FUJIFILM

# FC1

## *User Guide*

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# CONTENTS

## Chapter 1: Introduction


Conventions ..... 1
Customer comments ..... 1
Open-source software ..... 2


## Chapter 2: Getting Started


About the system ..... 3
- System controls ..... 5
- Screen layout ..... 8
- Touch panel ..... 8

Preparing the system ..... 9
- Installing or removing the battery ..... 10
- Using AC power and charging the battery ..... 11

Turning the system on or off ..... 12
- Logging in as a user ..... 13
- Urgent log in ..... 13
- Logging out ..... 14
- Waking up the system from sleep mode ..... 14
- Sorting a list ..... 14
- Entering text ..... 15
- Control panel ..... 16

Preparing transducers ..... 16
- Connecting and removing transducers ..... 18

Basic operating steps ..... 18
Intended uses ..... 19
- Abdominal imaging applications ..... 19
- Cardiac imaging applications ..... 20
- Gynecology and infertility imaging applications ..... 20
- Interventional imaging applications ..... 20
- Pediatric and neonatal imaging applications ..... 20
- Superficial imaging applications ..... 20
- Vascular imaging applications ..... 20


## Chapter 3: System Setup


Security ..... 21
- About login permissions ..... 21
- Adding and managing user accounts ..... 22

# CONTENTS


Exporting exam data ..... 25
Disposal ..... 25
Specifying notification and Doppler volumes ..... 25
Setting the trackball speed ..... 26
Display setting ..... 27
Power Setting: Configuring power conservation ..... 28
Configuring Store buttons ..... 29
Configuring archiving (image export) ..... 32
Assigning functions to function buttons ..... 34
Defining the input of patient information ..... 36
Configuring examination image appearance ..... 37
Configuring peripheral devices ..... 40
Adjusting printer settings ..... 40
Adjusting foot-switch settings ..... 41
Barcode reader and magnetic card reader setting ..... 42
Specifying network settings ..... 43
Server connection settings ..... 44
Specifying DICOM settings ..... 45
DICOM MWL setting ..... 46
DICOM storage operation ..... 48
Setting timing for DICOM network storage ..... 50
Calibrating the display ..... 50
Enabling automatic image deletion (Data Configuration) ..... 51
Database optimization ..... 52
Output queue (examination/image) operation (Output Manage) ..... 53
Positioning the body-mark display ..... 53
Managing annotation lists ..... 54
Managing measurement functions ..... 56
Configuring measurements for all modes ..... 56
Specifying 2D-mode default measurement tools ..... 57
Specifying the CF-mode or the M-mode default measurement tool ..... 58
Configuring PW/CW/TDI-mode measurements ..... 59
Configuring preset-specific measurements ..... 60
Setting Auto IMT (intima-media thickness) measurement (Optional) ..... 61
Defining preset settings for examination types ..... 61
Assigning a function to the FREEZE button ..... 63
Selecting the default annotation type ..... 63
Selecting ready-made annotation lists ..... 64
Selecting the priority cursor for steer-link priority ..... 64

# CONTENTS


Selecting the area for applying sound-speed compensation ..... 64
Starting the electrocardiogram automatically ..... 65
Selecting the standard of acoustic output ..... 65
Setting the calculation unit ..... 66
Setting Priority/Preset for each transducer ..... 66
Configuring examination defaults (Exam Type Setting) ..... 67
Changing examination information display settings (Exam Type Format) ..... 68
Changing patient information display settings ..... 69
Restart setting (reexamination setting) ..... 70
Backing up and restoring presets ..... 70
Backing up and restoring presets ..... 71
Backing up and restoring system settings ..... 72
Backing up and restoring the Patient Log ..... 73
Resetting user configuration ..... 74
Formatting the USB memory ..... 75
Using USB memory ..... 76
Inserting a USB memory ..... 76
Removing a USB memory ..... 77
Formatting the SSD ..... 77
Viewing system information ..... 77
Changing site information settings ..... 78
Setting the system date and time ..... 78
Setting the date and time display formats ..... 79
Setting the language to display ..... 79
Setting the login method for the FC1 ..... 80
Setting the license ..... 80
Logs ..... 81
Setting log acquisition ..... 81
Setting audit log acquisition ..... 82


## Chapter 4: Imaging


Getting familiar with the examination screen ..... 85
Information in the header ..... 86
Information in the footer ..... 87
Imaging modes ..... 89
2D mode ..... 89
M mode ..... 96
CD and PD modes ..... 99
PW, CW, and TDI modes ..... 105

# CONTENTS


Controlling the image ..... 110
- Showing or hiding data on the monitor ..... 110
- Magnifying the image ..... 111
- Adjusting the depth and gain of the image ..... 111
- Setting the sound speed ..... 112
- Setting the sweep speed ..... 112
- Setting the transmission frequency ..... 113
- Setting the transmission-output level ..... 113
- Raising or lowering the emphasis of edges ..... 113
- Raising or lowering the level of sharpness ..... 114
- Adjusting image tone ..... 114
- Adjusting persistence ..... 114
- Setting the range of contrast ..... 114
- Setting the focus depth ..... 115
- Setting the color scale ..... 115
- Setting the filter cutoff frequency ..... 116
- Optimizing the image ..... 116
- Sizing mode images relative to each other ..... 117

Examination procedures ..... 118
Imaging modes and exams available by transducer ..... 119
Entering patient information ..... 124
- Patient information fields ..... 126
- Obtaining patient information by bar code or card reader ..... 129

Entering examination information ..... 130
- Precautions before starting an exam ..... 131
- Opening a patient's existing record from Patient Log ..... 132
- Opening an existing examination record from USB memory ..... 132
- Starting an examination from the DICOM work list ..... 132
- Deleting patient information from the DICOM worklist ..... 137

Starting an examination from the Patient Log screen ..... 137
- Starting an examination from patient information (Optional, Japan only) ..... 137
- Starting an examination from orders (Optional, Japan only) ..... 139

Restarting an examination ..... 140
Working with the Patient Log screen ..... 140
- Finding patient records in the Patient Log screen ..... 141
- Acquiring logs ..... 142
- Deleting logs ..... 142
- Editing patient examination records ..... 143
- Deleting patient examination records ..... 143

Working with the Examination List screen ..... 143
Obtaining patient information from USB memory ..... 145

# CONTENTS


Selecting the preset ..... 146
Displaying or hiding a preset ..... 146
Working with imaging presets ..... 147
Selecting a transducer ..... 153
Precautions when connecting or disconnecting a transducer ..... 153
Viewing in Dual-screen mode ..... 155
Controlling the display of images in Dual-screen mode ..... 156
Viewing in Simultaneous Dual-screen mode ..... 158
Using the M or D cursor ..... 159
Viewing the ECG waveform display ..... 160
The ECG waveform and display formats ..... 160
Displaying and configuring the ECG waveform ..... 161
Performing cine search while the ECG waveform is on-screen ..... 162
Using triplex mode ..... 162
Performing a needle procedure ..... 163
Preparing for a needle procedure ..... 164
Needle procedure precautions ..... 164
Verifying the needle path ..... 165
Using the needle guide ..... 169
Needle profiling (Optional) ..... 171
Using Cine mode ..... 172
Cine search ..... 172
Annotating images ..... 174
Creating text annotations ..... 175
Closing the annotation screen ..... 180
Displaying annotations ..... 181
Using body marks ..... 181
Displaying a body mark ..... 181
Selecting body marks registered in a preset ..... 183
Closing the Body Mark screen ..... 183
Switching the TI type ..... 183
Playing clips back ..... 184
Displaying a raw-data image ..... 184
Deleting raw-data images ..... 186
Transferring images via a network ..... 186
Printing images ..... 187
Working with archived examinations and their images ..... 188
The Archive screen and controls ..... 188
Selecting archived examinations ..... 188
Locking archived examinations ..... 190
Exporting archived examinations ..... 190
Deleting archived exams ..... 190

CONTENTS


Viewing archived exam images ..... 191
Deleting an archived raw-data image ..... 192
Printing archived images ..... 193
Moving archived examinations over a network ..... 194
Storing examination images ..... 195
Reviewing examination images ..... 196
Deleting images ..... 197
Printing exam images ..... 198
Managing the output queue of examinations and images ..... 199
Changing the transfer destination ..... 200
Changing printers ..... 202
Deleting an examination or image from the queue ..... 202
Exporting examination data ..... 203
Importing examination data ..... 205
Using a USB keyboard ..... 208
Ending an examination ..... 209


## Chapter 5: Measurements and Calculations


Measurement overview ..... 211
User interface for measurement ..... 212
Built-in measurement functions ..... 214
Measurement operation overview ..... 214
Measuring at points ..... 216
Trace ..... 223
Figure ..... 226
Line ..... 231
Auto Trace ..... 233
Measurement using auxiliary lines ..... 234
Deleting measurement tools ..... 236
Setting and using the Set and Next button ..... 237
Using the Set Default button ..... 237
Specifying settings ..... 238
Basic measurement ..... 238
Functional overview ..... 238
Measurement results display ..... 243
2D mode ..... 246
CD mode ..... 258
M mode ..... 260
D mode ..... 263
Settings ..... 274

# CONTENTS


Calculation formula ..... 274
Abbreviations ..... 278
Cardiac measurement ..... 279
Functional overview ..... 279
Cross-sectional views for measurement ..... 284
Built-in measurement functions ..... 287
Specifying the measures that are visible on CALCS tabs ..... 302
All modes: Accessing the cardiac measurement tabs ..... 303
All modes: Deleting measurements ..... 303
2D (B) mode ..... 303
M mode ..... 315
D mode ..... 320
Aortic stenosis ..... 334
Aortic regurgitation ..... 337
Mitral stenosis ..... 344
Mitral regurgitation ..... 350
Pulmonic regurgitation ..... 355
Tricuspid valve flow ..... 357
Tricuspid regurgitation ..... 359
Qp/Qs ..... 360
MPI (Myocardial Performance Index) ..... 363
Worksheet/Report ..... 365
Terms and abbreviations ..... 367
Vascular measurement ..... 373
Mode measurement functions ..... 374
Built-in mode measurement functions ..... 375
2D (B) mode ..... 396
Auto IMT (intima-media thickness) measurement (Optional) ..... 403
D mode ..... 405
Measurement of upper and lower extremity artery ..... 409
Measurement of upper and lower extremity venous ..... 410
Vascular worksheet and report ..... 412
Abdominal Measurement ..... 416
Functional Overview ..... 416
Built-in Measurement Functions ..... 418
2D mode ..... 421
D-mode ..... 431
2D mode ..... 436
Worksheet/Report ..... 437
Terms and Abbreviations ..... 440
Urological Measurement ..... 442
Functional Overview ..... 442

CONTENTS


Built-in Measurement Functions ....443
2D mode ....444
D-mode ....454
Worksheet/Report ....456
Terms and abbreviations ....458


## Chapter 6: References for Measurement Accuracy


Measurement accuracy ....461
Sources of measurement errors ....463
Measurement publications and terminology ....463
Cardiac references ....463
Obstetrical references ....473
General references ....474


## Chapter 7: Troubleshooting and maintenance


Troubleshooting ....477
System does not turn on ....477
System image quality is poor ....477
There is no CPD image ....477
There is no color image ....478
There are no measurement selections ....478
Printing does not work ....478
System does not recognize the transducer ....479
System does not mount the USB memory ....479
System does not accept the data imported from USB ....479
The external video is not working ....479
Patient information cannot be edited during examinations ....479
Patient information cannot be edited after examinations ....480
Edited patient information is not reflected to the image ....480
Barcode cannot be read correctly ....480
Patient information link with C@RNACORE cannot be used ....486
Order link with C@RNACORE cannot be used ....486
When using order link with C@RNACORE, the examination cannot be started with the transducer I want to use ....487
Software licensing ....487
Maintenance ....488

CONTENTS

## Chapter 8: Cleaning and disinfecting


Before getting started ....489
Determining the required cleaning and disinfecting level ....490
- Spaulding classifications ....490
- Clean and disinfect system and transducer to a high level (semi-critical uses) ....491
- Clean and disinfect system and transducer to a low level (non-critical uses) ....496

Storing the transducer ....499
Transporting the transducer ....499
Accessories ....501


## Chapter 9: Safety


Ergonomic considerations ....507
Positioning the system ....508
Positioning yourself ....509
Taking breaks, exercising, and varying activities ....510
Electrical safety ....510
- Electrical safety classification ....514

Equipment safety ....515
Battery safety ....516
Clinical safety ....518
Hazardous materials ....519
Electromagnetic compatibility ....519
Electrostatic discharge ....521
Separation distance ....522
Compatible accessories and peripherals ....522
Guidance and manufacturer's declaration ....525
Immunity testing requirements ....528
Labeling symbols ....528
- The label position on the FC1 system ....532

Specifications ....532
- Dimensions ....532
- Environmental limits ....533
- Electrical specifications ....533
- Battery specifications ....534

Standards ....534
- Electrical safety standards ....534

CONTENTS

EMC standards classification ..... 534
Acoustic standards ..... 534
Biocompatibility standards ..... 535

## Chapter 10: Acoustic Output

ALARA principle ..... 537
Applying the ALARA principle ..... 537
Direct controls ..... 538
Indirect controls ..... 539
Receiver controls ..... 539
Acoustic artifacts ..... 539
Guidelines for reducing MI and TI ..... 539
Output display ..... 540
MI and TI output display accuracy ..... 540
Factors that contribute to display uncertainty ..... 540
Related guidance documents ..... 541
Transducer surface temperature rise ..... 541
Acoustic output measurement ..... 542
In situ, derated, and water value intensities ..... 542
Tissue models and equipment survey ..... 543
Acoustic output tables ..... 544
Terms used in the acoustic output tables ..... 601
Acoustic measurement precision and uncertainty ..... 602
Terms ..... 603
Abbreviations ..... 605

## Chapter 11: IT network

Functions ..... 615
Network for connecting the device ..... 615
Specification for the connection ..... 615
Hardware specification ..... 615
Software specification ..... 615
Security ..... 616
Data flow ..... 616
Measures when failures occur in IT networks ..... 617
Warnings and cautions for IT networks ..... 618

CHAPTER 1

# Chapter 1: Introduction

This user guide provides information on preparing and using the FC1™ ultrasound system and on cleaning and disinfecting the system and transducers. It also provides references for calculations, system specifications, and safety and acoustic output information.

The guide is intended for a reader who is familiar with ultrasound technique and who has received training in sonography an clinical practices. Before using the system, you must receive such training.

See the applicable FUJIFILM SonoSite accessory user guide for information on using accessories and optional items. See the manufacturer's instructions for specific information about peripherals.

## Conventions

The document follows these conventions:

- A WARNING describes precautions necessary to prevent injury or loss of life.
- A Caution describes precautions necessary to protect the products.
- A Note provides supplemental information.
- Numbered and lettered steps must be performed in a specific order.
- Single-step procedures begin with this symbol: ❖.
- Items in bulleted lists do not need to be performed in sequence.

## Customer comments

Questions and comments are encouraged. FUJIFILM SonoSite is interested in your feedback regarding the system and the user guide. Please call FUJIFILM SonoSite at 888-482-9449 in the U.S. Outside the U.S., call the nearest FUJIFILM representative. You can also email FUJIFILM SonoSite at comments@sonosite.com.

For technical support, contact FUJIFILM SonoSite as follows.

| | |
|---|---|
| **Phone (U.S. or Canada)** | 877-657-8118 |
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| | |
|---|---|
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| | French support: +33 1 8288 0702 |
| | German support: +49 69 8088 4030 |
| | Italian support: +39 02 9475 3655 |
| | Spanish support: +34 91 123 8451 |

## Open-source software

This product uses third party's software that is made available as open source software or free software. This software is provided "as is" with no warranty of any kind as to its merchantability or fitness for any particular purpose. For information on open source software used in this product, please see the attached CD. If you would like to obtain a copy of the source code, please contact FUJIFILM SonoSite Technical Support.

**Note** FUJIFILM has successfully performed verification and validation testing on all third party software and has confirmed its suitability to be used in the FC1 system.

CHAPTER 2

# Chapter 2: Getting Started

## About the system

The FC1 ultrasound system is a portable, software-controlled device using all-digital architecture. The system has multiple configurations and feature sets used to acquire and display high-resolution, real-time ultrasound images. Features available on your system depend on your system configuration, transducer, and exam type.

A license key is required to activate the software. For more information, see "Software licensing" on page 487.

