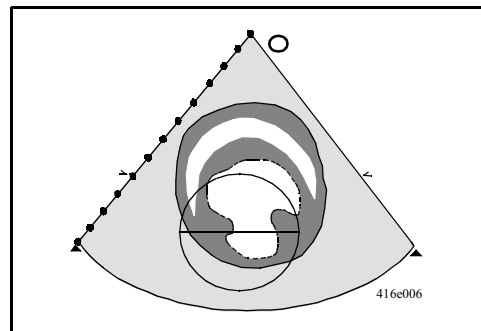
## Defining the ROI: Two-Point Quick ROI

Use the two-point quick-ROI method to define a region of interest (ROI) for area studies of short-axis views. **Study** should be set to Area.

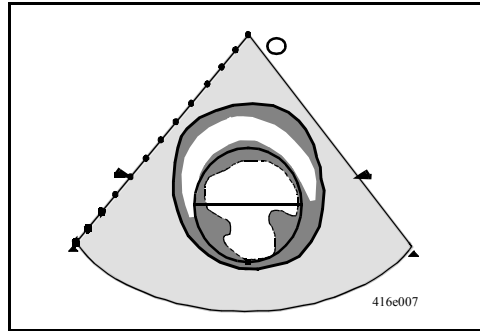
- 1 Touch ROI on the right touch panel and position the caliper outside the blood pool of interest.



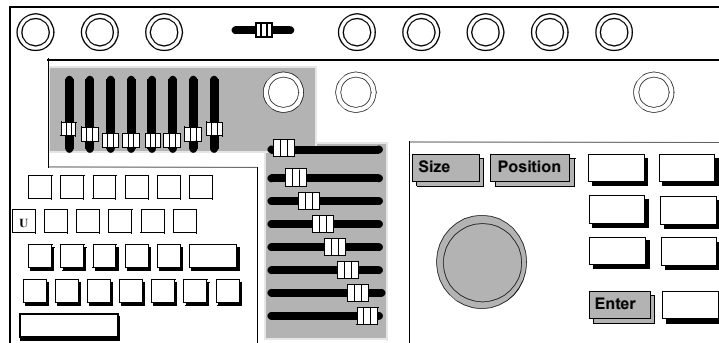
- 2 Press **Caliper**, and a circle displays over the image.



- 3 Move the second caliper to position the circle over the blood pool of interest. Press **Enter**.



- 4 Make sure that only the blood pool of interest is within the ROI.
  - a. To check border accuracy with respect to the image, touch **Border** to turn borders on and off.
  - b. Use the LGCs, TGCs, and Gain to control the AQ border locations.
  - c. If necessary, adjust **Size** and **Position** with the trackball, to fine-tune the ROI.
  - d. When you are satisfied, press **Enter**.



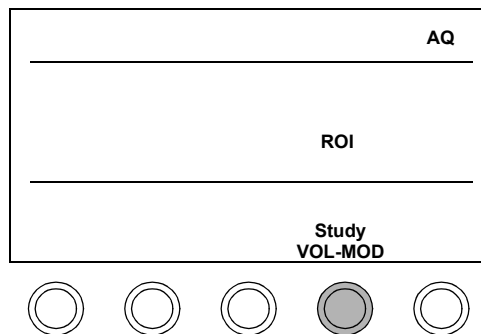
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## Defining the ROI: The Three-Point Quick ROI

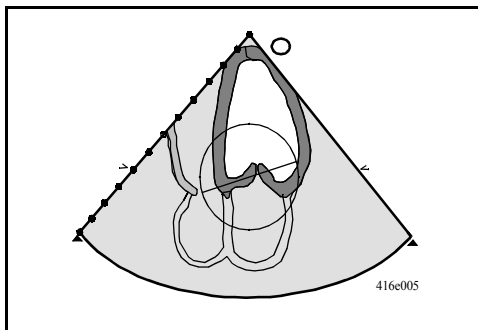
Use the three-point quick-ROI method to define a region of interest (ROI) for volume studies of apical and other views which require positioning a long-axis (for example, a parasternal long-axis view). **Study** should be set to **Vol-AL**, or **Vol-MOD**.

The following process describes using the three-point method with an apical view.

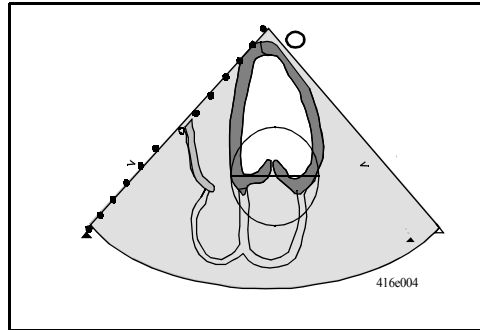
- 1 Touch **ROI**, and position the caliper to one side of the mitral annulus. Make sure that the caliper is outside the blood pool of interest.



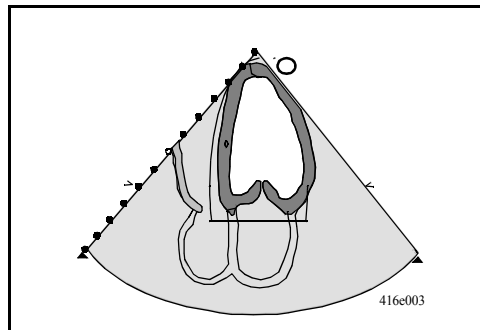
- 2 Press **Caliper**, and a circle displays over the image.



- 
- 3 Move the free caliper to the other side of the mitral annulus.

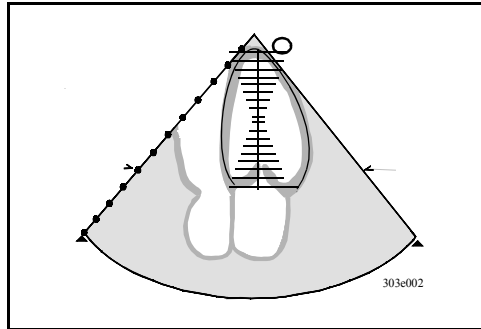


- 4 Check to be sure that the ROI is wider than the blood pool. If it's not, move the caliper until the ROI is the correct width.
- 5 Press **Caliper**. Move the third caliper slightly above the true apex. Make sure that the ROI fully includes the blood pool of interest. When you are satisfied, press **Enter** to display the reference graphic (step 6).