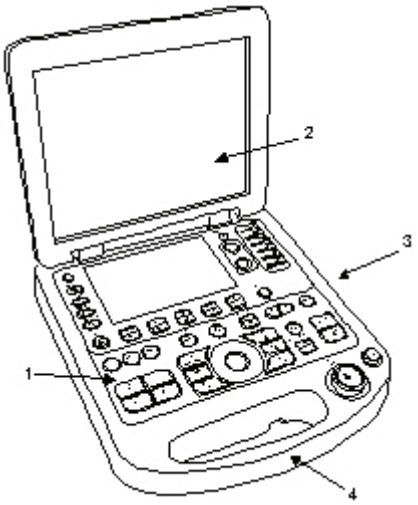



Figure 2-1: System Front Features

**1** Control panel **2** Display

**3** USB ports **4** Handle

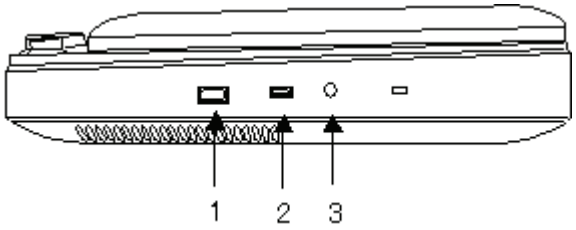



Figure 2-2: System Side Connectors

**1** USB port **2** ECG

**3** Earphone port

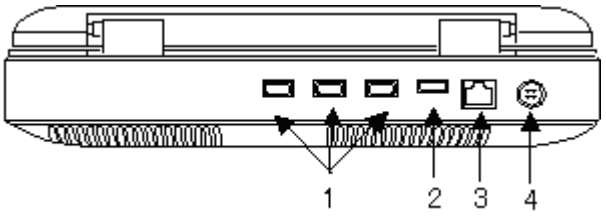



Figure 2-3: System Back Connectors

**1** USB port **2** HDMI port

**3** LAN port **4** Power connector

## System controls

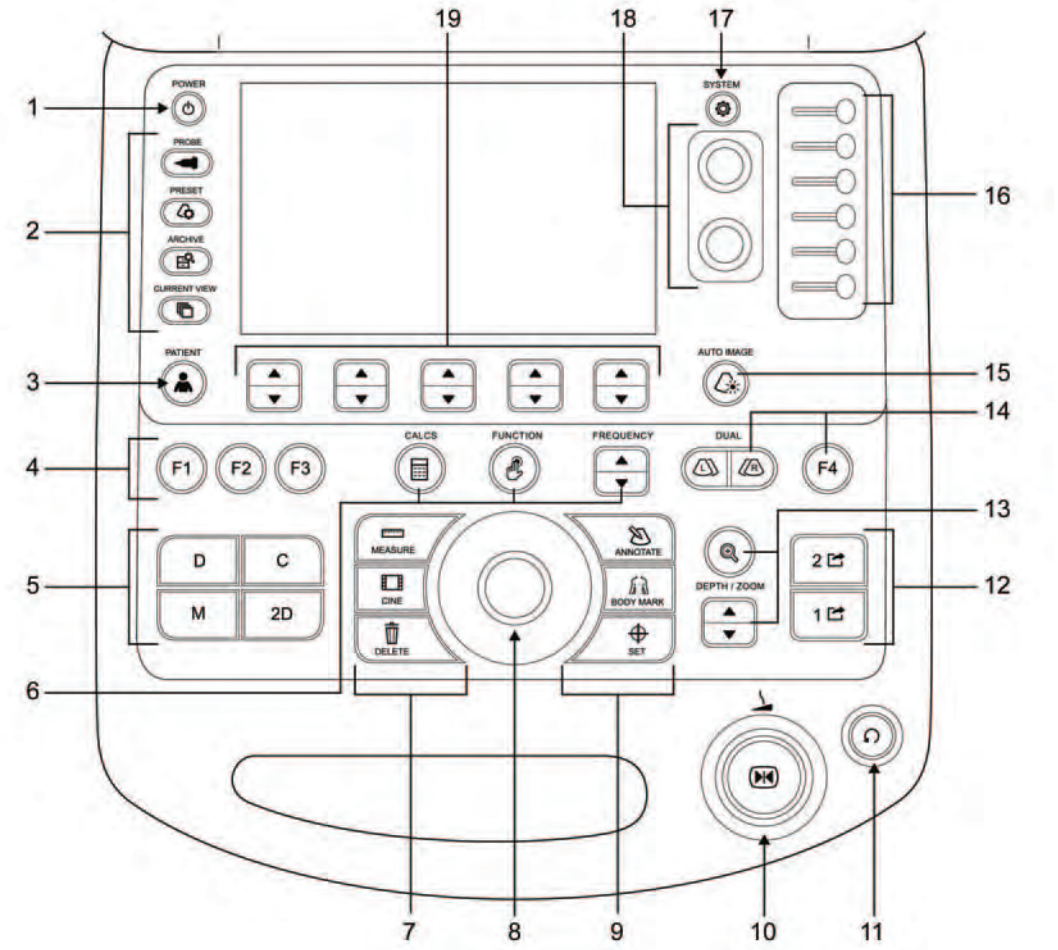



Figure 2-4: System controls

**Table 2-1: System controls**

| | Control | Used for |
|---|---|---|
| 1 | **POWER** button | Turning on/off FC1 |

**Table 2-1: System controls**

| | Control | Used for |
|---|---|---|
| 2 | Menu buttons | |
| | **PROBE** button | Selecting the transducer. |
| | **PRESET** button | Selecting the preset. |
| | **ARCHIVE** button | Storing the image stored at past examinations. |
| | **CURRENT VIEW** button | Viewing any images that have been stored in the current examination. |
| 3 | **PATIENT** button | Toggling between the Patient Info screen and the examination screen. |
| 4 | F-key (**F1**, **F2**, **F3**) | Carrying out a function assigned by the user.<br>For details on how to assign functions to the function buttons, see "Assigning functions to function buttons" on page 34 . |
| 5 | Mode buttons | |
| | **2D** button | Activating 2D mode. |
| | **C** button | Activating and deactivating the Color Doppler (CD) mode. |
| | **D** button | Activating and deactivating the Pulsed Wave Doppler (PW) mode. |
| | **M** button | Activating and deactivating the M mode. |
| 6 | **CALCS** button | Performing measurements that are specific to a preset. |
| | **FUNCTION** button | Selecting a trackball function from:<br>M/D cursor motion, Cine Search scroll, Caliper motion, Body Mark motion, Annotation motion, and ROI Zoom motion |
| | **FREQUENCY** button | Specifying the transmission frequency of the 2D (B) mode.<br>In CD, PD, PW, CW, and TDI (PW) modes, this button toggles to the function to change the scale in PRF (pulse repetition frequency). |
| 7 | **MEASURE** button | Displaying the dynamic caliper or calculation menu (for frozen images).<br>Pressing this button twice in succession in the PW mode activates the Auto-Dop Trace function. |
| | **CINE** button | Activating the Cine mode to perform cine playback. |
| | **DELETE** button | Correcting measurement results during measurement. |
| 8 | Trackball | Moving the cursor, defining the size/position of ROI, positioning the measurement tools, etc. |

**Table 2-1: System controls**

| | Control | Used for |
|---|---|---|
| 9 | **ANNOTATE** button | Entering arrows and annotations. |
| | **BODY MARK** button | Displaying or hiding the body patterns for the current examination. |
| | **SET** button | Selecting a function. |
| 10 | **FREEZE** button | Halting active imaging to display a frozen image on the screen. |
| | **GAIN** dial | Adjusting the gain of each screen mode. |
| 11 | Multi dial | Selecting from the following functions:<br>Finely adjusting the Doppler angle in the PW mode.<br>Rotating the transducer mark on each body pattern.<br>Rotating the Arrow annotation mark.<br>Deleting the trace line. |
| 12 | Store buttons | Storing or printing the ultrasound image currently displayed. For details on the setting of the STORE buttons, see "To configure Store buttons" on page 30. |
| 13 | **DEPTH/ZOOM** button | DEPTH: Changing the imaging depth of the display.<br>ZOOM: Magnifying the image. |
| 14 | **L** button/ **R** button | Activating the Dual screen mode and switching the active image. |
| | **F4** button | Selecting a function assigned by the user.<br>For details on how to assign functions to the function buttons, see "Assigning functions to function buttons" on page 34. |
| 15 | **AUTO IMAGE** button | Enabling the image (brightness and resolution) optimization function. |
| 16 | DGC (Depth Gain Control) keys | Adjusting the gain for each depth of field. |
| 17 | **SYSTEM** button | Displaying the system configuration on the touch panel. |
| 18 | Dial menu buttons | Adjusting certain touch panel menu items. |
| 19 | Switch menu buttons | Each button corresponds to a function menu on the touch panel |

## Screen layout

Following are instructions on how to use and modify elements of the unit such as the touch panel, lists, and changes you can make to keyboard functions.

## Touch panel

Activate a function by tapping its button on the touch panel. The way that you operate the button depends on the type of the button.

To select a function, tap the function's button on the touch panel. The display may change to show that the function is active. For instance, some buttons acquire a small orange dot when you select them. When you tap the function again, the display shows that the function is no longer active.

If the function has a submenu, tapping the function's touch-panel button opens the submenu. If the submenu has multiple pages, you can navigate among the pages by tapping switch-menu button 4 (the rocker button under **Page**).

To make the submenu disappear, tap **Cancel**.

For details about using a function, see the description of each function.

**Note**

If a button displayed on the touch panel is gray, the button is disabled—that is, it is unavailable and you cannot select it.

While the submenu screen is visible, only the power button, DGC (depth-gain compensation) key, Store button, and a function button to which the image storage function is assigned are enabled.

### Touch panel controls and dial menu buttons

Certain functions are associated with dial buttons. Use the menu dial buttons to change the functions that are associated with dial buttons.

**To reset the value of functions with dial buttons**

**1** If the function that you are interested in is not active, tap it to make it active.

**2** To change the function's value, turn the dial button.

**Note**

If there is no item beside the dial menu buttons on the right side of the touch panel, then none is available to assign to either button.

## Touch panel controls and switch menu buttons

Certain functions are associated with switch menu buttons. The switch menu buttons are numbered, from left to right, 1 through 5. Use the switch menu buttons to change the values of the functions that are associated with them.

**To change the value of functions with switch menu buttons**

1 If the function that you are interested in is not active, tap it to make it active.

2 To change the function's setting, press the top or bottom of the button.

**Note** If there is no item above the switch menu buttons, then none is available to assign to either button.

## Common operations on list screens

This section explains operations that are carried out on screens such as the Archive screen.

**Table 2-2: What the touch panel buttons do**

| Touch panel button | What it does |
|---|---|
| **Select All** | Tapping **Select All** toggles between selecting all the items in the list and clearing all the selections. |
| **First/Last** | Pressing the upper side of switch menu button 1 (under **First/Last**) displays the first page of the list. Pressing the lower side displays the last page. |
| **L/R Scroll** | Pressing the upper side of switch menu button 2 (under **L/R Scroll**) scrolls the display to the right. Pressing the lower side scrolls the display to the left. |
| **Page** | Pressing the upper side of switch menu button 3 (under **Page**) displays the previous page. Tapping the lower side displays the next page. |

# Preparing the system

**Caution** To reduce the risk of tripping, do not allow the power cord to intrude into walkways or workspaces.

The FC1 system requires that the battery be installed and charging before you use it.

## Installing or removing the battery

| | |
|---|---|
| **WARNING** | To avoid injury to the operator and to prevent damage to the ultrasound system, inspect the battery for leaks before installation.<br>To avoid data loss and to conduct a safe system shutdown, always keep a battery in the system.<br>For more information, see "Battery safety" on page 516. |
| **Caution** | Before using the ultrasound system, make sure the battery is installed. |

**To install the battery**

1 Disconnect the power supply from the ultrasound system.

2 Turn the system upside down.

3 Place the battery into the battery compartment, at a slight angle. See Figure 2-5

4 Slide the battery inward until it locks into place.

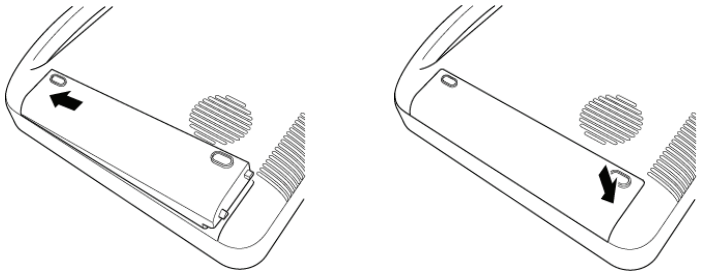


Figure 2-5: Install the battery

**To remove the battery**

1 Disconnect the power supply from the ultrasound system.

2 Turn the system upside down.

3 Insert your finger into the battery access port.

4 Press the battery release button on the side of the battery.

5 Lift the battery to remove it.

## Using AC power and charging the battery

The battery charges when the system is connected to the AC power supply. A fully discharged battery recharges in fewer than five hours.

The system can run on AC power and charge the battery if AC power is connected to the system (or to the FC series stand to which the system is attached).

The system can run on battery power for up to one hour, depending on the imaging mode and the display brightness. When running on battery power, the system may not restart if the battery is low. To continue working when the battery is low, connect the system to AC power.

When using the system in the United States and running connected to a 240V supply system, connect the equipment using a center-tapped, single-phase supply circuit.

**Caution**

Verify that the hospital supply voltage corresponds to the power supply voltage range. See "Electrical specifications" on page 533.

During use of the FC1, do not touch the AC adapter, as it becomes and stays very hot, and there is risk of burns.

**To operate the system using AC power**

**Caution**

Be sure to keep the battery inserted in the system even if the system is connected to the AC power supply.

Install the FC1 in a place where you can easily connect or disconnect the AC power cord. The equipment is not provided with the AC mains power switch. To disconnect the equipment from mains, use the appliance coupler or mains plug on the power supply cord.

**1** Connect the AC adapter to the power connector on the FC1 system.

**2** Push the cable in firmly to ensure a secure attachment.

**3** Connect the AC power cord from the FC1 power supply to a hospital-grade electrical outlet.

# Turning the system on or off

**WARNING** When opening or closing the monitor of the FC1, take care to not let your fingers be caught between the monitor and the control panel of the FC1.

**Caution** Do not use the system if an error message appears on the display. If you see an error code:
**1** Note the error code and turn the system off.
**2** Call FUJIFILM SonoSite or your local representative.

The FC1 is powered by either AC or battery power.

The internal battery automatically charges if the AC adapter is connected to the FC1.

**Caution** Use only with AC adapter provided by FUJIFILM SonoSite, PN P18011

**To start the FC1**

**1** Make sure that the FC1 system is connected to a hospital-grade power source or that the battery of the FC1 is fully charged.

**2** Connect a transducer.

**3** Press the power button.

**4** Check the screen display of the FC1.

During initialization of the system, the opening screen appears on the main monitor and the touch panel, and all the buttons on the control panel are lit up.

When initialization has completed:

- The system automatically starts up in 2D-mode.
- A 2D-mode image appears in the image area.
- The buttons for the 2D-mode appear on the touch panel.

**To shut down the FC1**

| | |
|---|---|
| **Caution** | Before you press the power button, make sure that you hear the sound indicating that the saving of data is complete. If you press the power button before you hear the data-save completion sound, the saved data may be erased.<br><br>Pay attention since pressing the power button 10 seconds or longer will forcibly shutdown the FC1. If you force shutdown of the system, data inconsistency may result.<br>Force shutdown should be used only when the FC1 cannot be otherwise shut down. |

❖ Press the power button.

The **Power off** indication appears on the main monitor and the touch panel, the operation of FC1 stops, and then the power is turned off.

## Logging in as a user

If login settings are configured, login authentication is required when the system is started, restarted, or woken from sleep mode.

For more information about user privileges and security settings, see "Security" on page 21

For more information about login settings, see "Setting the login method for the FC1" on page 80.

**To log in**

If login settings have been configured, follow this procedure.

**1** Start the FC1.

**2** On the login screen, type the user name and password and tap **OK**.

## Urgent log in

In an emergency, you can use the urgent login feature to log in quickly as a guest and bypass the normal login procedure.

**To perform an urgent login**

**1** Start the FC1.

**2** On the login screen, enter a user name. You are not restricted to specific user names. A password is not required.

**3** Tap **Emergency.**

| | |
|---|---|
| **Caution** | Use the urgent login feature only in emergency situations. As an urgent login guest user, you can perform ultrasound scanning and save images and/or clips, but you cannot search or view patient information, or change security settings. |

## Logging out

You must log out of the FC1 system before another user can log in. You cannot log out during an examination. By default, during sleep mode, the system will log the current user out after a specified period of time. To stop the system from logging out users during sleep mode, see "To set the sleep and shutdown power settings" on page 28 and turn sleep mode to OFF.

For security reasons, remember to log out before turning the system off so that others cannot use your login privileges.

**To log out**

**1** Tap [Other].

**2** Tap [Logout].

**3** On the confirmation page, tap OK.

The login screen appears

## Waking up the system from sleep mode

The system goes into sleep mode if there is no user activity for a preset time. This conserves battery life while the system is on. To adjust the time for sleep delay, see "Power Setting: Configuring power conservation" on page 28 .

**To wake up the system**

❖ Press a key or the touch panel.

## Sorting a list

Tapping one of the column names in a list sorts the list based on that column name and toggles between the sort orders: from ascending to descending, or vice-versa.

▸ The mark displayed next to the column name indicates that the list is sorted in ascending order.

- The mark indicates that the list is sorted in descending order.

**Note** You cannot base the sorting of a list on multiple columns.

## Entering text

If you have already typed any characters in the text box, those characters also appear in the text box of the virtual keyboard, and the text cursor shows at the end of the text.

To move the text cursor, tap the position where you want the text cursor to move to.

**Note** You cannot type more characters than the maximum number of characters allowed for a given field.

**To enter data**

**1** To open the virtual keyboard on the touch panel, do one of the following:

- Tap in the text box.
- Tap **Keyboard**.

The text cursor appears in the text box of the virtual keyboard, and character input becomes available.

**2** Type on the virtual keyboard.

As you type characters, they appear in the text boxes of the virtual keyboard and the original screen.

The and buttons are like the Tab and Alt+Tab keys, respectively, on a physical keyboard: They move the cursor (and the focus—where your entry will have an effect) from one entry item to the next (or previous).

To move the focus between items in a screen, tap or , according to where you want the focus to go.

Entering the date switches the virtual keyboard to the number or symbol input mode. When entering the date in Japanese format, the date can be entered in the Western calendar format, but also in the Japanese calendar format.

You can enter dates in any of the following three types of date formats (Japanese, American, or European):

- Japanese format: year, month, day
- American format: month, day, year
- European format: day, month, year

**To close the virtual keyboard**

❖ Tap **Close**.

## Control panel

As you work with the control panel, you can use the trackball to do the following:

- Move the cursor and specify the region of interest (ROI) and the PW gate in an image.
- Operate PAN.

You can also assign certain functions to the trackball. To change the functions assigned to the trackball, press the **FUNCTION** button.

Use the mode buttons to switch modes between 2D (B), M, CD, and PW.

For details on each button, see "System controls" on page 5.

For more information on the touch panel, see "Touch panel" on page 8.

# Preparing transducers

Acoustic coupling gel is necessary during examinations. Some gels are incompatible with some transducer materials and may cause damage. FUJIFILM SonoSite recommends Aquasonic gel and provides a sample with the system.

**WARNING**

Some transducer sheaths contain natural rubber latex and talc, which can cause allergic symptoms, such as itching, reddening, hives, swelling, fever, dyspnea, asthma-like symptoms, drop in blood pressure, and anaphylactic reaction or shock. If you observe such symptoms, stop using the product immediately and take appropriate measures.

Some individuals may have an allergic reaction to some gels and sterilants.

To prevent contamination, the use of sterile transducer sheaths and sterile coupling gel is recommended for clinical applications of an invasive or surgical nature. To lessen the risk of contamination, apply the gel and sheath only when you are ready.

**Caution**

To avoid damage to the transducer, use only gels recommended by FUJIFILM SonoSite. Using other gels can damage the transducer and void the warranty. If you have questions about gels, contact FUJIFILM SonoSite or your local representative.

FUJIFILM SonoSite recommends that you clean transducers after each use. For general use, apply a liberal amount of gel between the transducer and the body. For invasive or surgical use, apply a transducer sheath.

If acoustic coupling gel adheres to the FC1, be sure to wipe it off. If the FC1 is operated with a liquid such as acoustic coupling gel adhering to it, it may cause malfunction.

**To apply a transducer sheath**

**Caution**

FUJIFILM SonoSite recommends the use of market-cleared, transducer sheaths for surgical applications.

**1** Place gel inside the sheath.

**2** Insert the transducer into the sheath.

**3** Pull the sheath over the transducer and cable until the sheath is fully extended.

**4** Secure the sheath using the bands supplied with it.

**5** Check for and eliminate bubbles between the face of the transducer elements and the sheath.

Such bubbles between the face of the transducer and the sheath may affect the ultrasound image.

**6** Inspect the sheath to ensure that it has no holes or tears.

## Connecting and removing transducers

| | |
|---|---|
| **WARNING** | Operate the FC1 system on a FC series stand or on a flat hard surface to allow good airflow below and behind the FC1.<br>Note that the temperature of the FC1 may rise and the system may shut down automatically if no sufficient air intake and evacuation is allowed. |
| **Caution** | To avoid damaging the transducer connector, do not allow foreign material to get into the connector. |

**To connect a transducer**

**1** Disconnect the power supply from the FC1 ultrasound system.

**2** Turn the system upside down after the monitor is closed.

**3** Pull the transducer latch up and rotate it clockwise.

**4** Insert the transducer connector into the system connector.

**5** Turn the latch counterclockwise.

**6** Press the latch down, securing the transducer connector to the system.

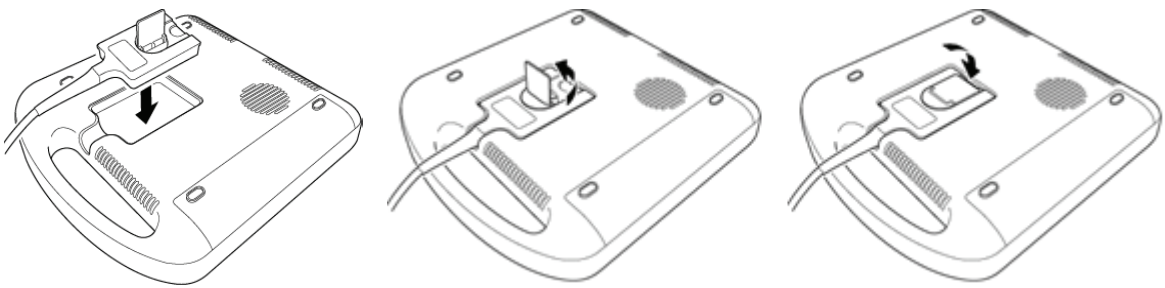


Figure 2-6: Connect the transducer

**To remove a transducer**

**1** Raise the transducer latch and rotate it clockwise.

**2** Pull the transducer connector away from the system.

# Basic operating steps

**1** Install the battery.

2 Attach a transducer.

3 Turn the system on after connecting the AC adapter.

For the power switch location, see "System controls" on page 5.

4 Press the **PATIENT** button, and enter the required information on the Patient Info screen.

5 Press a mode button: **2D** (2D mode), **M** (M mode), **C** (Color Doppler mode), or **D** (Pulsed Wave Doppler mode).

# Intended uses

The FC1 system is used with a transducer attached and powered by either battery or AC electrical power. The clinician is beside the patient and places the transducer onto (or into, for invasive procedures) the patient's body where needed to obtain the desired ultrasound image.

The system transmits ultrasound energy into the patient's body to obtain ultrasound images, as described below.

For the intended transducer and imaging modes for each exam type, see "Imaging modes and exams available by transducer" on page 119.

**FDA clinical indications for use:**

- Fetal - OB/GYN
- Abdominal
- Intra-operative (Abdominal organs and vascular)
- Pediatric
- Small Organ (breast, thyroid, testicles, prostate)
- Neonatal Cephalic
- Trans-vaginal
- Musculo-skel. (Convent.)
- Musculo-skel. (Superfic.)
- Cardiac Adult
- Cardiac Pediatric
- Peripheral Vessel

## Abdominal imaging applications

You can transabdominally assess the liver, kidneys, pancreas, spleen, gallbladder, bile ducts, transplanted organs, abdominal vessels, and surrounding anatomical structures for the presence or absence of pathology.

## Cardiac imaging applications

You can assess the heart, cardiac valves, great vessels, surrounding anatomical structures, overall cardiac performance, and heart size for the presence or absence of pathology.

You can also do the following:

- Identify the presence and location of fluid around the heart and lungs, or assist in pericardiocentesis or thoracentesis
- Visualize blood flow through cardiac valves
- Obtain the patient's electrocardiogram (ECG), for timing cardiac events

**WARNING**

Do not use an ECG that you obtain by ultrasound to diagnose cardiac arrhythmias.

The FC1 is not designed for long-term cardiac-rhythm monitoring.

## Gynecology and infertility imaging applications

You can transabdominally assess the uterus, ovaries, adnexa, and surrounding anatomical structures for the presence or absence of pathology.

## Interventional imaging applications

You can use the FC1 for ultrasound guidance in biopsy and drainage procedures, vascular line placement, nerve blocks, and puncture during abdominal, breast, and neurological surgery.

## Pediatric and neonatal imaging applications

You can assess the pediatric and neonatal abdominal, pelvic, and cardiac anatomy, pediatric hips, neonatal head, and surrounding anatomical structures for the presence or absence of pathology.

## Superficial imaging applications

You can assess the breasts, thyroid, testicles, lymph nodes, hernias, musculoskeletal structures, soft-tissue structures, and surrounding anatomical structures for the presence or absence of pathology. You can use the system for ultrasound guidance in biopsy and drainage procedures, vascular line placement, peripheral nerve blocks, and spinal nerve blocks and taps.

## Vascular imaging applications

You can assess, for the presence or absence of pathology, the carotid arteries, deep veins and arteries in the arms and legs, superficial veins in the arms and legs, great vessels in the abdomen, and various small vessels that feed organs.

CHAPTER 3

# Chapter 3: System Setup

You can configure FC1 system settings (for example, system date and time, power conservation, settings for measurement functions, presets, trackball sensitivity, and defaults such as initial examination types) that affect how you use the system.

**Caution**

When an examination is being performed (with a patient ID already registered), or when a large amount of data is stored in the output queue, and if you are logged in to the FC1 as a user, some settings are disabled. In addition, note that some settings are not reflected immediately.

## Security

**Caution**

Healthcare providers who maintain or transmit health information are required by the Health Insurance Portability and Accountability Act (HIPAA) of 1996 and the European Union Date Protection Directive (95/46/EC) to implement appropriate procedures: to ensure the integrity and confidentiality of information and to protect against any reasonably anticipated threats or hazards to the security or integrity of the information or unauthorized users or disclosures of the information.

The **Security** page includes security settings that help you to meet the applicable security requirements listed in the HIPAA standard. Users are ultimately responsible for ensuring the security and protection of all electronic protected health information collected, stored, reviewed, and transmitted on the system.

## About login permissions

There are two types of user accounts: Admin and User.

- **Admin** - A user that has been given administrator privileges. Admins are allowed access all functionality and patient/examination data without any restriction.

| Caution | To protect patient and examination data, only assign Admin privileges to appropriate personnel and according to operational needs. |
|---|---|

- **User** - Not allowed to edit or delete patient/examination data. The security settings and system settings that impact application behaviors cannot be accessed.

In addition, there is the default **Administrator** account that cannot be deleted or changed. Someone logged in to the Administrator account can perform the following tasks:

- All of the functions of a user Admin.
- Add users.
- Change the privilege level of any other user account.
- Change the password of any other user account.
- Delete any other user account.

Only the default Administrator account can change the security settings for other users.

## Adding and managing user accounts

Access privileges are restricted by the user account type. Before creating or changing user accounts, determine the amount of access you want the user to have.

You can add up to 20 user accounts in the FC1 system (including the default Administrator account).

**To add a new user**

1. Log in to the default Administrator account.
2. Press the **SYSTEM** button ( ).

   The **User Setting** screen appears.
3. On page 3/4, tap **Security**. The **Security** screen appears.
4. Tap **Login User**. The **Login User Setting List** screen appears.
5. Tap a blank list item, and then tap **Edit**.

6 Enter information in the following fields:

- **User Name**
- **User Password**
- **User Password (Confirm)**

7 If you want this user to have administrative privileges, select **Admin**.

8 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

**Note**

To ensure security, choose a password that contains upper case characters (A-Z), lowercase characters (a-z), and numbers (0-9). Passwords are case-sensitive.

- Change passwords regularly.
- User names should be between 3 and 15 characters.
- Passwords should be between 6 and 15 characters

**To edit user settings**

1 Log in to the default Administrator account.

2 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

3 On page 3/4, tap **Security**. The **Security** screen appears.

4 Tap **Login User**. The **Login User Setting List** screen appears.

5 Tap a user name, and then tap **Edit**.

6 Change the following information as necessary:

- **User Name**
- **User Password**
- **User Password (Confirm)**

7 If you want this user to have administrative privileges, select **Admin**.

**8** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

**To delete a user**

**1** Log in to the default Administrator account.

**2** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**3** On page 3/4, tap **Security**. The **Security** screen appears.

**4** Tap **Login User**. The **Login User Setting List** screen appears.

**5** Tap a user name, and then tap **Delete**.

**6** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

**To change a user password**

**1** Log in to the default Administrator account.

**2** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**3** On page 3/4, tap **Security**. The **Security** screen appears.

**4** Tap **Login User**. The **Login User Setting List** screen appears.

**5** Tap a user name, and then tap **Edit**.

**6** Change the following information:

- **User Password**
- **User Password (Confirm)**

**7** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Exporting exam data

You can export examination data saved in the FC1 system internal storage to a USB memory. When exporting exam data, observe the following:

- USB memory should have data security functionality.
- Use proper security measures to protect patient information, such as using secure passwords and storing in a secure location.

When using an unencrypted USB memory to store patient information, do not leave the memory unattended, and erase the data securely when you are finished using it. For more information about exporting exam data, see "Configuring archiving (image export)" on page 32.

## Disposal

You are responsible for protecting any patient information stored on the FC1 system before it leaves the custody of your organization. When disposing of the FC1 system, or when transferring ownership, be sure to perform the following operations to delete all internal data:

- Restore the factory settings. See "Resetting user configuration" on page 74
- Delete the audit log. See "Setting audit log acquisition" on page 82
- Delete the user logins. See "To delete a user" on page 24

# Specifying notification and Doppler volumes

You can set the volume for the following:

- Beeps (sounds when you save an image)
- Alarms (sounds when an error occurs or a warning message appears)
- Doppler

**To adjust the volume settings**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Device**. The **Common Setup** screen appears.

3 Tap **Volume Setting**. The **Volume Setting** screen appears.

4 To change the beep volume or the alarm volume:

**a** Tap the green right-arrow virtual button ( ) for either **Beep Volume** or **Alarm Sound**.

**b** On the **Beep Volume** or **Alarm Sound** screen that appears, do one of the following:

- Tap **OFF** to mute the beep or alarm.
- Tap **Low**, **Mid**, or **High** to set the volume level of the beep or the alarm.

5 To adjust the Doppler volume, tap the left- or right-arrow virtual buttons ( or ) at the right of **Doppler Volume**.

You can set the Doppler volume from 0 to 100.

6 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Setting the trackball speed

You can set the following aspects of responsiveness to rotation of the trackball:

- The vertical and horizontal speed of the cursor
- The speed of 2D and Strip Cine search movement

**To set the trackball speed**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Device**. The **Common Setup** screen appears.

3 Tap **Trackball Config.** The **Trackball Config** screen appears.

4 To increase or decrease the trackball sensitivity, tap the left- or right-arrow virtual buttons ( or ) for any of the following.

The range for each aspect of trackball sensitivity is 1 - 100. Decreasing the value makes the trackball more sensitive to movement.

- **Up/Down**

  Vertical operation of the trackball.

- **Left/Right**

  Horizontal operation of the trackball.

- **Cine Search (2D)**

  Cine loop review of 2D images.

  For more information on Cine and Cine search, see "Using Cine mode" on page 172.

- **Cine Search (Strip)**

  Cine loop review of strip image.

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Display setting

You can set the brightness level of the monitor and touch panel of the FC1, ECO mode, power settings, and test pattern printing. (ECO mode is a power-saving setting.)

**To change brightness levels and power and ECO mode settings**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Device**. The **Common Setup** screen appears.

3 Tap **Display**. The **Display** screen appears.

4 To set the brightness of either the larger monitor or the touch panel, to the right of, respectively, **Main Monitor Brightness** or **Touch Panel Brightness**, tap either the right- or left-arrow virtual button ( or ).

You can set the brightness level from 1 to 10.

**Note**

You can set **Main Monitor Brightness** and **Touch Panel Brightness** only when **Economy Mode Setting** is set to **OFF**.

5 To enable the ECO mode, make sure that the **ON** virtual button to the right of **Economy Mode Setting** is selected (orange). To disable the ECO mode, make sure that the **OFF** virtual button is selected.

6 To use the AC power supply in the normal power supply connection mode, make sure that the **Normal** virtual button to the right of **External Power Connection** is selected. To use AC power supply in the ECO mode, tap **Economy**.