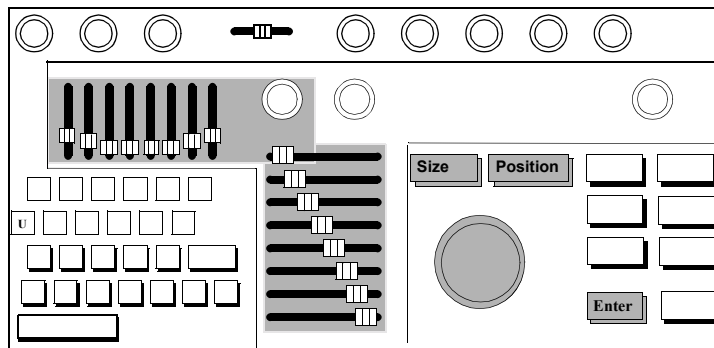


- 6 For volume studies, edit the reference graphic as necessary. The length axis of the reference graphic should cut through the ventricle's long axis. To reposition the reference:
- Move the free caliper to the midpoint of the mitral annulus
  - Press **Caliper**.

- c. Position the second caliper at the true apex
- d. Press **Enter**.



- 7 Make sure the ROI correctly outlines the blood pool of interest.
  - a. Use the LGCs, TGCs, and Gain to control the border location.
  - b. Touch **Border** on and off to check border accuracy with respect to the image.
  - c. When you are satisfied, press **Enter**.
  - d. If necessary, use **Size** and **Position**, with the trackball, to adjust the ROI. Press **Enter** when size and position are correct.

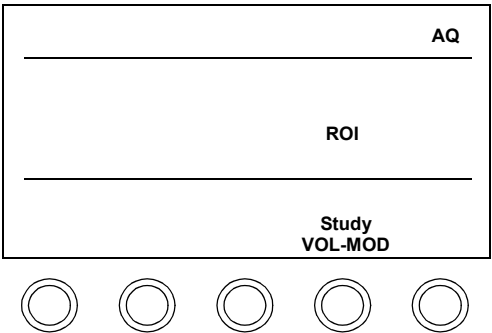


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## Defining the ROI: Manual Method

The manual method for defining an ROI may be used at any time. It is useful for views in which blood-pool shapes are not easily defined by either the Two-Point (circular) or the Three-point (apical) methods.

- 1 Touch **ROI** and position the caliper at the start of the trace.

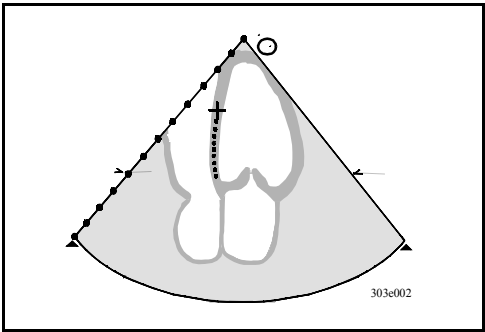


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### NOTE

If this is an ROI for an apical study, plan to begin and end your trace at the mitral valve annulus. The system will connect the start and end points and will use these points to position the long axis of the trace.

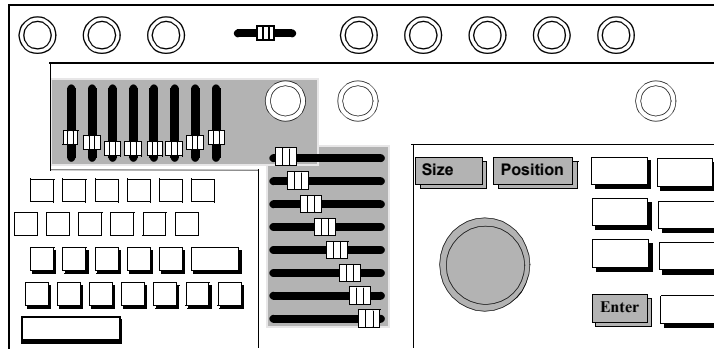
- 2 Press **Trace**, and outline the region-of-interest with the trackball.



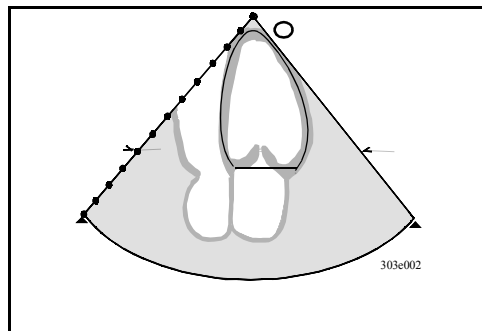
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3 Make sure the ROI correctly outlines the blood pool of interest.

- Use the LGCs, TGCs, and Gain to position the borders.
- As you adjust ROI position, frequently touch **Border** on and off to check border accuracy with respect to the image.



- When you are satisfied, press **Enter**. The system will connect the start and end points.



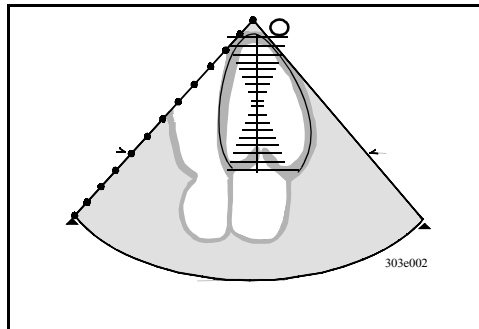
- If necessary, use **Size** and **Position**, with the trackball, to adjust the ROI. Press **Enter** when size and position are correct.



- 
- 4 For volume studies, the system will display a long-axis reference graphic: The long-axis of the reference graphic should cut through the ventricle's long axis.