You can set **External Power Connection** only when **Economy Mode Setting** is set to **ON**.

7 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Power Setting: Configuring power conservation

Use the power settings (Sleep Timer with Battery, Sleep Timer with AC Power, Shutdown Timer with Battery, and Shutdown Timer with AC Power) to conserve power by controlling when the system goes into sleep mode (temporary suspension of the system) and/or shuts down entirely. With these settings, you specify, for either battery or AC power:

- Whether the system automatically goes into sleep mode and/or shuts down
- If you specify automatic power conservation, after how long a period of inactivity it occurs

**To set the sleep and shutdown power settings**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Device**. The **Common Setup** screen appears.

3 Tap **Power Setting**. The **Power Setting** screen appears.

4 To configure the **Sleep Timer with Battery**, **Sleep Timer with AC Power**, **Shutdown Timer with Battery**, and **Shutdown Timer with AC Power** settings:

**a** Make sure that the **ON** virtual button is selected (orange).

**b** To set the amount of idle time before the FC1 enters the sleep mode or shuts down, tap the right- or left-arrow virtual button ( or ) for the appropriate setting.

The possible ranges for these settings are:

- **Sleep Timer with Battery** and **Sleep Timer with AC Power**: 1 to 60 minutes
- **Shutdown Timer with Battery** and **Shutdown Timer with AC Power**: 1 to 120 minutes

**c** To disable sleep mode or automatic system shutdown for a particular source of power, tap **OFF**.

5 To change the **Shutdown Timer with AC Power** setting (the shutdown setting when the system is running on AC power):

**a** Press the down arrow on switch menu button 4 (the rocker button beneath **Page**).

**b** Change settings as for the other power settings.

6 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Configuring Store buttons

You can assign functions to two Store buttons, including the function that stores or prints images on the FC1 to a Store button.

You can also configure the Store3 button so that its function is assigned to one of the function (**F1**, **F2**, **F3**, and **F4**) buttons.

For information on assigning functions to the function buttons, see "Assigning functions to function buttons" on page 34.

**Caution** Before you try to store images in the DICOM network storage device, make sure that the status icon (network icon) display is valid.

**To configure Store buttons**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Store**. The **Common Setup** screen appears.

3 Tap the button to which you want to assign a function:

- **Store 1**
- **Store 2**
- **Store 3**

You can assign functions only for the number of buttons displayed in the **Store** screen.

4 In the **Raw Data** row, decide whether you want this button's function to store raw data or not and select the **ON** or **OFF** virtual button (orange), accordingly.

5 To specify whether the button captures live stills (single frames) or clips (video sequences), in the **Live Capture** row, tap one of the following:

- **Still**

  When you press the Store button, the system captures a snapshot (a single frame) of the live ultrasound image.

  The system either stores the image in the FC1's internal storage media or prints it, according to your settings.

- **Clip**

  When you press the Store button, the system captures a real-time sequence (clip) of the live ultrasound image and/or during cine playback and stores it in the FC1's internal storage media. For clips of an ECG display, set the duration with the **Beat** setting.

  **Note** The Beat setting is effective only when a live image is displayed. When you store a clip during cine playback, make sure that Beat is set to OFF.

6 To set the duration of captured clips:

- When using the time other than ECG displays:

In the **Clip Time** row, tap the right- or left-arrow virtual button ( or ).

Setting duration is available only when, for **Live Capture**, you have selected **Clip**. The valid range is between 2 seconds and 60 seconds.

In the **Clip Type** row, tap [DICOM] or [AVI] to set the storage format of the clip (except the format of the ECG display).

**Caution**

Clips in the AVI format exported to USB memory cannot be imported to the FC1.

Clips in the AVI format cannot be stored in the DICOM network storage device. If you select AVI and tap OK, a message appears indicating that the clip cannot be stored.

Even when the AVI format is selected, if a still image is stored while the image is frozen, the still image is stored in DICOM format.

- For ECG displays, to select the number of heartbeats to be recorded when the ECG waveform appears:

In the **Beat** row, tap the right-arrow virtual button ( ).

i In the **Beat** selection screen, tap a button to select from one to five heartbeats.

ii To set the duration of the clip according to the **Clip Time** setting, tap **OFF**.

**Caution**

When storing heartbeat images, do not perform image adjustments. Otherwise the images cannot be stored.

When you specify the number of heartbeats with this setting, the maximum duration of the clip is 5 seconds. For this reason, image data for the specified number of heartbeats cannot be stored.

**7** To store ultrasound images on the DICOM server:

**a** In the **Network Output** row, tap the right-arrow virtual button ( ).

**b** On the **Network Output** selection screen, tap **DICOM Server**.

To store images on the DICOM Server, the system must be connected to it; to *not* store the images on the DICOM server, tap **Disable**.

**8** To specify whether to use a printer, and whether to print in black-and-white or color:

**a** In the **Use Printer** row, tap the right-arrow virtual button ( ).

**b** On the **Use Printer** selection screen, tap one of the following:

- **B&W**, to use a black-and-white printer
- **Color**, to use a color printer
- **Disable**, to not print images

**9** To set JPEG compression quality:

**a** Tap **Store**.

**b** Tap **AVI**.

**c** Tap the right- or left-arrow virtual button ( or ) to set the image quality of the clip in the AVI format.

**d** Tap **OK** to save the setting. **Note**: if you set a smaller value, the compression rate increases, although the image quality is degraded.

**10** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Configuring archiving (image export)

You use the archive settings to specify the following for images that you export to a USB memory for archiving:

- The image file formats and color settings
- Whether patient information is attached to the image and, if so, how you create the information

| | |
|---|---|
| **Caution** | Although you can reduce image file sizes by compressing images, image compression degrades the image quality. |

**To select file-format and color settings for archived images**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 1/4, tap **USB Image Export**. The **Common Setup** screen appears.

**3** Tap **Export Config**. The Export Config screen appears.

**4** To select the file format of still images:

**a** Tap the right-arrow virtual button ( ) to the right of **Still Image File Format**.

**b** Tap the desired file format: **DICOM**, **TIFF**, or **JPEG**.

**c** With **JPEG** selected, to set the image quality of JPEG images, tap the right- or left-arrow virtual button ( or ) at the right of JPEG Compression Quality.

The range of possible compressions is 80% to 100%.

When you specify the TIFF or JPEG file format, the system also stores images in the DICOM format.

**5** To specify the image quality for DICOM still images and for DICOM videos (DICOM clip images):

**a** Tap to the right of **DICOM Still Image Syntax** or **DICOM Clip Image Syntax**, respectively.

**b** For each, tap one of the following compression levels:

- **Implicit VR Little Endian**
- **Explicit VR Little Endian**
- **JPEG Lossy**
- **RLE Lossless**

**c** Tap **Close**.

**6** To access the next page of settings, press switch menu button 4 (the rocker button under **Page**).

**7** To specify the image quality for the secondary capture image:

**a** Tap to the right of **DICOM SC Image Syntax**.

**b** In the **DICOM SC Image Syntax** box, tap either of the following:

- **Implicit VR Little Endian**
- **Explicit VR Little Endian**

**c** Tap **Close**.

**8** To choose a color setting for storing images:

**a** Tap to the right of **DICOM Color Setting**.

**b** In the **DICOM Color Setting** box, tap one of the following:

- **RGB (Pixel)**
- **RGB (Plane)**

**c** Tap **Close**.

**9** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

**To specify patient info to be attached to archived images**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 1/4, tap **USB Image Export**. The **Common Setup** screen appears.

**3** Tap **Export Config**. The **Export Config** screen appears.

**4** To access the next page of settings, press switch menu button 4.

**5** To de-identify the patient's personal information before exporting images, beside **De-identify Patient Information**, tap **ON**; to keep patient information with the exported images, tap **OFF**. Note that, to export files to a USB memory, **De-identify Patient Information** must be set to **OFF**; patient identity is displayed in the file that results.

**6** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Assigning functions to function buttons

The FC1 has four function buttons. You can assign a function of your choice to each one.

**To specify the function button settings**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 1/4, tap **UI**. The **Common Setup** screen appears.

3 Tap **F-key Config**. The **F-key Config** screen appears.

4 On the right end of the row for the function button (**F1**, **F2**, **F3**, or **F4**) whose assigned function you want to change, tap the right-arrow virtual button ( ).

5 In the **F1**, **F2**, **F3**, or **F4** selection screen, tap one of the following functions:

- **None**
- **PD-mode**
- **CW-mode**
- **TDI-mode**
- **TH (Tissue Harmonic)**
- **CH (Compound Harmonic)**
- **SC (Spatial Compound)**
- **Hide Pt Bar**
- **Remove Data Fields**
- **Worklist**
- **Pat. Log**
- **Exam List**

The following functions are on page 2 of the screen. To see them, tap switch menu button 4 (the rocker button under **Page**).

- **End Exam**
- **Report**
- **M/D Cursor**
- **Custom Presets**
- **Image Width**
- **L/R Invert**
- **U/D Invert**
- **ECG**

- **Store 3**
- **Needle Profiling**
- **Update**
- **Steer Shallow**
- **Steer Steep**

For information on assigning functions to the Store buttons, see "To configure Store buttons" on page 30.

6 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Defining the input of patient information

In the **Patient Input** screen, you can specify the following:

- The type of patient information that is available for data input when you start a session
- The maximum length for each character in patient information

**To specify aspects of patient-information input**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **UI**. The **Common Setup** screen appears.

3 Tap **Patient Input**. The **Patient Input** screen appears.

4 To specify the type of data that the user enters first when inputting patient data, tap the right-arrow virtual button ( ) to the right of **Default Focus**.

5 In the **Default Focus** selection screen, tap either **Patient ID** or **Accession No.**

6 To force a maximum character length of a single byte for entry of patient information, make sure that the **ON** virtual button beside **Compulsory input (1-byte char.)** is selected (orange).

- If instead you want to allow a double-byte character length, make sure that the **OFF** virtual button beside **Compulsory input (1-byte char.)** is selected.

- Single-byte characters are characters, numbers, and special characters in the western alphabet, excluding those with diacritical marks such as accents, cedillas, tildes, macrons, circumflexes, and umlauts.

**7** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Configuring examination image appearance

You can specify settings that affect the examination image as it appears on the FC1 system, including the following:

- The image as related to steer direction in Doppler operation
- Optimizing of acoustic (imagery) output when AUTO IMAGE is enabled:
  - Gain (enhancement)
  - Lateral-gain and depth-gain compensation
  - Sound speed compensation
  - Focus correction
- Electrocardiogram (ECG) waveform settings
- Probe orientation settings

**To configure Doppler images**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 1/4, tap **Image**. The **Common Setup** screen appears.

**3** Tap **Doppler**. The **Doppler** screen appears.

**4** To link the color region of interest (color ROI) with the steer direction of the PW cursor in the triplex mode, make sure that the **ON** virtual button beside **Link** is selected (orange).

To break the link, make sure that the **OFF** virtual button is selected.

5 To invert the signs of the velocity scale automatically if the steer direction is changed in the triplex mode, make sure that the **ON** virtual button beside **Auto U/D Invert** is selected.

To make inversion of the velocity-scale signs *not* automatic, make sure that the **OFF** virtual button is selected.

When automatic inversion of velocity-scale signs is enabled, turning off the linking of the color ROI with the steer direction of the PW cursor in the triplex mode also cancels automatic inversion of the velocity-scale signs.

6 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

**To configure the probe orientation mark**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Image**. The **Common Setup** screen appears.

3 Tap **Probe Orientation**. The **Probe Orientation Mark** screen appears.

4 Tap the right-arrow virtual button ( ) to the right of **Probe Orientation Mark**, and then tap either **Right** or **Left**, as desired.

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

**Note** | Use the Cardiovascular preset.

**To specify optimization function settings**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Image**. The **Common Setup** screen appears.

3 Tap **Optimize**. The **Optimize** screen appears.

4 To obtain any of the following adjustments when you press the **AUTO IMAGE** button, for each of the following, make sure that the **ON** virtual button is selected (orange) for each of the adjustments.

To make the adjustment nonautomatic, tap **OFF**.

- **Gain**: for gain adjustment
- **DGC**: Depth-gain compensation
- **LGC**: Lateral-gain compensation
- **Sound Speed**: Sound speed compensation
- **Auto Focus**: Focus correction

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

**To specify ECG waveform settings**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Image**. The **Common Setup** screen appears.

3 Tap **ECG**. The **ECG Config** screen appears.

4 To adjust the display position of the ECG waveform:

**a** Tap the right-arrow virtual button ( ) to the right of **Position**.

**b** Tap either **TOP** or **BOTTOM**, as desired.

5 To set the initial gain of the ECG waveform, to the right of **Initial Gain**, tap either the right- or left-arrow virtual button ( or ).

You can set the initial gain between 0 to 100.

6 To adjust the sweep speed of the EGC waveform in the 2D, CD, or PD mode:

**a** Tap to the right of **Sweep Speed**.

**b** On the displayed selection screen, tap the desired speed.

The possible sweep speeds are 1, 2, 3, 4, 6, 8, or 10 seconds).

**Note** The sweep speed is set automatically for the M, PW, CW, and TDI modes.

**7** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Configuring peripheral devices

You can adjust settings for printers and foot switches that are connected to the FC1.

## Adjusting printer settings

**Caution** When printing the image, make sure that the "SIDE" setting on the black-and-white printer is "STD". If the setting is not "STD", the image may not print correctly. For details on how to specify the setting, see the operation manual for the black-and-white printer.

**Note** The settings that you can change in the FC1 system for black-and-white printers and color printers are the same. Therefore, the screens for changing printer settings are identical for either type of printer. The following procedure applies to both types of printers.

If you use a Sony UP-X898MD printer, check "Table A.11 Printers and Devices" in its Service Manual, as some settings must be adjusted.

**To specify printer settings**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 1/4, tap **Peripheral**. The **Common Setup** screen appears.

**3** Do one of the following:

**a** To change settings for a black and white printer, tap **B&W Printer**. The **B&W Printer** screen appears.

**b** To change settings for a color printer, tap **Color Printer**. The **Color Printer** screen appears.

4 To set the number of copies, to the right of **Number of copies**, tap either the left- or right-arrow virtual button ( or ).

You can select from 1 to 5 copies.

5 To specify how many images you can print on a single sheet and how they're arranged, do the following:

**a** Tap the right-arrow virtual button ( ) to the right of **Print Format**.

**b** On the **Print Format** screen, tap the layout you want for the printed images.

You can print up to four images on a page; the available layouts are 1x1, 1x2, 2x1, and 2x2.

6 To specify whether the paper orientation to the image is vertical (also called "portrait"—taller than it is wide), horizontal (also called "landscape"—wider than it is tall), or automatically chosen:

**a** Tap the right-arrow virtual button ( ) to the right of **Paper Orientation**.

**b** In the **Paper Orientation** screen, tap the orientation you want: **Vertical**, **Horizontal**, or **Auto**.

7 To print the patient ID and exposure date and time, make sure that the **ON** virtual button to the right of **Caption** is selected (orange). To prevent the data from being printed, make sure that the **OFF** virtual button is selected (orange).

8 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Adjusting foot-switch settings

**To adjust foot-switch settings**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Peripheral**. The **Common Setup** screen appears.

3 Tap **Foot Switch**. The **Foot Switch** screen appears.

4 To assign a function to one of the pedals:

**a** Tap the right-arrow virtual button ( ) to the right of either **Left Pedal** or **Right Pedal**, depending on which you are assigning the function to.

**b** On the **Left Pedal** or **Right Pedal** selection screen, tap the function that you want to assign to the pedal.

You can assign the following functions to a pedal:

- **Freeze**
- **Store1**, **Store2**, or **Store3** (the function assigned to Store 1, Store 2, or Store 3, respectively). For more information on assigning a function to one of the Store buttons, see "To configure Store buttons" on page 30.
- **None**

**5** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Barcode reader and magnetic card reader setting

### To set the connection to barcode reader or magnetic card reader

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 1/4, tap **Peripheral**. The **Common Setup** screen appears.

**3** Tap **Peripheral Type**. The **Peripheral Connection Type** screen appears.

**4** Tap the right-arrow virtual button ( ) at the right of **Select Connection** and tap the connection you want. Select **None** to not connect any peripheral, **Barcode** to connect a barcode reader, or **Card** to connect a magnetic card reader.

**5** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

### To specify a barcode reader

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 1/4, tap **Peripheral**. The **Common Setup** screen appears.

3 Tap **Barcode Reader**. The **Barcode Reader** screen appears.

4 To set the start position and length, tap either the right- or left-arrow virtual button ( or ).

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

**To specify a magnetic card reader**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Peripheral**. The **Common Setup** screen appears.

3 Tap **Card Reader**. The **Card Reader** screen appears.

4 To set the start position and length, tap either the right- or left-arrow virtual button ( or ).

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Specifying network settings

If the FC1 system is connected to a Digital Imaging and Communications in Medicine (DICOM)-format network storage server, you can specify several kinds of settings.

**To specify network settings**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Network and DICOM**. The **Common Setup** screen appears.

3 Tap **Network**. The **Network** screen appears.

4 Set any of the following for this FC1 system:

- **IP Address**

- **Gateway Address**
- **Subnet Mask**

5 In the **Link Speed/Duplex** row, from the list that appears when you tap the right-arrow virtual button ( ), tap the communication speed and type that you prefer (**Auto**, **100MB/Full Duplex**, or **100MB/Half Duplex**).

6 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Server connection settings

**WARNING** | Use our C@RNACORE product only with this function.

The FC1 can operate linked to the FUJIFILM C@RNACORE system to start examinations after obtaining patient information or orders.

C@RNACORE V4.0(B) and later support this function.

For more information about the link with the C@RNACORE system, see "Starting an examination from patient information (Optional, Japan only)" on page 137 and "Starting an examination from orders (Optional, Japan only)" on page 139.

**To set the link with the C@RNACORE system (Optional)**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Network and DICOM**. The **Common Setup** screen appears.

3 Tap **C@RNACORE**. The **C@RNACORE** screen appears.

4 Set the following for this FC1 system.

- **Device Name (the station name of the FC1. 16 characters maximum.)**
- **C@RNACORE Network Setting IP Address** (**IP address of the C@RNACORE server**)

5 In the **Connection Type** (**connection with the C@RNACORE server**) row, tap the right-arrow virtual button ( ).

6 On the displayed screen:

- Tap **Patient Information Link** to use patient information link. The patient information link button ( ) appears at the left of **ID** on the **Patient Info** screen on the touch panel.

- Tap **Order Link (MWL)** to use order link. To use order link, DICOM and C@RNACORE's DICOM MWL must be configured. For more information, see "Specifying DICOM settings" on page 45 and "DICOM MWL setting" on page 46. For the procedure to start examinations from C@RNACORE, see the C@RNACORE Reference Guide.

- Tap **OFF** to disable the link to C@RNACORE.

**7** Tap **Verify** to confirm that link to the C@RNACORE system has been established properly.

**8** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Specifying DICOM settings

If the FC1 system is connected to a Digital Imaging and Communications in Medicine (DICOM)-format network storage server, you can specify its settings.

**To specify DICOM settings:**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 1/4, tap **Network and DICOM**. The **Common Setup** screen appears.

**3** Tap **DICOM General**. The **DICOM General** screen appears.

**4** Set any of the following:

**Table 3-1: DICOM settings**

| Setting | Description |
|---|---|
| **AE Title** | The application title. 16 characters maximum. |
| **Station Name** | The Station Name of the FC1. 16 characters maximum. |
| **Port Number** | Not used at present |
| **TCP Timeout** | The maximum transfer waiting time of the network (in seconds). 600 seconds maximum. |

**Table 3-1: DICOM settings**

| Setting | Description |
|---|---|
| **Keep Alive Timeout** | The period of time during which DICOM connection is maintained after the last data is transferred. 7,200 seconds maximum. |
| **Exams are Restarted Using** | The series of examinations.<br><br>Tap . On the screen that appears, tap **Prior Series** or **New Series**. |
| **Verification** | Specify the setting at the time of DICOM data transfer. |
| **Query on Display** | The update timing of the worklist.<br><br>To update the worklist automatically when the Worklist screen appears, tap **ON**.<br><br>To update the worklist by using the button in the Worklist screen, tap **OFF**. |
| **Maximum Entries** | The maximum number of worklists that can be used (maintained). 3,000 worklists. |
| **Modality** | The modality at the time of querying the DICOM MWL. Tap . On the screen that appears, tap the modality (**Blank**, **US** [ultrasonic processor], or **OT** [others]). |
| **Clear Order** | Clear the worklist orders. |
| **Default Character** | The default character code.<br><br>Use this setting to update the default character code of the data submitted to DICOM. For more information, see the DICOM conformance statement. |

**5** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# DICOM MWL setting

When you press **SYSTEM**, **Network and DICOM**, and then **DICOM MWL**, the following operations are available for the worklist server setting in the selected list.

**Table 3-2: DICOM MWL buttons**

| Button | Description |
|---|---|
| **Edit** | Allows you to edit the setting. |
| **Delete** | Allows you to delete the setting. |

**Table 3-2: DICOM MWL buttons**

| Button | Description |
|---|---|
| **Ping** | Allows you to check the network condition. |
| **Verify** | Allows you to verify the setting. |

**To set the DICOM Modality Worklist (MWL) (Optional)**

**1** Press the **SYSTEM** button ( ).

The **User Setting screen** appears.

**2** On page 1/4, tap **Network and DICOM**. The **Common Setup** screen appears.

**3** Tap **DICOM MWL**. The **DICOM MWL List** screen appears.

**4** Tap the name of a worklist server or a blank line, and then tap **Edit**.

The **DICOM MWL Server Config** screen appears.

**5** Set any of the following:

**Table 3-3: DICOM MWL settings**

| Setting | Description |
|---|---|
| **Use** | To use MWL, tap Use. To not use MWL, tap Not use. |
| **Device Name** | Type the nickname of the connected worklist server (maximum 16 characters). |
| **AE Title** | Type the application title of the connected worklist server (maximum 16 characters). |
| **IP Address** | Type the IP address of the connected worklist server. |
| **Port Number** | Type the port number of the connected worklist server. |
| **Transfer Syntax** | Tap the green button on the right. On the screen that appears, tap the transfer syntax that you want to use. |
| **Scheduled Proc Step Start Date** | Tap the green button on the right. On the screen that appears, tap the date of the start of the examination (Today, Last 2 Days, Last 7 Days, or All). |

**6** Press the **Ping** button to test the connection with the MWL server.

**7** Press the **Verify** button to test the communication with the MWL server.

**Note**

Even when multiple worklist servers are registered, you can use only one of them.
When multiple worklist servers are registered, set Use for only one of them.

# DICOM storage operation

When you press **SYSTEM**, **Network and DICOM**, and then **DICOM Storage**, the following operations are available for the storage server setting in the selected list.

**Table 3-4: DICOM Storage buttons**

| Button | Description |
|---|---|
| **Edit** | You can edit the setting. |
| **Delete** | You can delete the setting. |
| **Ping** | You can check the network condition. |
| **Verify** | You can verify the setting. |

### To set the DICOM storage (Optional)

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 1/4, tap **Network and DICOM.** The **Common Setup** screen appears.

**3** Tap **DICOM Storage.**

**DICOM Storage List screen** is displayed.

**4** Select the connected storage server or a blank line, and then tap **Edit.**

**DICOM Storage Server Config screen** is displayed.

**5** Set any of the following.

**Table 3-5: DICOM Storage settings**

| Setting | Description |
|---|---|
| **Device Name** | Enter nickname of Storage server connected. |
| **AE Title** | Enter application title of Storage server connected.<br><br>Maximum of 16 characters can be entered. |
| **IP Address** | Enter IP address of storage server connected. |
| **Port Number** | Enter the port number of the connected storage server. |
| **Color Model** | Tap ▶ on the right. On the displayed selection screen, tap the color model to be used. For instance: RGB (Pixel), RGB (Plane), or MONOCHROME2. |
| **Single** | Tap **ON** to use still image store, or tap **OFF** not to use still image store. |
| **Single Transfer Syntax** | Tap ▶. On the displayed selection screen, tap the desired compression level of the DICOM still image (Implicit VR Little Endian, Explicit VR Little Endian, JPEG Lossy or RLE Lossless).<br>When **JPEG Lossy** is selected, tap ◀ or ▶ to set the image quality (80% to 100%). |
| **Multiple** | Tap **ON** to use clip image store, or tap **OFF** not to use clip image store. |
| **Multiple Transfer Syntax** | Tap ▶. On the displayed selection screen, tap the desired compression level of the DICOM clip (Implicit VR Little Endian, Explicit VR Little Endian, JPEG Lossy or RLE Lossless).<br>When **JPEG Lossy** is selected, tap ◀ or ▶ to set the image quality (80% to 100%). |
| **Secondary** | Tap **ON** to use secondary capture image store, or tap **OFF** not to use secondary capture image store. |
| **Secondary Transfer Syntax** | Tap ▶. On the displayed selection screen, tap the desired compression level of the secondary capture image (Implicit VR Little Endian or Explicit VR Little Endian). |

**6** Press the **Ping** button to test the connection with the DICOM server.

**7** Press the **Verify** button to test the communication with the DICOM server.

# Setting timing for DICOM network storage

If the FC1 system is connected to a Digital Imaging and Communications in Medicine (DICOM)-format network storage server, you can specify the timing for storing images on that server.

**To specify DICOM network storage timing setting**

1 To store images in the DICOM network storage device, make sure that the FC1 is connected to the DICOM server through Ethernet or that the status icon (network icon) display is valid.

2 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

3 On page 1/4, tap **Store**. The **Common Setup** screen appears.

4 Tap **Image Transfer.** The **Image Transfer Setup** screen appears.

5 To select the timing of storage of the ultrasound image on the DICOM server, tap the right-arrow virtual button ( ) on the right side of Image Transfer Setup.

6 On the displayed selection screen:

- To store the image on the DICOM server when the Store button is pressed, tap **Exam in Progress.**
- To store the image on the DICOM server when the examination is over, tap **Exam Completed.**

7 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Calibrating the display

**To view display-color test patterns**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Calibration.** The **Common Setup** screen appears.

3 Tap **Test Pattern.** The **Test Pattern** screen appears.

4 Tap **Start** on the right side of the test pattern you want to view (**Grayscale**, **Resolution**, **White**, **Black**, **Red**, **Green**, or **blue**). The selected test pattern appears on the main monitor.

5 To exit the test pattern, tap **Cancel**.

**To set the lookup table (LUT)**

**Note**

The LUT must be updated whenever the system LCD is replaced. The number selected must match the number on the new LCD installed.

1 Press the **SYSTEM** button.

The **User Setting** screen appears.

2 On page 1/4, tap **Calibration**. The **Common Setup** screen appears.

3 Tap **LCD LUT**. The **Update** screen appears.

4 The following item can be set.
Tap the monitor number to be used.
**I5 / I6 / J5 / J6 / K5 / K6**

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Enabling automatic image deletion (Data Configuration)

You can enable the system to automatically delete images after a certain period of time, and specify how long that period is.

**Note**

You can lock examinations you do not want to delete.
For the procedure to lock examinations, see "Locking archived examinations" on page 190.

**To specify automatic image deletion**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Data Config**. The **Data Management** screen appears.

3 Tap **Data Config.** The **Data Configuration** screen appears.

4 To activate or deactivate automatic image deletion, make sure that the **ON** or **OFF** virtual button is selected (orange).

To set an auto delete time limit, the **Auto Delete Image** setting must be set to **ON.**

5 To decrease or increase the age (in months) at which the system automatically deletes an image record (the **Auto Delete Time Limit**), tap the right- or left-arrow virtual button ( or ), respectively.

The range for **Auto Delete Time Limit** is 1 to 36 months.

6 To have network or printer output appear automatically, make sure that **Automatic** appears in the **Print/ Network Output** field. To have this output controlled manually, tap the green arrow button and tap **Manual** on the screen that appears.

7 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

**Caution**

With automatic image deletion, the images are deleted automatically but the patient logs remain.
Up to 8000 patient logs can be recorded.
To avoid exceeding the maximum number of logs, delete patient information periodically.
To delete patient logs individually, use the Patient Log screen.
If you want to delete all patient logs, see "Resetting user configuration" on page 74.

# Database optimization

**To optimize the database**

After using the FC1 for a long time, unnecessary empty spaces may appear in the database and the way data is stored may become more complex, therefore decreasing the system performance. Database optimization is used to resolve this problem.

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Optimize Database.** The **Optimize Database** screen appears.

3 Tap **Start** to begin the process.

4 When prompted to confirm optimization, tap **OK** to confirm this process. At this point, you must restart the unit.

## Output queue (examination/image) operation (Output Manage)

1 Press the **SYSTEM** button.

The **User Setting** screen appears.

2 On page 1/4, tap **Output Manage**. The **Output Management** screen appears.

For more information, see "Managing the output queue of examinations and images" on page 199

# Positioning the body-mark display

You can choose where the body mark will appear by default in each mode's display setting.

**To position the body-mark display**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 2/4, tap **Body Mark**. The **Category/Library** screen appears.

3 Tap **Position**. The **Position** screen appears.

You can specify body-mark display settings for the following screen modes:

- **Single** (for 2D (B), CD, and PD modes)
- **Duplex** (for M, PW, CW, and TDI modes)
- **Dual Mode** (for Dual-screen modes)
- **Simul Dual Mode** (for Simultaneous Dual-screen modes)

4 To specify (in single and duplex displays) the location on the monitor where you want the body mark to appear by default:

**a** Tap the right-arrow virtual button ( ) to the right of either **Single** or **Duplex**. Either the **Single** or **Duplex** screen appears.

**b** Depending on where you want the body mark's default location to be for this display setting, tap **Left-Bottom**, **Left-Top**, **Right-Top**, or **Right-Bottom**.

**5** To specify (in Dual Mode and Simul Dual Mode displays) the location on the monitor where you want the body mark to appear by default:

**a** Tap the right-arrow virtual button ( ) to the right of either **Dual Mode** or **Simul Dual Mode**. Either the **Dual Mode** or **Simul Dual Mode** screen appears.

**b** Depending on which corner of each of the two images you want to show the body mark's default location, tap one of the following:

- To have the body-mark appear in the same place in both screens, tap **Left-Bottom**, **Left-Top**, **Right-Top**, or **Right-Bottom**.
- To configure a different location for each screen, tap **LB/RB**, **RB/RB**, **LB/LB**, **LT/RT**, **RT/RT**, or **LT/LT**.

**6** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Managing annotation lists

You can create, edit, and delete lists of annotations that you can add to examination images.

Annotation-list maximums:

- Number of annotation lists: 100
- Number of annotations per list: 30
- Number of characters per annotation: 20

**To open the Annotation List screen**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 2/4, tap **Annotate**. The **Category/Library** screen appears.

**3** Tap **Annotation List**. The **Annotation List** screen appears, showing any existing annotation lists.

**To create an annotation list**

1 With the **Annotation List** screen open, press switch menu button 4 (the rocker button under **Page**) until you reach an empty row in the list of existing annotation lists.

2 Tap the empty row, and then tap **Edit List**. The **Annotation Config** screen appears.

3 To name the annotation, tap the text box for **List Name**, type the name, and then tap **Close**.

4 To add an annotation to the list, tap the text box beside **Item** *n* (where *n* is the number of the item), type the name, and then tap **Close**.

   To navigate among the pages of annotations, press switch menu button 4.

5 Tap **OK** to save the settings.

   Press the **SYSTEM** button to return to the examination screen.

**To edit an annotation list**

1 With the **Annotation List** screen open, press switch menu button 4 (the rocker button under **Page**) to navigate to the annotation list that you want to edit.

2 Tap the annotation list that you want to edit, and then tap **Edit List**. The screen for editing the annotation list appears.

3 Tap the annotation that you want to change, and then correct it.

4 Tap **OK** to save the settings.

   Press the **SYSTEM** button to return to the examination screen.

**To delete an annotation list**

1 With the **Annotation List** screen open, press switch menu button 4 (the rocker button under **Page**) to navigate to the annotation list that you want to delete.

2 Tap the annotation list that you want to delete, and then tap **Delete**.

3 When prompted to confirm the deletion, tap **OK**.

4 Tap **OK** to save the settings.

   Press the **SYSTEM** button to return to the examination screen.

# Managing measurement functions

Of the measurement functions available for FC1, some are common to all display modes, and some are particular to certain display modes.

Manage settings for the measurement functions on the **Measure** screens.

## Configuring measurements for all modes

The measurement settings that are common to all display modes are as follows:

- **Continuous Measurement**
- **Beat**
- **Measure Unit (B,M) (for B and M mode)**

The **Beat** setting determines the default number of heartbeats used as a basis for measurement.

### To change common measurement settings

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 2/4, tap **Measure**. The **Measure screen** appears.

3 Tap **Common**. The **Common** screen appears.

4 To change the control that you use to start the next measurement in continuous measurement, tap the right-arrow virtual button () to the right of **Continuous Measurement Setting**.

5 On the **Continuous Measurement Setting** screen:

- To display the next caliper by pressing the **SET** button when continuous measurement is available, select **Set/Set**.
- To display the next caliper for the next measurement by tapping **Next** on the touch panel, select **Set/Next**.