To reposition the reference:

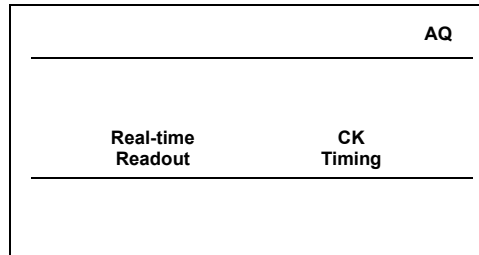
- a. Move the free caliper to the midpoint of the mitral annulus
- b. Press **Caliper**.
- c. Position the second caliper at the true apex
- d. Press **Enter**.



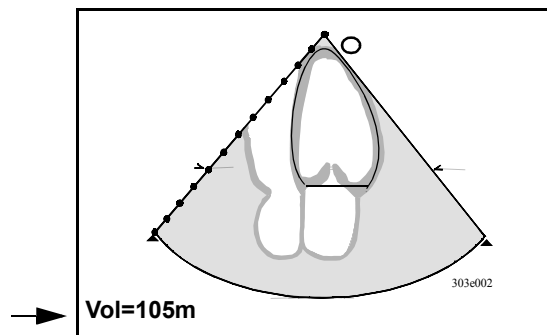
---

## Displaying a Real-Time Readout

- 1 To turn a running volume or area readout on and off after you have approved an ROI, press **Setup**. Then touch **Real-time Readout**.



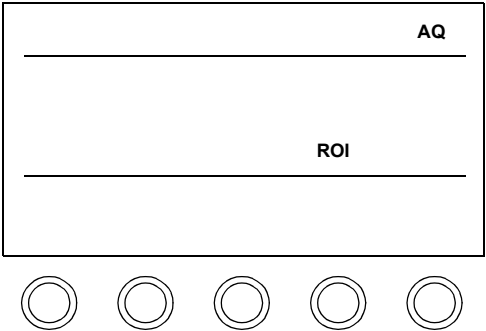
- 2 A real-time digital readout of the volume or area in the currently approved ROI will display at the bottom left of the sector.



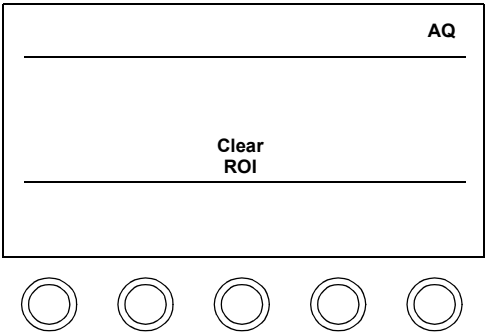
---

# Editing an Approved ROI

1 Touch **ROI**.

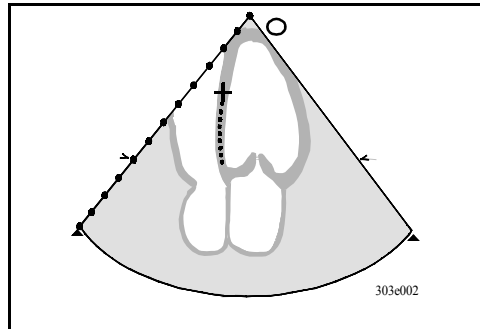


2 To erase the entire ROI, touch **Clear ROI**. To redraw the ROI, repeat one of the ROI drawing methods described earlier.

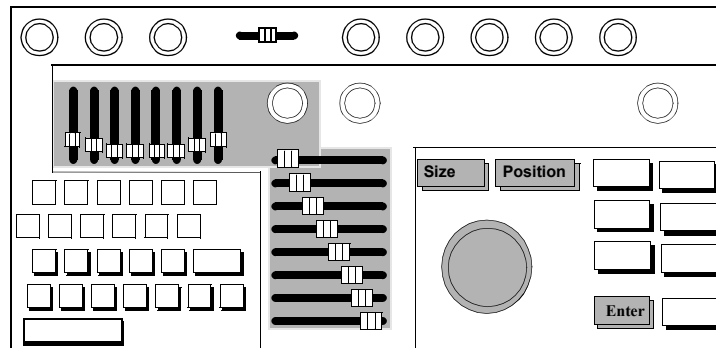


3 To erase the current ROI one dot at a time, press **Erase**.

- 
- 4 To continue a trace from which you have erased dots, use the trackball to redraw the new portions. When you are satisfied with the new trace, press **Enter**.



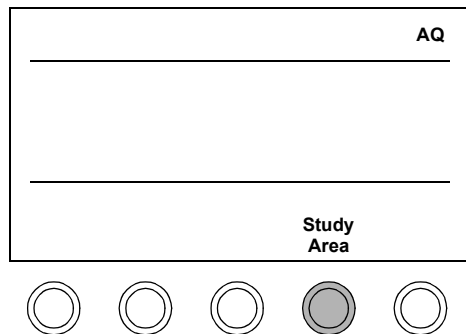
- 5 To adjust the ROI without changing the outline's shape, use the **Size** and **Position** keys to adjust size and position. Press **Enter** to confirm the new size and position.



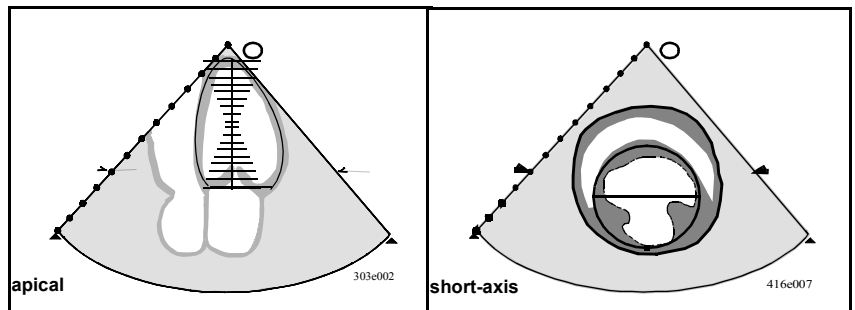
---

## Displaying Waveforms

- 1 In AQ full-sector mode (no waveform on the screen), perform the steps in the [“Obtaining an AQ Border” on page 14](#).
- 2 Use the **Study** control to select the kind of measurements you want to display: **Area**, **Vol-AL**, or **Vol-MOD**.



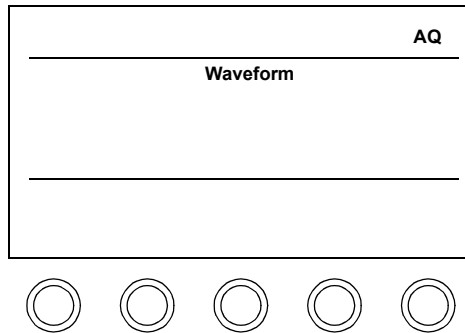
- 3 Define the ROI as appropriate for the view you are using:
  - a. For apical studies, perform the steps for a three-point quick ROI on [page 18](#).
  - b. For short-axis studies, perform the steps for a two-point ROI on [page 16](#)



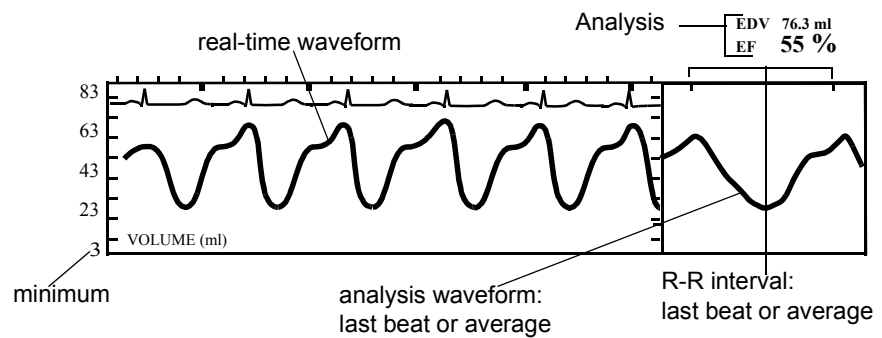
- c. For unusually shaped blood pools, perform the steps for a manual ROI on [page 21](#).

---

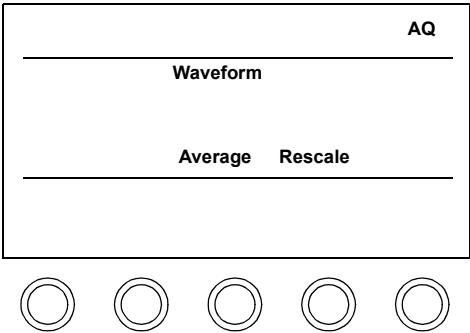
**4 Touch Waveform.**



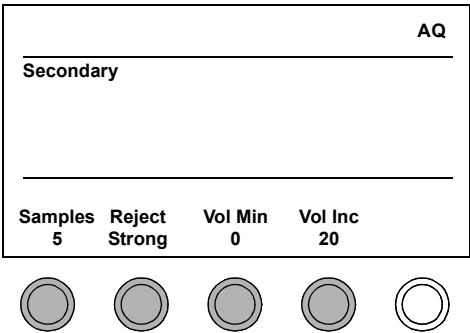
- 5** The selected real-time waveform has an "analysis waveform window" on the right. The window shows the last beat or, if **Average** is on, the average beat, and an analysis of this beat.



6 Adjust the waveform as desired.



- a. **Average** - turns averaging on and off. When on, the waveform complexes are averaged. When off, real-time, non-averaged data displays in the analysis waveform window. (See step 7 for other controls that affect averaging.)
  - b. **Rescale** - resets the scale to fit the current waveform.
- 7 For further refinement, touch **Secondary Controls** to access other waveform adjustment controls.



- a. Use **Min** to change the waveform's minimum scale value.
- b. Use **Inc** to change the increment between the vertical markers on the waveform.

- 
- c. Set the **Reject** control to the amount of reject you want to be applied to produce the averaged analysis waveform:

Reject Setting	Effect	Meaning
Off	No beats are rejected.	All beats are used in analysis.
Strong	A relatively high standard for rejecting beats from the average is applied.	To be included in analysis, beat morphology and R-R interval must meet the highest standard.
Weak	A relatively weak standard for rejecting beats from the average is applied.	To be included in analysis, beat morphology and R-R interval must meet a minimal standard.

- d. Set the **Samples** control to the number of cardiac cycles you want to be averaged to produce the analysis waveform.

- 8** Observe the color changes in the analysis waveform for an indication of whether averaging is turned on and whether the incoming waveforms being analyzed conform to the system's minimum variance standards:

blue: Averaging is off green: Consistent averaged data yellow: Marginally consistent averaged data red: Inconsistent averaged data
---

---

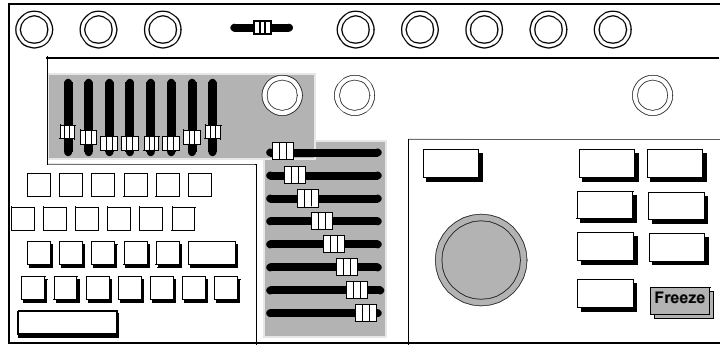
**NOTE**

The system's minimum variance standards are based on the system's default consistency standards and the current **Reject** setting.

---



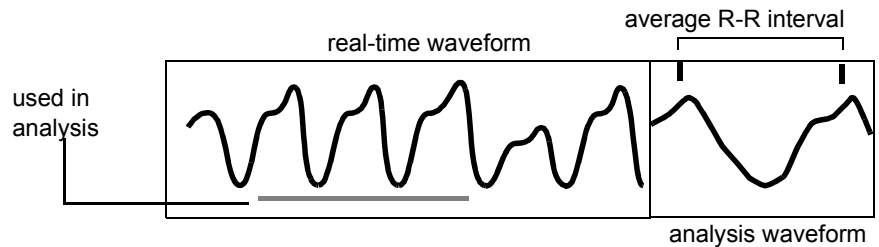
- 9 To scroll the waveform, press **Freeze** and then roll the trackball.



- 10 Note that averaging can be turned on and off when the image is frozen.