6 To change the default number of heartbeats to use for measurement, tap the button to the right of **Beat**.

7 On the **Beat** screen, select from one to three heartbeats.

**8** To change the calculation unit of B and M mode, tap the button to the right of **Measure Unit (B,M)**.

**9** At the **Measure Unit (B,M)** screen, select **mm** or **cm**.

**10** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Specifying 2D-mode default measurement tools

You can change the tool that is the default for several measurements and calculations.

**To choose default tools for 2D-mode measurements and calculations**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 2/4, tap **Measure**. The **Measure** screen appears.

**3** Tap **B mode**. The **B mode** screen appears.

**4** Tap the right-arrow virtual button ( ) on the row of the measurement or calculation for which you want to change the default tool.

The settings, the items that they change, and the measurement tools that you can choose from are as follows:

- **Initial Measure**

  The measurement that first appears when the user presses the **MEASURE** button ( ) in 2D mode.

  The possible measurements are **Distance**, **Trace**, **Area**, **Volume**, **Ratio Distance**, **Ratio Area**, **%Steno Dist**, **%Steno Area**, and **Angle**.

- **Area**

  The default measurement tool for area measurements.

  The possible measurement tools are **Free Trace** and **Ellipse**.

- **Ratio Area**

The default combination of measurement tools for calculating an area ratio.

The possible measurement tools are **2 Ellipse** and **Ellipse/Free Trace (Area)**.

- **%Steno Area**

  The default tool for measuring the stenosis ratio and circumference and area.

  The possible measurement tools are **2 Ellipse** and **Ellipse/Free Trace (Area)**.

- **Angle**

  The default tool for measuring an angle.

  The possible measurement tools are **2 Line**, **3 Line**, or **3 Point**.

**5** In the selection screen for the measurement or calculation, tap the tool that you want to be the default for that measurement.

**6** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

**Note** | When you adjust the image parameter, the spectral trace is updated.

## Specifying the CF-mode or the M-mode default measurement tool

You can select the measurement that is the first to appear when the user presses the **MEASURE** button (

) in either CF mode or M mode.

**To change the default measurement tool for CF mode or M mode**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 2/4, tap **Measure**. The **Measure** screen appears.

**3** Do one of the following:

**a** To choose CF mode, tap **CF mode**. The **CF mode** screen appears.

**b** To choose M mode, tap **M mode**. The **M mode** screen appears.

**4** Tap the right-arrow virtual button ( ) on the **Initial Measure** row.

**5** Depending on the mode whose default measurement tool you are setting, on the **Initial Measure** selection screen, choose one of the following:

- For **CF Mode**, tap either **Point Vel** or **Area Vel.**
- For **M Mode**, tap **Distance, Time, HR,** or **Slope.**

**6** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Configuring PW/CW/TDI-mode measurements

**To change the PW/CW/TDI mode measurement settings**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 2/4, tap **Measure**. The **Measure** screen appears.

**3** Tap **D mode**. The **D mode** screen appears.

**4** Tap the right-arrow virtual button ( ) on the row of the measurement or calculation for which you want to change the default tool.

The settings, the items that they change, and the measurement tools that you can choose from are as follows:

- **Initial Measure**

  The measurement that first appears when the user presses the **MEASURE** button ( MEASURE ) in 2D mode.

  The possible measurements are **Time, HR, Velocity, Trace, Accel, Decel, Velocity Trace, PI, RI,** or **Vessel Diam.**

- **Trace**

  The default measure tool for tracing the Doppler waveform.

The possible measure tools are **Free Trace** or **Auto Trace.**

- **Trace Type**

  The possible types are **Max**, **Average**, and **Both.**

- **trackball**

  The possible types are **Max** or **Average.**

- **Envelope Type**

  The possible types are **Positive**, **Negative**, and **Alternative.**

  - In the **Trace Level** row, tap either the right- or left-arrow virtual button ( or ) to set the trace level between 0% and 100%.

**5** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Configuring preset-specific measurements

You can change the layout of the touch panel

**To design application-specific displays on the touch panel**

**1** Press the **SYSTEM** button.

The **User Setting** screen appears.

**2** On page 2/4, tap **Calculation.** The **Calculation** screen appears.

**3** Tap **TP Layout.** The **TP Layout** screen appears.

**4** On the **TP Layout** screen, tap the right-arrow virtual button ( ) for the application for which you want to change the layout of the touch panel.

The available applications are as follows:

- **Cardiac**
- **Ped Heart**
- **Carotid**

5 On the application's selection screen, tap the layout that you want the touch panel to have.

6 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Setting Auto IMT (intima-media thickness) measurement (Optional)

You can customize the Auto IMT measurement menu.

For more information about Auto IMT measurement, see "Auto IMT (intima-media thickness) measurement (Optional)" on page 403.

**To customize the Auto IMT measurement menu**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 2/4, tap **Calculation**. The **Calculation** screen appears.

3 Tap **Auto IMT**. The **Carotid** screen appears.

4 To set the width of the region of interest, tap the right- or left-arrow virtual button ( or ) at the right of **Width**.

5 Tap the right-arrow virtual button ( ) on the right of **Priority Tab** to configure the tabs which you want to display prior to others in the initial startup.

Tap **B-Mode** or **AutoIMT** on the displayed selection screen.

6 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Defining preset settings for examination types

This section explains the settings that make up the preset used for each examination.

**To define the preset settings for an examination type**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 2/4, tap **Preset Setting.** The **Exam Setting** screen appears.

**3** Tap the examination for which you want to define the preset settings.

You can set the preset menu for the following types of examinations (to access **Breast** and subsequent examination types, press switch menu button 4).

- **Abdomen**
- **Small Parts**
- **Cardiac**
- **OB**
- **OB-Twin**
- **Fetal Heart**
- **Gyn**
- **Vascular**
- **Carotid**
- **Thyroid**
- **Breast**
- **MSK**
- **Ped**
- **Ped Heart**
- **Nerve**
- **Urology**
- **Neonate**
- **Arterial**

▸ **Venous**

The preset-specification screen, which is named for the type of examination that you have selected, appears.

# Assigning a function to the FREEZE button

You can select a function to be activated when you press the **FREEZE** button ( ).

**To select a freeze-shortcut function**

1 To select the examination type for which you are specifying a freeze-shortcut function, see the procedure in "Defining preset settings for examination types" on page 61.

2 On the examination presets screen, tap the right-arrow virtual button ( ) on the **Freeze Shortcut** row.

3 On the **Freeze Shortcut** selection screen, tap the function that you want pressing the **FREEZE** button to activate.

You can select one of the following: **None**, **Annotation**, **Body Mark**, **Measure**, and **Calculation**.

To specify that the **FREEZE** button only freeze the image and not activate a function, select **None**.

4 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Selecting the default annotation type

**To select arrows or text as the default type of annotation when the user presses the ANNOTATE button**

1 To select the preset you want to set, see "Defining preset settings for examination types" on page 61.

The screen that appears shows the current settings for default annotation: text or arrows.

2 To change the default, tap the button on the **Annotation Init** row, and tap either **Arrow** or **Text**. The **Annotation Init** row now shows your choice.

3 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Selecting ready-made annotation lists

**To select annotation lists of predefined annotations for ready use**

1 To select the preset you want to set, see "Defining preset settings for examination types" on page 61.

2 On the examination presets screen, tap the button for **Annotation List1**, **Annotation List1**, or **Annotation List3**.

3 If you do not see the annotation list that you want on page 1 of the **Annotation List***n* selection screen (where *n* is **1**, **2**, or **3**), press switch menu button 4 to go to page 2.

4 Tap the annotation list that you want as one of your default lists of annotations.

For more information on using and creating annotation lists, see "Managing annotation lists" on page 54.

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Selecting the priority cursor for steer-link priority

**To select the steer-link priority**

1 To select the preset you want to set, see "Defining preset settings for examination types" on page 61.

2 On the examination presets screen, tap the button for **Steer Link**.

3 On the **Steer Link** selection screen, tap **M priority**, **CF priority**, **D priority**, or **Fix**.

4 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Selecting the area for applying sound-speed compensation

**To select the area for applying sound-speed compensation**

1 To select the preset you want to set, see "Defining preset settings for examination types" on page 61.

2 To specify the area where sound speed compensation is applied, in the exam presets screen, tap **Sound Speed**.

▸ To apply it to the overall image, make sure that **All** is selected (orange).

- To apply it only to the ROI, make sure that **ROI** is selected.

**3** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Starting the electrocardiogram automatically

**To specify that the electrocardiogram starts automatically when an examination is started**

**1** To select the preset you want to set, see "Defining preset settings for examination types" on page 61.

**2** Make sure that the **ON** button for **ECG** is selected (orange).

**3** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Selecting the standard of acoustic output

You can select one of three combinations of acoustic-output indices: MI (mechanical index) and one of the thermal indices:

- **TIS** (soft-tissue thermal index)
- **TIB** (bone thermal index)
- **TIC** (cranial-bone thermal index)

**To select a standard of acoustic output**

**1** To select the examination type, see "Defining preset settings for examination types" on page 61.

**2** Tap the button for **MI/TI**.

**3** Tap the desired combination of indices from the following:

- **MI, TIs**
- **MI, TIb**
- **MI, TIc**

**4** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Setting the calculation unit

**To set the unit of calculation**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 2/4, tap **Preset Setting**. The **Exam Setting** screen appears.

3 Tap **Cardiac**. The **Cardiac** screen appears.

4 On page 2/2, in the **Calc Unit** section, tap the ▸ button. The **Calc Unit** screen appears.

5 Tap **cm** or **mm** to select the unit.

**Note**

You can choose a calculation unit only when you have selected Cardiac or Ped Heart. However, when area or volume is measured, this setting may not be reflected.

6 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Setting Priority/Preset for each transducer

You can choose the transducer that the priority preset will launch.

**To set the priority preset:**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 2/4, tap **Probe/Preset**. The **Exam Setting** screen appears.

3 Tap the transducer for which you want the priority to be set.

4 When that name appears on a new screen, tap the ▸ button on the right.

5 On the screen that appears, select the type of examination that the transducer will conduct (which is set by default for the probe you selected in step 4).

6 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Configuring examination defaults (Exam Type Setting)

You can specify the following for each type of examination:

- Whether it is available for selection when the user registers a patient
- The transducer and preset that are selected by default for that type of examination

**To specify examination settings for patient information registration**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 2/4, tap **Exam Type Setting**. The **Exam Setting** screen appears.

3 Tap the type of examination. The **Exam Type Setting** screen appears, with the examination types that you can choose from. These include ABDOMEN, SMALL PARTS, CARDIAC, OB, OB-TV, GYN-TV, FETAL HEART, GYN, VASCULAR, CAROTID, THYROID, BREAST, MUSC SKEL, PED, PED-HEART, NERVE, URO, NEO HEAD, OB TWIN ARTERIAL, and VENOUS.

To change pages of the **Exam Type Setting** screen, press switch menu button 4 (the rocker button beneath **Page**.)

**Note** | Some examination types may be unavailable.

When you select the examination type, the screen on which you specify its settings opens.

4 To display the examination type and make it available for the user to select during patient registration, on the **Valid** line, make sure that the **Enable** virtual button is selected (orange).

5 To select the examination type's default probe (the probe that is by default displayed for the examination type during patient registration):

**a** Tap the button for **Priority Probe**.

**b** On the **Priority Probe** screen that appears, tap a transducer. You can choose among the following transducers: C60xf, P21xp, HFL38xp, C11xp, ICTxp, HFL50xp, C35xp, L25xp, and L38xp.

**6** To select the examination type's default preset (the preset that is displayed by default for the examination type during patient registration):

**a** Tap the button for **Priority Preset**.

**b** On the **Priority Preset** screen, tap a preset. You can choose among the following presets: Abdomen / Small Parts / Cardiac / OB / OB-Twin / Fetal Heart / Gyn / Vascular / Carotid / Thyroid / Breast / MSK / Ped / Ped Heart / Nerve / Urology / Neonate / Arterial/ Venous

To switch among pages of the **Priority Preset** screen, press switch menu button 4.

**7** Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Changing examination information display settings (Exam Type Format)

You can alter the appearance of the examination name that appears when you are preparing a report--either its full name or an abbreviation, as shown in the following list:

**Table 3-6: Examination types**

| Examination type | Full name | Short name (abbreviation) |
|---|---|---|
| Abdomen | Abdominal | ABD |
| Breast | Breast | BREAST |
| Cardiac | Cardiac | CARD |
| Carotid | Carotid | CAROTID |
| Gynecology | Gynecology | GYN |
| Musculoskeletal | Musculoskeletal | MSK |
| Nerve | Nerve | NERVE |
| Obstetrical | Obstetrical | OB |
| Operative | Operative | OPE |
| Pediatric | Pediatric | PED |

**Table 3-6: Examination types**

| Examination type | Full name | Short name (abbreviation) |
|---|---|---|
| Small parts | Small part | SP |
| Thyroid | Thyroid | THYROID |
| Urology | Urology | URO |
| Vascular | Vascular | VASC |

**To change examination information display settings**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 2/4, tap **Exam Type Format**. The **Exam Setting** screen opens.

3 Tap **Exam Info Name**. The **Exam Information Display Size** screen appears.

4 For each examination type whose display size you want to change, tap either **Full** or **Short**. Use the Page button to see other examination types.

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Changing patient information display settings

You can alter how patient names appear (the order of first and last names) and change the unit used to display height (centimeters or meters).

**To change patient information display settings**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 2/4, tap **Exam Type Format**. The **Exam Setting** screen opens.

3 In the **Exam Info** section, tap **Patient Info**. The **Patient Information Display Format** screen appears.

4 If you want to change the middle name setting, in that field, tap the green arrow and tap **Last First** or **Last First Middle**.

5 If you want to change the height unit, in that field, tap the green arrow and tap the unit you want: **cm** (centimeters) or **m** (meters).

6 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

## Restart setting (reexamination setting)

You can change the period in which reexamination is allowed on prior exam data (in the case of another later patient visit).

**To change the period of reexamination**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page2/4, tap **Restart**. The **Exam Setting** screen appears.

3 Tap **Restart.** The **Restart config** screen is displayed.

4 To set the Maximum Age Of Restart, tap . On the displayed selection screen, tap the maximum period to be used:

**1 Day** / **2 Days** / **1 Week** / **1 Month** / **Unlimited**

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Backing up and restoring presets

You can back up and restore the following:

- Presets
- System settings
- The Patient Information Log

When outputting data from the FC1 to a USB memory, the output data are encrypted to prevent the personal information leakage. The following output data are automatically encrypted.

In order to secure patient's health data, the output file used for back/up and restore will be encrypted. The file will not be visible in any systems except for FC1 Ultrasound System.

## Backing up and restoring presets

You can save the presets that you have specified as one file in the USB memory.

To protect the data, save the presets in the USB memory periodically.

**Caution**

Be sure to save presets to the USB memory every time that you change a preset.

Use the USB memory only for purposes mentioned in this *User's guide*. Using the USB memory for other purposes may damage the FC1.

To back up all user settings, back up both the presets and the system settings.

To restore a preset, connect the USB memory in which the preset is stored and then start FC1.

If necessary, you can restore a configuration immediately by retrieving the presets from the USB memory.

**To back up presets**

**1** Connect the USB memory on which you back up presets to the USB connector.

**2** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**3** On page 3/4, tap **Backup**. The **Backup** screen appears.

**4** To the right of **Preset Configuration**, tap **Start**.

**5** When you are prompted to confirm starting the backup, tap **OK**. The user presets are saved in the USB memory.

**To restore presets**

**1** Connect the USB memory that holds the backup of the presets to the USB connector.

**2** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

3 On page 3/4, tap **Restore**. The **Restore** screen appears.

4 To the right of **Preset Configuration**, tap **Start**.

5 When you are prompted to confirm restoration, tap **OK**.

Based on the data in the USB memory, the user presets are restored as the system restarts.

## Backing up and restoring system settings

You can save the system settings (data customized by the user and examination settings) as a single file in the USB memory.

**Caution**

Be sure to save system settings to the USB memory periodically, and every time you change the user settings, particularly after the first time you change them.

Use the USB memory only for purposes mentioned in this *User's guide*. Using the USB memory for other purposes may damage the FC1.

To back up all user settings, back up both the presets and the system settings.

To restore a system setting, connect the USB memory in which the setting is stored and then start FC1.

If necessary, you can restore a configuration by retrieving the system settings from the USB memory.

**To back up system settings**

1 Connect the USB memory on which you back up system settings to the USB connector.

2 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

3 On page 3/4, tap **Backup**. The **Backup** screen appears.

4 To the right of **System Configuration**, tap **Start**.

5 When you are prompted to confirm starting the system backup, tap **OK**. The system settings are saved in the USB memory.

**To restore system settings**

**1** Connect the USB memory that holds the backup of the system settings to the USB connector.

**2** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**3** On page 3/4, tap **Restore.** The **Restore** screen appears.