If averaging is on:

- Averaged measurements are displayed during scrolling and change for each data set.
- A blue line appears under the beats used to produce the current analysis waveform.



If averaging is off:

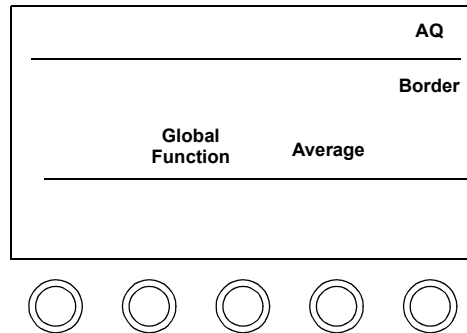
- Unaveraged measurements are displayed during scrolling and change for each data set.
- A blue line appears under the beat shown in the analysis waveform window.

---

## Displaying the Global Function Report

You can view a detailed analysis report page for any frozen waveform. This report displays the current analysis waveform, the first derivative of this waveform, and measurements and calculations.

- 1 Press **Freeze** and scroll the waveform to select the portion of the waveform for which you want to see measurements and calculations. (See [“Displaying Waveforms” on page 27](#) for more details.)
- 2 Touch **Global Function**.



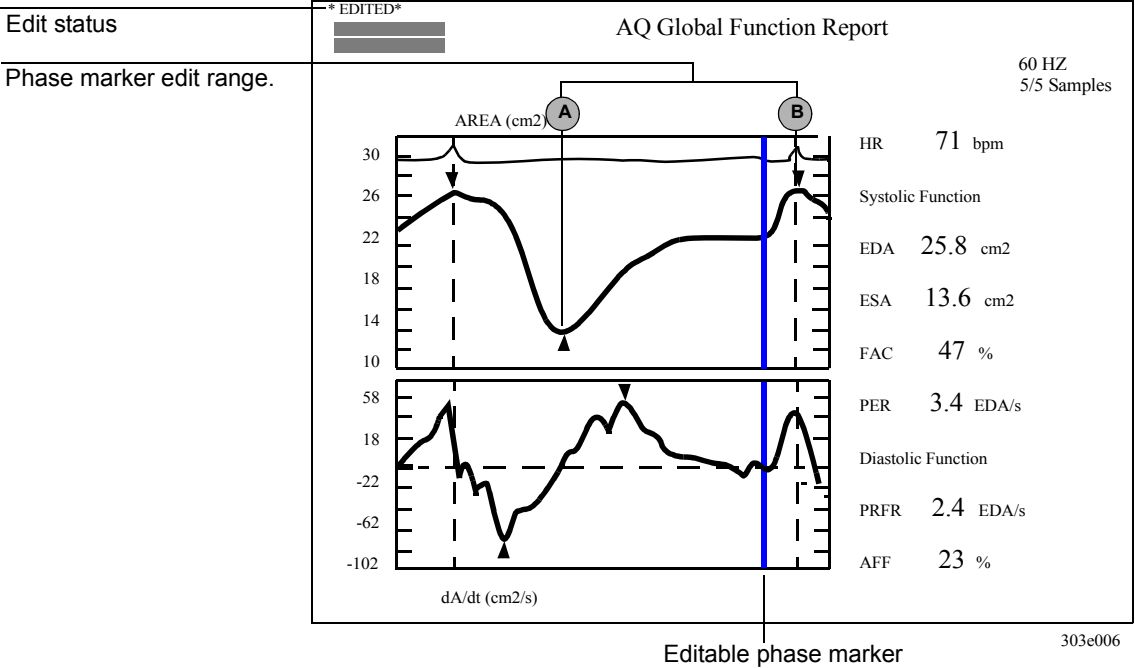
- 3 The system displays the currently selected average waveform (or the last real-time waveform if **Average** is off) and its first derivative waveform. The same colors are used as for an averaged waveform on the waveforms screen:

blue:	Averaging is off
green:	Consistent averaged data
yellow:	Marginally consistent averaged data
red:	Inconsistent averaged data

- 4 The ECG and, if setup and selected, the Pulse physio display in green.

## Editing the Global Function Report

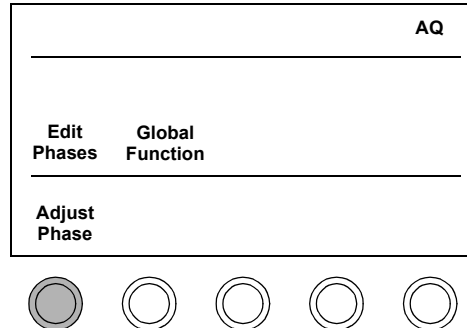
The calculations and measurements displayed in the Global Function Report are based on cardiac phases detected on the volume or area analysis waveform. You can edit the position of the marker which the system draws to indicate the beginning of atrial contraction. This position is used to produce the atrial filling fraction (AFF) calculation on the AQ Global Function Report



**NOTE** The beginning of atrial contraction phase marker will not appear if the system cannot select this point accurately. In this case, the AFF value will be displayed as dashes (----). However, when you select **Edit Phases** as described in step 1 below, a blue bar marking the system's **best estimate** of the location will appear so that you can adjust the phase marker, if necessary.

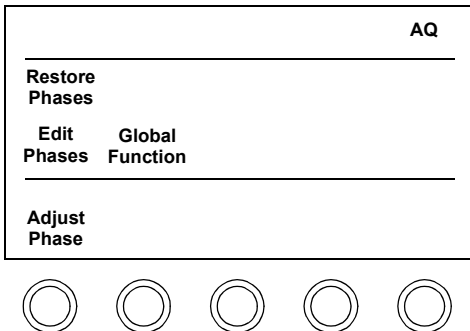
To edit a phase marker or to set a marker position when no marker is present:

- 1 While displaying a Global Function Report, select **Edit Phases**.



- 2 If you want to accept the system-selected position, simply press **Enter**.
- 3 If you want to change the marker's position, use the **Adjust Phase** control to move the marker to a new position.
- 4 Movement of the phase marker is limited to the portion of the waveform between the preceding ESA or ESV and the next EDA or EDV marker (A and B on the illustration on [page 33](#)).
- 5 To turn editing off without saving any changes, either:
  - a. touch **Edit Phases**, or
  - b. press **Erase**
- 6 To store the new position, press **Enter**.
  - a. The bar's color will change from blue to black.
  - b. The Global Function Report will display "\*\*EDITED\*" in the top left corner above patient ID.

7 To restore the default position, touch **Restore Phases**.



NOTE

Once you have edited the phase marker position and pressed **Enter**, the **"\*EDITED\*"** indication will display until you touch **Restore Phases** or select a new analysis waveform for the Global Function Report.

8 To exit the Global Function Report and return to a frozen waveform display, touch **Global Function** or **AQ Report**.

## Making Additional Measurements

You can use the measurements package to make one-point and two-point measurements on all displayed AQ waveforms. See the Measurements chapter in your *System Basics* guide for how to make one-point and two-point measurements.

NOTE

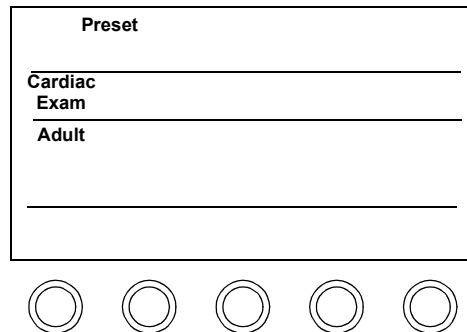
To make measurements on analysis waveforms on the real-time waveform screen, first press **Freeze** to freeze the waveform.

1 Perform the steps in [“Obtaining an AQ Border” on page 14](#).

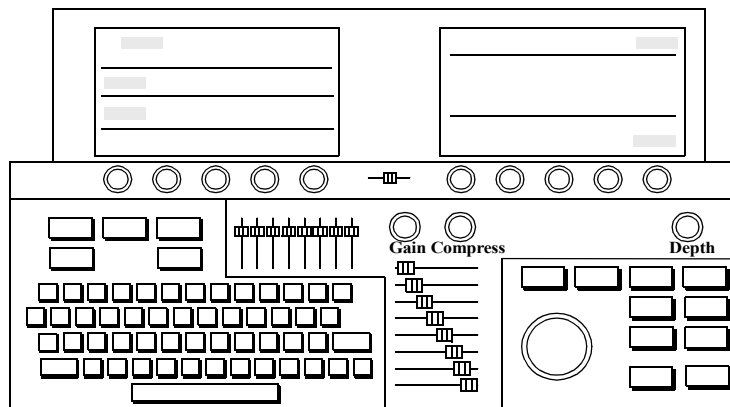
\_\_\_\_\_

You may want to change the default settings used for AQ to better meet your lab and patient requirements. If so, you can create one or more custom presets.

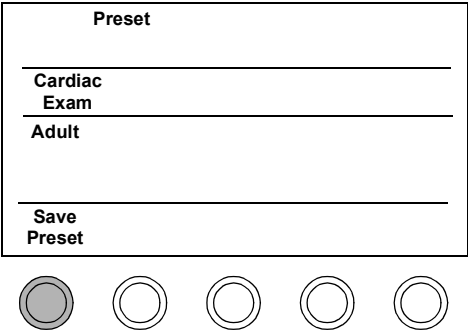
- 1 On the left touch panel, touch **Preset**, then touch a preset of the same exam type as the one you want to create, for example, the Adult Preset in the Cardiac Exam Group.



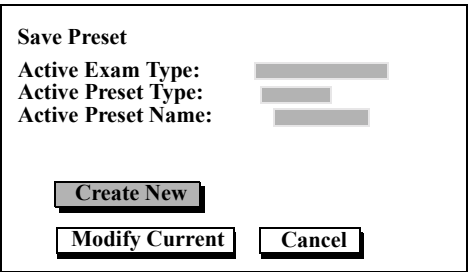
- 2** Adjust the controls to the way you would like to have them set for AQ studies.



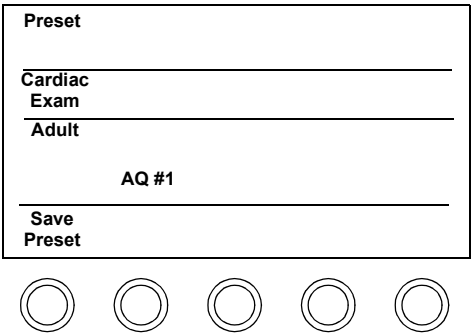
3 Touch **Save Preset**.



4 Highlight **Create New** with the trackball and press **Enter**.



5 Type the name for the new preset in the dialogue box which appears, and press **Enter** twice to save it. Your new preset will now appear.



**NOTE** For more details on creating, modifying, and deleting presets, see the Presets chapter of your *System Basics* guide.

---

## Using Color Kinesis

In Color Kinesis, colors are applied to mark changes in the frame-to-frame border position. By viewing the colors as they change from frame to frame, you can directly observe the extent of systolic endocardial contraction, and the time relationships of wall segment movements.

To perform CK, you display and adjust borders to outline endocardial boundaries, just as in AQ, described earlier. You may define a Region of Interest (ROI), as in AQ, though the ROI is optional in CK. Waveforms are not available when CK is active. To better visualize frame-to-frame changes, you can freeze the image and scroll through the frames, one-by-one.

In this section you will find information about:

- Using CK Systole mode
- Using CK Timing mode: advanced research
- Interpreting CK colors



---

## Systole Mode

- 1 Perform the steps in [“Obtaining an AQ Border”](#) on page 14.
- 2 Perform the steps in one of the methods for defining an ROI, beginning on [page 16](#).

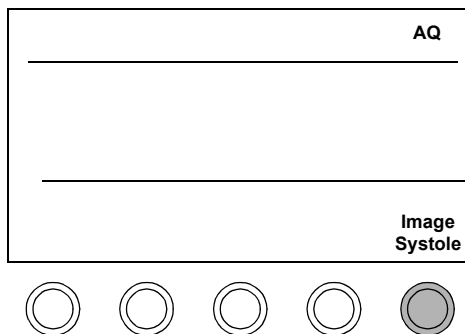
---

### NOTE

An ROI is not required to perform Color Kinesis, but is highly recommended, since the CK color display will be confined to the interior of the ROI. The color changes will then be easier to review.