**4** To the right of **System Configuration**, tap **Start.** When you are prompted to confirm restoration, tap **OK.**

Based on the data in the USB memory, the system settings are restored, and the FC1 restarts.

## Backing up and restoring the Patient Log

You can back up patient information (data set by the user) as a file in the USB memory.

By retrieving the patient information log that is stored in the USB memory, you can restore the previous configuration.

**Caution**

To protect the data set by the user, save the patient information log in the USB memory periodically, as well as every time the data changes.

Do not use the USB memory for purposes other than those mentioned in this *User's guide*. Using the USB memory for other purposes may cause damage to the FC1.

In order to avoid re-specifying all the patient information settings when replacing the FC1, execute a backup immediately after completing the settings to create backup data in the USB memory.

To restore the patient information log, connect the USB memory in which the log is stored and then start FC1.

If necessary, you can restore a configuration by restoring the patient information log from the USB memory.

**To back up the patient log**

**1** Connect the USB memory for backup of patient information log to the USB connector.

**2** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

3 On page 3/4, tap **Backup**. The **Backup** screen appears.

4 To the right of **Patient Log**, tap **Start**.

5 When you are prompted to confirm starting the backup of the patient log, tap **OK**.

The patient information log is saved in the USB memory.

**To restore the patient log**

1 Connect the USB memory in which the backup data of patient information log is saved to the USB connector.

2 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

3 On page 3/4, tap **Restore**. The **Restore** screen appears.

4 To the right of **Patient Log**, tap **Start**.

5 When you are prompted to confirm starting the restore operation, tap **OK**.

6 When the confirmation message appears, press the POWER button.

Based on the data in the USB memory, the patient information log is restored and the FC1restarts.

**Note** Data that are the same both on USB memory and in the Patient Log are not copied.

# Resetting user configuration

Use this function to clear any user configuration. You also reset any patient log or image data.

Resetting the configuration with **Patient Log/Image Data** deletes also the examinations and the patient data. You are advised to make a backup of examination images data in advance while referring to "Exporting examination data" on page 203.

**Note** The date, network and monitor settings are not deleted.

**To reset user configuration**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 3/4, tap **Reset**. The **Reset** screen appears.

3 Do one of the following:

**a** To delete system information (such as Store) set by the user, tap **Start** on the **User Configuration** line. (Date, Network, and Monitor settings are not deleted.)

**b** To delete examination and patient data (such as patient logs and images and clips obtained during examinations), tap **Start** on the **Patient Log/Image Data** line.

4 When a message saying that user configuration will be initialized appears, tap **OK**.

5 When a message saying that patient information will be initialized appears, tap **OK**. When the second screen appears, tap **OK** again.

6 You must restart the FC1 at this point to proceed.

# Formatting the USB memory

When you format the USB memory, all the data on it are deleted.

**To format the USB memory**

1 Connect the USB memory to the USB connector.

2 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

3 On page 3/4, tap **Format USB**. The **Format USB** screen appears.

4 Tap **Start**.

5 When you are prompted to confirm the formatting of the USB memory, tap **OK**.

The USB memory is formatted, and all the data on it are deleted.

# Using USB memory

You can use a USB memory to do the following:

- Store various logs and setup configurations for import and export
- Archive images and clips

Images and clips are saved to internal storage and are organized in a sortable patient list.

You can archive the images and clips from the FC1 system to a PC using a USB memory. To view the images and clips stored in a USB memory on the ultrasound system, import them to the ultrasound system.

The system has four USB ports.

**WARNING**

To avoid damaging the USB memory and losing patient data from it, observe the following:

- Do not remove the USB memory or turn off the ultrasound system while the system is exporting.
- Do not bump or otherwise apply pressure to the USB memory while it is attached to one of the FC1's USB ports. The connector could break.

**Caution**

If the USB icon does not appear in the system status area on-screen, the USB memory may be defective or password-protected. Turn the system off and replace the device.

**Note**

The system does not support password-protected USB memory. Make sure that the USB memory that you use does not have password protection enabled. See also "Troubleshooting" on page 477.

For more information about the device, see "Importing examination data" on page 205.

# Inserting a USB memory

**To insert a USB memory**

❖ Insert the USB memory into any of the FC1 USB ports. For more information about USB locations, see Figure 2-1, "System Front Features" on page 3.

When the USB icon appears, the USB memory is ready.

# Removing a USB memory

| Caution | Removing the USB memory while the system is exporting to it may cause the exported files to be corrupted or incomplete. |
|---|---|

**To remove a USB memory**

1 If the system is exporting to the device, wait for the USB animation to stop, and then wait another five seconds.

2 Remove the USB memory from the port.

# Formatting the SSD

The SSD is an internal storage device.

Formatting the SDD deletes the examinations and the patient data. You are advised to make a backup of examination images data in advance while referring to "Exporting examination data" on page 203.

**To format the SSD**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 3/4, tap **Format SSD**. The Format SSD screen appears.

3 Tap **Start**. You are asked to confirm that you want internal memory to be formatted. Tap **OK** to confirm.

4 The SSD formatting begins. When it is done, you will be asked to restart the system.

# Viewing system information

**To display the System Information screen**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 3/4, tap **System Info.** The **System Information** screen appears.

# Changing site information settings

You can alter the information that appears about your site name and its address.

**To change site information**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 3/4, tap **Site Info.** The **System** screen appears.

3 Tap **Site Info.**

4 Tap any of the two fields (**Site** or **Address**) to see the keyboard. Enter the information and then press **Close** to return to the **System** screen.

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Setting the system date and time

Use the **DateTime** screen to specify the system's date and time. You can also choose whether to receive date and time information from the NTP (Network Time Protocol) server.

**To set the system's date and time**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 3/4, Tap **Date and Language.** The **Date and Language** screen appears.

3 Tap **Date Time.** The **DateTime** screen appears.

4 To change the date setting type, select **Manual** or **NTP.** If you tap **NTP,** the available fields are displayed below. Tap a field (the keyboard appears) and type the IP address of the NTP server.

5 Tap the date and time to be set: **YYYY** (year), **MM** (month), **DD** (day), **hh** (hour), **mm** (minute), and **ss** (second).

6 Tap ▲ or ▼ to set the selected item.

7 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Setting the date and time display formats

You can specify how to display date and time information.

**To specify date and time display formats**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 3/4, tap **Date and Language**. The **Date and Language** screen appears.

3 Tap **Date Time Format**. The **Date Display Format** screen appears.

4 In the **Date Format** section, tap the green arrow button to see a choice of date formats: **YYYY/MM/DD**, **MM/DD/YYYY**, or **DD/MM/YYYY**.

5 Tap the date format you want to use.

6 To display the seconds, tap **ON** in the **Second Display** section. To hide the seconds, tap **OFF**.

7 To use the 12-hour format, tap **12H** in the **Time Format** section. To use the 24-hour format, tap **24H**.

8 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Setting the language to display

**To change the language setting**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 3/4, tap **Date and Language**. The **Date and Language** screen appears.

3 Tap **Language**. The **Language** screen appears.

4 Tap the right arrow button to change the language.

5 Tap **OK** to save the settings.

Press the **SYSTEM** button to return to the examination screen.

# Setting the login method for the FC1

On the security settings page, you can configure the system to require users to login and enter passwords. You can also add and delete users and change passwords. The default Administrator login name is Administrator. If you don't have the administrator password, contact FUJIFILM SonoSite. (See "Customer comments" on page 1) Any user with administrative privileges can login as an administrator.

**To set the login method:**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 3/4, tap **Security**. The **Security** screen appears.

3 Tap **Login Common**. The **Login Common Setting** screen appears.

4 Tap **ON**.

5 Tap **OK**.

At this point, you must restart the unit.

**Note** When the login setting is ON, the logout function is enabled. Tap the Others button, at the top right of the panel, to access it.

# Setting the license

This part of the software provides instructions on how to obtain a license key, and a place to input that key.

**To set the system license**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 4/4, tap **System License**. The **License** screen appears.

3 Tap **System License**, and then follow the instructions to obtain the license key.

4 Once you have obtained the license key, tap the first field to see a keyboard where you can type the numbers of the license. Type all the numbers.

5 Tap **OK**.

# Logs

You can choose to acquire all logs stored in the FC1 (or specify the range of dates for these logs), and delete all logs.

**Note** | Logs have limited space and overwrite existing content when full.

## Setting log acquisition

**To set log acquisition behavior**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 4/4, tap **Get Log**. The **Get Log** screen appears.

3 Do one or more of the following:

**a** if you want to acquire all logs, in the **Get All Log** row, tap **Start**.

**b** If you want to limit log acquisition to a certain time range, in the **Get Between Log** row, tap the date boxes to specify the range and tap **Start**.

4 When you are prompted to confirm this action, tap **OK** (or tap **Cancel** to cancel it).

**To delete all logs**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 4/4, tap **Delete Log**. The **Delete Log** screen appears.

3 tap **Start**.

## Setting audit log acquisition

Provides access to personal information, and allows you to save or export the audit log to maintain a record of security feature changes.

**To set audit log acquisition behavior**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 4/4, tap **Get Audit Log**. The **Get Audit Log** screen appears.

3 To get specific audit logs, in the **Get Between Audit Log** row, specify the date or dates of the audit logs you want, and then tap **Start**.

When you are prompted to confirm this action, tap **OK**. (or tap **Cancel** to cancel it).

**Note**

The audit log is saved as a password-secured ZIP file. The password will be the same as user password that was used to log in to the FC1 system. Software that conforms to RFC3881 can view the exported audit log file.

**To delete all audit logs**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 4/4, tap **Delete Audit Log**. The **Delete Audit Log** screen appears.

3 Tap **Start**.

**To view the exported audit log**

The exported audit log is XML and/or CSV file.

Software that conforms to RFC3881 can view XML file.

CSV file can be viewed in the most of generally available software.

CSV format is as follows:

- Event Time
- User ID
- Event Type ID
- Event Action
- Event Outcome
- Audit Enterprise Site ID
- Audit Source ID
- Participant Objects Type
- Participant Objects ID
- Participant Objects Name
- Alternative User ID
- Role ID
- Network Access Point
- Details XML

**Note** | csv file there is a limit to the read size. If the output is large it will be split.

CHAPTER 4

# Chapter 4: Imaging

## Getting familiar with the examination screen

This section describes the information that is necessary for ultrasound diagnosis and that is common to all screen modes.

On the main monitor, the examination screen includes the following:

- Header

  The strip across the top of the monitor

  The header displays patient and exam information, current date and time, and facility information. For more, see "Information in the header" on page 86.

- Grayscale or color scale bar

  At the top left, to the left of the acoustic output information

- Acoustic output information

  Transducer name, MI/TI value, frame rate, etc.

- Examination image

  The two parts of the image in the image area

- Information added by the user

  Information such as body marks, annotations, and measurement information

- Above the footer, operation information including:

  - Frame rate

  - Current mode

- Operation interface information, such as the functions of the trackball, function buttons, and Store buttons
- System information such as the amount of free space on internal storage media

- Footer

  The strip across the bottom of the monitor

  Information in the footer includes functional information, such as magnification ratio, number of heartbeats for ECG function, and cine memory. For more information, see "Information in the footer" on page 87.

In addition, you can show or hide the grayscale or color scale bar, the transducer name, and the AP (acoustic output) value and parameters for each mode.

## Information in the header

The header may include information such as the following (depending on the types of information that the user has recorded and has chosen to show or hide):

- Patient information
  - The patient name, and under it, the patient ID, date of birth, and age

    If the date of birth is registered in the Japanese calendar format, it is converted to the Western calendar format.

    If the age is less than one month, it displays with the number of weeks and the number of days (for example, 2w3d); if the age is one month or more, it displays with the number of months (for example, 1M).
  - The patient's gender, and under it, the patient's week of pregnancy (if applicable)
- Examination information
  - Examination type and presets
  - Patient accession number
  - Preset name
  - Operator name
- System information

- Facility name
- Current date and time

## Information in the footer

The footer may include information such as the following (depending on the information that the user has recorded and has chosen to show or hide):

- Message display area, which displays status and other messages
- The function assigned to the trackball
- The function assigned to the multi dial
- Functions assigned to the Store buttons 1 and 2

  When Store 3 is assigned to a function button, **Store 3** also appears.
- System information
- The amount of data stored in an examination

  This is equal to the count of recorded images, including clips.

  The count rolls over at 300.
- Connection status of optional devices

  This displays the icon for each optional device that is currently connected to the FC1.
- USB keyboard.
- Barcode reader:
- Card reader:
- Foot switch:
- USB memory:
  -

    The green image of USB memory means that the amount of free space is more than 200MB.

-

  The gray image of USB memory means that the amount of free space becomes 200MB or less.

- Printer, black-and-white or color:

  The following icons represent the print job's status. In each case, to represent a color printer, the icon for a black-and-white printer has the letter "C" superimposed.

  - Printing in progress:
  - Error: or
  - Queuing:

    If you format printing with multi-image output (in which several images may print in one print frame), the number of images in the queue is superimposed on the gray printer icon.

- Network

  - Connecting:
  - Communication in progress:
  - Error: or

    When there is no connection, no icon is displayed.

- The amount of free space on the internal storage media

  The display changes in increments of 1%. If it becomes 20% or less, the color of the icon changes.

**Table 4-7: Free space icon**

| Amount of free space | Icon |
|---|---|
| 81% to 100% | |
| 61% to 80% | |
| 41% to 60% | |
| 21% to 40% | |

**Table 4-7: Free space icon**

| Amount of free space | Icon |
|---|---|
| 1% to 20% | |
| 0% | |

- AC power supply connection status
  - When the AC adapter is connected:

    When there is no connection, no icon is displayed.
- Internal battery charge status

  The charge of the battery installed in the FC1 is displayed as an icon; the percentage of available power appears inside the battery icon, in increments of 1%.

**Table 4-8: Charge status icon**

| Charging or discharging status and percentage of charge available | Icon |
|---|---|
| Charge in progress—21% to 100% | |
| Discharge in progress—21% to 100% | |
| 0% to 20% | |

# Imaging modes

The availability of individual imaging modes depends on the transducer and exam type that you are using.

For details, see "Imaging modes and exams available by transducer" on page 119.

Each of the modes has a unique combination of controls. It shares some tasks with the other modes and has others that are unique to it. Thus, each of the following sections about modes describes a mode's controls and work procedure for accomplishing its unique tasks, and refers you to the sections that describe how to accomplish tasks that it shares with other modes.

## 2D mode

2D mode shows an arbitrary cross-section of biomedical tissue in a tomographic view.

Starting an examination or changing a transducer activates the 2D mode.

**Note** | 2D mode may be represented in the touch panel and main monitor as B mode.

## The 2D-mode examination screen

In the 2D-mode examination screen, note the following, in particular.

- Probe orientation mark

  The probe orientation mark indicates the direction of the transducer. The display of the probe orientation mark changes depending on the situation:

- Live image or active image in Dual screen mode: Green
- Frozen image or inactive image in Dual screen mode: Gray
- When the image is inverted vertically or horizontally, the probe orientation mark changes position accordingly.
- Mode mark (current mode identifier)

  The mode mark (**B**) in the illustration indicates that the 2D mode image is displayed.

  - When a live image is displayed, this mark shows in light blue.
  - When a frozen image is displayed, this mark shows in gray.

- Cine memory bar

  The cine memory bar shows only when a frozen image is displayed or when you review images in the cine memory.

## 2D-mode controls

On the touch panel, the 2D-mode controls are on the **B** screen.