---

- 3 Select **Image Systole** to display the contraction pattern during the systolic interval. For each frame in the systolic time interval, the movement of the border is displayed in a different color.



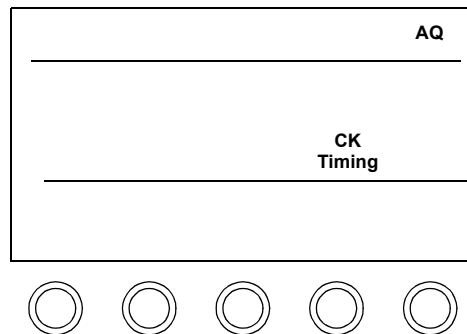
- 4 To examine the colors frame-by-frame, press **Freeze** and use the trackball to scroll back through stored frames. Use the table on [page 43](#) for more information on color interpretation.

---

## Using Color Kinesis: Timing Mode for Advanced Research

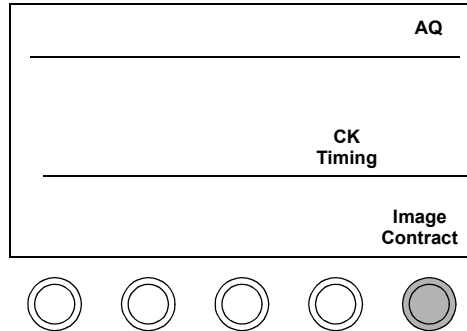
With CK Timing turned on in Setup, you can access advanced research options which let you look at contraction and expansion patterns at user-settable ECG intervals.

- 1 In AQ mode, press **Setup** and turn on **CK Timing**. Press **Setup** again to return to AQ mode.



---

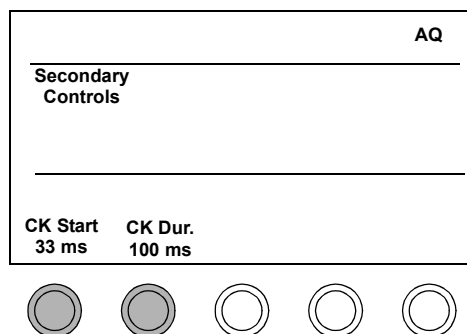
2 Select **Image Expand** or **Image Contract**.



- a. **Image Expand** lets you look at the colors as the borders move during an expansion phase - for example, from end systole to end diastole. This choice is indicated on the screen with a < > symbol beneath the CK color bar.
- b. **Image Contract** lets you look at the colors as the borders move during a contraction phase - for example, from end diastole to end systole. This choice is indicated on the screen with the > < symbol beneath the CK color bar.

3 Touch **Secondary Controls** and adjust the ECG timing controls as desired:

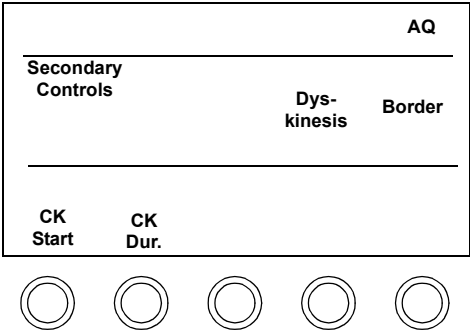
- a. Set the **CK Start** control to the number of milliseconds (ms) after the R-wave at which you want the CK colors to begin to display.
- b. Set the **CK Dur.** control to the desired duration of the color display after the start time.



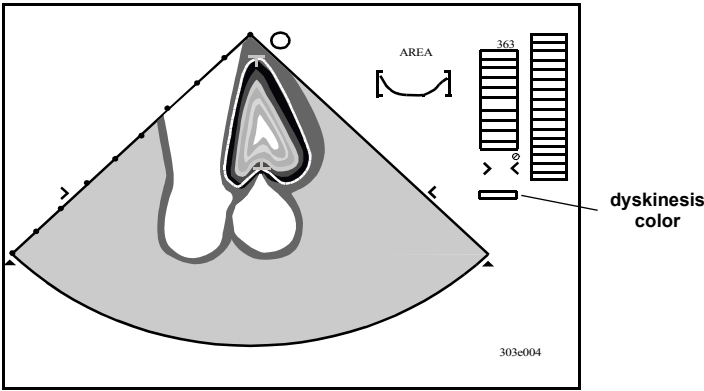
NOTE

Settings of **CK Start** and **CK Dur.** affect the number of colors displayed on the color bar and in each frame of the image as you scroll through the stored frames. Shorter color duration times will produce fewer frames of color and, therefore, fewer different colors.

4 On the main AQ panel, turn **Dyskinesis** on or off as desired:



- a. On - A color indicator representing dyskinetic motion displays below the CK color bar. Wherever you see this color in the image represents dyskinetic motion.
- b. Off - The dyskinesis indicator is removed from the display and the dyskinesis color does not appear in the image.



# Interpreting CK Colors

The colors shown in a CK image depend upon the CK settings you select. This table summarizes (for an NTSC display) the number of frames in which a border will be marked with a new color as the border changes position in each CK mode. The colors change progressively, from the first to the final frame. You can review each color change by scrolling through the stored frames from a frozen display.

Frame	Systole Color	Contraction Color	Expansion Color
1	orange	orange	blue
2			
3	yellow		
4			
5			
6	green	yellow	
7			
8			
9			green
10			
11	blue	green	
12			
13			
14			yellow
15			
16			
17			
18		blue	orange
19			
dyskinesis color	red	red	red

---



## AQ and CK Troubleshooting

This section lists tips for handling the most common problems in using AQ and CK. To find the problem you are having, look under the column labelled "Symptoms." To find possible solutions, look under the column labelled "Suggestions."

---

### AQ and CK Troubleshooting Overview

Before beginning an AQ or CK study make sure you have selected the appropriate preset for the study being performed.

Check to make sure that the  and  monitor controls are set for the ambient light. See "Calibrating the Monitor" in the first chapter of your *System Basics* guide.

Consult the following table for other symptoms and suggestions

**AQ Troubleshooting Table**

Symptoms	Suggestions
AQ Calculations do not appear to be accurate, even though the waveform looks right.	Check your ECG signal. A good ECG signal is required for the most accurate AQ calculations and waveforms.
No ECG waveform displays	Activate R-wave Beep momentarily, to verify the ECG signal.  Check that the ECG signal displays correctly on the system. If it does not, check the patient cable, the connection to the system, the electrodes, and lead placement, and the Physio Setup selections.  Adjust <b>ECG Gain</b> in the Physio control set on the left panel.
No heartsound, pulse, or respiration signal displays on the AQ waveform, even though I turned them on in AQ Setup.	Check to make sure that <b>Physio Suppress</b> is turned off in the Physio control set on the left panel.  Touch Physio on the left panel and press <b>Setup</b> to check the physios which are enabled. Physios not turned on in Physio Setup will not display, even if you turned them on in AQ.

---

### AQ Troubleshooting Table (Continued)

---

Symptoms	Suggestions
Values above the analysis waveform fluctuate too much.	<p>Make sure the blood pool of interest is positioned within the ROI.</p> <p>The ECG could be triggering off both the R-wave and the T-wave. If the T-wave is larger than the R-wave, reposition the electrodes to decrease the T-wave amplitude.</p> <p>Turn on averaging.</p> <p>Ask the patient to suspend respiration, and be sure to hold the transducer still while recording values.</p>
No analysis appears above the AQ analysis waveform.	Check that the ECG signal displays correctly on the system. If it does not, check the patient cable, its connection to the system, and the electrodes. No values will display without a connected ECG.
No <b>Waveform</b> control appears when I am ready to turn on the area or volume waveform.	Make sure the ROI is approved (solid outline after pressing <b>Enter</b> ); if this is a volume study, also make sure the long-axis reference graphic is approved ("T" markers display after pressing <b>Enter</b> ).
The analysis waveform will not turn green. It stays red or yellow.	<p>If the patient has an arrhythmia, change to a weaker <b>Reject</b> setting.</p> <p>If the waveform is erratic, try decreasing the <b>Samples</b> setting.</p>



---

### AQ Troubleshooting Table (Continued)

---

Symptoms	Suggestions
Endocardium and AQ border are not aligned.	<p>Adjust Gain, TGCs, and LGCs, as necessary.</p> <p>Try a different Frequency Fusion setting.</p> <p>Check the position of the transducer.</p> <p>Try using two focal zones, one at LV apex, and one at LV base.</p> <p>Turn on <b>Harmonic Fusion</b>. (However, the frame rate will decrease.)</p>
No real-time numeric readout appears to the left of the sector.	<p>Make sure that <b>Real-time Readout</b> has been selected in AQ Setup.</p> <p>Make sure the ROI is approved (solid outline after pressing <b>Enter</b>); if this is a volume study, also make sure the long-axis reference graphic is approved (“T” markers display after pressing <b>Enter</b>).</p>
An AQ waveform is too big or too small.	<p>Touch <b>Rescale</b> to adjust the minimum value and increments between vertical markers for the active waveform.</p>
Stationary “false walls” appear in the image.	<p>Lower some of the LGC sliders to make the LGC profile smooth instead of peaked. If false walls still appear, lower the sliders that affect the wall area and then either side of the wall area, maintaining a smooth profile.</p> <p>After adjusting LGC sliders, the transducer position might have changed. Go back to the original transducer position.</p>

---

### AQ Troubleshooting Table (Continued)

---

Symptoms	Suggestions
AQ tracks an LV artifact line	<p>Try adjusting the transducer position.</p> <p>If LGC is on, check to ensure the slider positions are not creating an artifact.</p> <p>Select a different Frequency Fusion setting or change to a higher frequency transducer.</p>
Numeric results appear to be incorrect	<p>Ask the patient to suspend respiration, and be sure to hold the transducer still while recording values.</p> <p>Make sure the imaging view is optimal. For volume studies, use a non-foreshortened apical view.</p> <p>Make sure the blood pool of interest is positioned within the ROI, and that no targeted areas are moving outside of the ROI. Also, ROI should exclude extraneous blood pools.</p> <p>The ECG could be triggering off both the R-wave and the T-wave. If the T-wave is larger than the R-wave, reposition the electrodes to decrease the T-wave amplitude.</p> <p>For volumes, check the position of the long-axis reference.</p> <p>Check endocardial and AQ border alignment by repeatedly touching Border to turn borders on and off so that you can compare the AQ borders with the real endocardial borders. Make any necessary adjustments.</p>
No line marks the beginning of the atrial contraction phase on the waveform and AFF=- - - -% appears in the analysis results.	<p>The system is unable to identify a point as the beginning of atrial contraction on this waveform. To set the position manually, touch <b>Edit Phases</b> and use <b>Adjust Phase</b> to position the bar, which now appears, marking the system's "best estimate" of the beginning of atrial contraction. Press <b>Enter</b> to store the new position.</p>

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### AQ Troubleshooting Table (Continued)

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Symptoms	Suggestions
Color Kinesis colors are broken up or mottled.	Realign the AQ borders with the endocardial borders.
Color Kinesis colors stop before the endocardial motion is complete.	Readjust the <b>CK Dur.</b> (duration) control in the Secondary control panel. If this control is not active, go into AQ Setup and turn on CK Timing.
Color Kinesis colors continue displaying later in the heart cycle than they should.	Readjust the <b>CK Dur.</b> control. If this control is not active, go into AQ Setup and turn on <b>CK Timing</b> .
Color Kinesis colors do not start with the first color in the color map.	Readjust the <b>CK Start</b> control. If this control is not active, go into AQ Setup and turn on <b>CK Timing</b> .
Too much dyskinesis color appears on the image.	Turn off dyskinesis by touching <b>Dyskinesis</b> .  There may be too much noise in the image. Adjust Gain control, if necessary.
I find it hard to view the colors, since there are so many different areas of color on the screen.	If you are not drawing an ROI for your CK study, do so. Even though an ROI is not required, CK is probably best viewed from within the limited confines of an ROI.  Press <b>Freeze</b> and scroll back through the individual frames to better view CK changes.



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