**Table 4-9: 2D-mode controls**

| Control | What it does |
|---|---|
| **Imaging Preset** | Selects the imaging preset appropriate for your examination, on the touch panel. For information on working with imaging presets, see "Working with imaging presets" on page 147. |

**Table 4-9: 2D-mode controls**

| Control | What it does |
|---|---|
| **Image Type** | Selects the image type. The options are:<br>▸ **Fundamental**<br>▸ **Tissue Harmonic:** This transmits at one frequency and receives at a higher harmonic frequency to reduce noise and clutter and improve resolution.<br>▸ **Compound Harmonic:** This image type has a mix of fundamental and harmonic frequencies. It is desirable for linear transducers, because it reduces noise.<br>▸ Spatial compound: Image with a mix of data obtained by transmitting ultrasound waves multi-directionally |
| **Image Width** | Widens or narrows the image width. Also moves the field of view position. |
| **Trapezoid** | Changes image to the Trapezoid display mode, in order to extend the field of view when using a linear transducer.<br>**Note:**<br>You can select the Trapezoid display mode only when a linear transducer is connected. |
| **L/R** | Inverts the image horizontally.<br>**WARNING:**<br>When performing a diagnosis based on an inverted image, check the direction of the transducer so as not to misunderstand the direction of scanning and the orientation of the image. |
| **U/D** | Inverts the image vertically.<br>**WARNING:**<br>When performing a diagnosis based on an inverted image, check the direction of the transducer so as not to misunderstand the direction of scanning and the orientation of the image. |
| **Simul Dual** | For details, see "Viewing in Simultaneous Dual-screen mode" on page 158. |
| **Optimize** | For details, see "Optimizing the image" on page 116. |
| **M/D Cursor** | For details, see "Using the M or D cursor" on page 159. |

**Table 4-9: 2D-mode controls**

| Control | What it does |
|---|---|
| **ECG** | Enables use and configuration of the ECG waveform display.<br>For more information, including setting the sweep speed, see "Displaying and configuring the ECG waveform" on page 161. |
| **Needle Guide** | For details, see "Using the needle guide" on page 169. |
| **Needle Profiling** | For details, see "Needle profiling (Optional)" on page 171. |

The following are controls that combine the touch panel and dial menu buttons:

**Table 4-10: 2D-mode combination controls**

| Control | What it does |
|---|---|
| **Sound Speed** | Sets the sound speed.<br>For details, see "Setting the sound speed" on page 112. |
| **A Output** | Sets the transmission output level.<br>For details, see "Setting the transmission-output level" on page 113.<br>**Note:**<br>You cannot change the transmission output level when the image is frozen. |
| **B Steer** | Sets the steering angle on images in the 2D-mode. |
| **Quick Angle** | Changes the cursor's gate angle.<br>To change the angle to plus or minus 45°, 60°, or 0°, tap **Quick Angle**, and then turn dial menu button 1 (the dial to the right of **Quick Angle**).<br>The angles with the upper end of the graphic to the left are positive; the angles with the upper end of the graphic to the right are negative. |
| **Cursor Steer** | Changes the cursor's steering angle.<br>To specify the steering angle, rotate dial menu button 1 (the dial menu button to the right of **Cursor Steer**).<br>**Note:**<br>▸ You can set the Cursor Steer angle only when a linear transducer is connected.<br>▸ The steer angle can be set to 30 degrees only when the HFL38xp or HFL50xp transducer is connected. |

The following are controls that combine the touch panel and switch menu buttons:

**Table 4-11: 2D-mode combination controls**

| Control | What it does |
|---|---|
| **Edge** | Sets the level of emphasis of edges.<br>The range of values is 0 to 4.<br>For details, see "Raising or lowering the emphasis of edges" on page 113. |
| **Sharpness** | Raises or lowers the level of sharpness.<br>The range of values is 0 to 4.<br>For details, see "Raising or lowering the level of sharpness" on page 114. |
| **Map** | Selects the map for adjusting the tone of the 2D mode image.<br>The possible maps are:<br>▸ Grayscale: G1 to G11<br>▸ Pseudo color: I1 to I4<br>▸ Single color: C1 to C3<br>For details, see "Adjusting image tone" on page 114. |
| **Persistence** | Raises or lowers the persistence value.<br>Persistence is frame correlation, which as it increases tends to suppress noise in the image. As you increase the value, the image becomes smoother.<br>The range of values is 0 to 4.<br>For details, see "Adjusting persistence" on page 114. |
| **DR** | Adjusts the dynamic range in the image.<br>The dynamic range is the range of contrast in the image.<br>You can increase or decrease the dynamic range in increments of 5. The range of values is 40 to 100.<br>For details, see "Setting the range of contrast" on page 114. |
| **Focus Depth** | Sets the focus depth.<br>For details, see "Setting the focus depth" on page 115.<br>**Note:**<br>You cannot change the focus depth when the image is frozen. |
| **Speckle Reduct** | Reduces speckling in the image.<br>Along the bottom of the touch panel, tap **Speckle Reduct**, if it is not already active, and then press switch menu button 3 (the rocker button beneath **Speckle Reduct**) to raise or lower the value.<br>The range of values is 0 to 4. |

**Table 4-11: 2D-mode combination controls**

| Control | What it does |
|---|---|
| **Focus Number** | Defines the number of focuses that you can set.<br>Along the bottom of the touch panel, tap **Focus Number**, if it is not already active, and then press switch menu button 3 (the rocker button beneath **Focus Number**) to raise or lower the value.<br>The maximum value is 2.<br>**Note:**<br>Increasing the number of focuses decreases the frame rate. |
| **Gate Size** | Sets the cursor's gate size.<br>**1** At the bottom of the touch panel, tap **Gate Size**, if it is not already active for switch menu button 4 (the rocker button beneath it).<br>**2** Press the up- or down-arrow side of the rocker button to increase or decrease the gate size.<br>**Note:**<br>You cannot set the gate size when the image is frozen. |

The following control is on the control panel:

**Table 4-12: 2D-mode combination controls**

| Control | What it does |
|---|---|
| **FREQUENCY** button | Changes the transmission frequency.<br>To change the transmission frequency, press either the up- or down-arrow side of the **FREQUENCY** button ( ). The current frequency is displayed at the bottom of the examination screen.<br>**Notes:**<br>▸ The range of available frequencies depends on the transducer type that you are using.<br>▸ You cannot change the frequency when the image type is Compound (see "**Image Type**," in the first table in this section).<br>▸ In CD, PD, PW, CW, and TDI (PW) modes, this button toggles to the function to change the scale in PRF (pulse repetition frequency). |

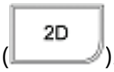
For more information on working with controls in 2D mode, see the following:

▸ "Adjusting the depth and gain of the image" on page 111

- Adjusting gain compensation (depth gain compensation or lateral gain compensation): "Optimizing the image" on page 116.
- Using the M or D cursor, including setting its gate size, steering angle, and cursor angle: "Using the M or D cursor" on page 159.
- Using Dual and Simultaneous Dual screen modes: "Viewing in Dual-screen mode" on page 155 and "Viewing in Simultaneous Dual-screen mode" on page 158.

## Working in 2D mode

**To work in 2D mode**

**1** Press the **2D** button ( 

).

A 2D mode image is displayed on the main monitor, and the 2D button turns orange. The 2D screen appears on the touch panel.

**2** To widen or narrow the image width:

**a** On the touch panel, tap **Image Width**. The region of interest (ROI) is displayed.

**b** Use the trackball to adjust the size of the image width.

A green outline showing the width of the image that you are setting the mode to appears slightly before the image changes to that width.

**Note** | Narrowing the image width increases the frame rate.

**c** To toggle between the size setting and the position setting, press the **SET** button (

).

**d** Use the trackball to adjust the position of the image.

A green outline showing the position of the image that you are setting the mode to appears slightly before the image changes to that position.

**3** To set the steering angle of the 2D mode image:

**a** On the touch panel, tap **B Steer**.

**b** To specify the steering angle of the 2D mode image, rotate the dial menu button to the right of **B Steer**.

You can set the steering angle in increments of 15 degrees.

**Caution** | You can set the B Steer angle only when a linear transducer is connected.

**4** Complete the part of the examination that requires 2D mode.

- For information on viewing an ECG (electrocardiogram) during ultrasound examination, see "Viewing the ECG waveform display" on page 160.
- For information on performing a needle procedure, see "Performing a needle procedure" on page 163.

**5** To freeze the image, press the **FREEZE** button ( ).

**6** As necessary, save the image or perform measurements.

For details on saving a frozen image or a cine loop, see "Storing examination images" on page 195.

# M mode

## The M-mode examination screen

The M mode displays temporal changes (motions) of the region that you specify with the M cursor in the 2D mode image.

The M cursor, which appears on the 2D mode image, indicates the position of the M-mode line in the cross-sectional view.

Working in M mode includes configuring the mode's settings.

**Caution** | When working in M mode, make sure that the **M** tab is current on the touch panel. If the **B** tab is current, you are working in 2D mode, and are adjusting 2D-mode image parameters.

## M-mode controls

The following controls are on the touch panel:

**Table 4-13: M-mode controls**

| Control | What it does |
|---|---|
| **Imaging Preset** | Enables selecting the imaging preset appropriate for your examination, on the touch panel.<br>For information on working with imaging presets, see "Working with imaging presets" on page 147. |
| **Format** | Enables changing the display sizes of the 2D-mode and M -mode images relative to each other.<br>For details, see "Sizing mode images relative to each other" on page 117. |
| **ECG** | Enables use and configuration of the ECG waveform display.<br>For more information, including setting the sweep speed, see "Displaying and configuring the ECG waveform" on page 161. |

The following controls combine the touch panel and dial menu buttons:

**Table 4-14: M-mode combination controls**

| Control | What it does |
|---|---|
| **Sound Speed** | Sets the sound speed.<br>For details, see "Setting the sound speed" on page 112. |
| **A Output** | Sets the transmission output level.<br>For details, see "Setting the transmission-output level" on page 113.<br>**Note:**<br>You cannot change the transmission output level when the image is frozen. |

The following controls combine the touch panel and switch menu buttons.

**Table 4-15: M-mode combination controls**

| Control | What it does |
|---|---|
| **Edge** | Sets the level of emphasis of edges.<br>The range of values is 0 to 4.<br>For details, see "Raising or lowering the emphasis of edges" on page 113. |

**Table 4-15: M-mode combination controls**

| Control | What it does |
|---|---|
| **Map** | Selects the map for adjusting the tone of the 2D -mode image.<br>The possible maps are:<br>▸ Grayscale: G1 to G11<br>▸ Pseudo color: I1 to I4<br>▸ Single color: C1 to C3<br>For details, see "Adjusting image tone" on page 114. |
| **DR** | Adjusts the dynamic range in the image.<br>The dynamic range is the range of contrast in the image.<br>You can increase or decrease the dynamic range in increments of 5. The range of values is 40 to 100.<br>For details, see "Setting the range of contrast" on page 114. |
| **Sweep Speed** | Sets the sweep speed in number of heartbeats per sweep.<br>For details, see "Setting the sweep speed" on page 112. |

For more information on adjusting depth and gain in M mode, see "Adjusting the depth and gain of the image" on page 111.

## Working in M mode

**To work in M mode**

**1** Press the **M** button.

**Note** | To activate the M mode while in another mode (live image), press the **M** button.

The 2D-mode and M-mode images show on the monitor, and the **M** button turns orange.

**2** To adjust depth gain compensation (DGC), see "Optimizing the image" on page 116.

**3** To freeze the image, press the **FREEZE** button ( ).

**4** Save the image or perform measurements, as needed.

For details on saving a frozen image or a cine loop, see "Storing examination images" on page 195.

# CD and PD modes

CD mode provides information regarding the blood-flow velocity within the color region of interest (color ROI).

PD mode provides qualitative Doppler signal power information regarding the blood flow inside the PD region of interest (PD ROI).

## The CD- and PD-mode examination screen

**Notes**

- The color-focus mark of the CD/PD mode image is green when the image is live, and white when the image is frozen.
- The mode mark indicates that the CD mode or PD mode image is displayed. When a live image is displayed, this mark has a light-blue background. When a frozen image is displayed, this mark has a gray background.
- The cine memory bar appears only when a frozen image is on screen or when you review images in the cine memory.

## CD- and PD-mode controls

The following controls are on the touch panel.

**Table 4-16: CD- and PD-mode controls**

| Control | What it does |
|---|---|
| **Imaging Preset** | Enables selecting the imaging preset appropriate for your examination, on the touch panel.<br>For information on working with imaging presets, see "Working with imaging presets" on page 147. |
| **ECG** | Enables use and configuration of the ECG waveform display.<br>For more information, including on setting the sweep speed, see "Displaying and configuring the ECG waveform" on page 161. |
| **Invert** | Enables inversion of the color map that indicates the blood-flow direction.<br>The blood-flow direction is relative to the transducer: toward or away from it.<br>Tap **Invert**. |
| **Simul Dual** | For details, see "Viewing in Simultaneous Dual-screen mode" on page 158. |

**Table 4-16: CD- and PD-mode controls**

| Control | What it does |
|---|---|
| **M/D Cursor** | For details, see "Using the M or D cursor" on page 159. |

The following controls combine the touch panel and dial menu buttons

**Table 4-17: CD- and PD-mode combination controls**

| Control | What it does |
|---|---|
| **A Output** | Sets the transmission output level.<br>For details, see "Setting the transmission-output level" on page 113.<br>**Note:**<br>You cannot change the transmission output level when the image is frozen. |
| **ROI Steer** | Sets the steering angle of the color ROI.<br>To specify the steering angle, rotate the dial menu button to the right of **ROI Steer**.<br>**Note:**<br>▸ You can set the ROI Steer angle only when a linear transducer is connected.<br>▸ The ROI Steer angle can be set to 30 degrees only when the HFL38xp or HFL50xp transducer is connected. |
| **Scale** | Expands or contracts the color scale.<br>For details, see "Setting the color scale" on page 115.<br>**Note:**<br>▸ You cannot change the color scale when the image is frozen.<br>▸ The color scale can be expanded or contracted also by **FREQUENCY** button. To change the frequency in 2D (B) mode, press the 2D (B) button to return to 2D (B) mode, and then press the **FREQUENCY** button. |
| **Quick Angle** | Changes the cursor's gate angle.<br>To change the angle to plus or minus 45°, 60°, or 0°, tap **Quick Angle**, and then turn dial menu button 1 (the dial to the right of **Quick Angle**).<br>The angles with the upper end of the graphic to the left are positive; the angles with the upper end of the graphic to the right are negative. |

**Table 4-17: CD- and PD-mode combination controls**

| Control | What it does |
|---|---|
| **Cursor Steer** | Changes the cursor's steering angle.<br>To specify the steering angle, rotate dial menu button 1 (the dial menu button to the right of **Cursor Steer**).<br>**Note:**<br>▸ You can set the Cursor Steer angle only when a linear transducer is connected.<br>▸ The steer angle can be set to 30 degrees only when the HFL38xp or HFL50xp transducer is connected. |

The following controls combine the touch panel and switch menu buttons.

**Table 4-18: CD- and PD-mode combination controls**

| Control | What it does |
|---|---|
| **Balance** | Sets the level of display priority of the 2D mode and CD/PD mode images (that is, which type of image displays at the front of the screen).<br>▸ At the bottom of the touch panel, tap **Balance**, if it is not already active for switch menu button 1 (the rocker button beneath it).<br>▸ Press the up- or down-arrow side of switch menu button 1 to raise or lower the value.<br>The range of values is 1 through 7. |
| **Baseline** | Sets the baseline of the color map.<br>▸ At the bottom of the touch panel, tap **Baseline**, if it is not already active for switch menu button 1 (the rocker button beneath it).<br>▸ Press the up- or down-arrow side of switch menu button 1 to raise or lower the value.<br>**Note:**<br>When the baseline is changed, the velocity and color assignments change accordingly. |
| **Map** | Selects the map for adjusting the tone of the CD or PD mode image.<br>The possible maps are:<br>▸ For CD mode, VD*n* and VE*n*, where *n* is 1 to 4<br>▸ For PD mode, PD*n*, PV*n*, and DPD*n*, where *n* is 1 to 4, and DPV*n*, where *n* is 1 to 5<br>For details, see "Adjusting image tone" on page 114. |

**Table 4-18: CD- and PD-mode combination controls**

| Control | What it does |
|---|---|
| **Flash Cancel** | Sets the level of filtering for flash artifacts that are generated as a result of movement of biomedical tissue such as the heart.<br>▸ At the bottom of the touch panel, tap **Flash Cancel**, if it is not already active for switch menu button 2 (the rocker button beneath it).<br>▸ Press the up- or down-arrow side of switch menu button 1 to raise or lower the value.<br>The range of values is 0 through 4. |
| **Persistence** | Raises or lowers the persistence value.<br>Persistence is frame correlation, which, as it increases, tends to suppress noise in the image. As you increase the value, the image becomes smoother.<br>The range of values is 0 to 4.<br>For details, see "Adjusting persistence" on page 114. |
| **Filter** | Sets the cutoff frequency of the filter for removing clutter in the CD- or PD-mode image persistence.<br>The range of values is 1 through 6. The smaller the number, the lower the cutoff frequency, and the less clutter.<br>For details, see "Setting the filter cutoff frequency" on page 116.<br>**Note:**<br>You cannot change the filter level when the image is frozen. |
| **DR** | Adjusts the dynamic range in the image.<br>The dynamic range is the range of contrast in the image.<br>You can increase or decrease the dynamic range in increments of 5. The range of values is 40 to 100.<br>For details, see "Setting the range of contrast" on page 114.<br>**Note:**<br>You can change the dynamic range only when the system is in PD mode. |
| **Focus Depth** | Sets the focus depth.<br>For details, see "Setting the focus depth" on page 115.<br>**Note:**<br>You cannot change the focus depth when the image is frozen. |

**Table 4-18: CD- and PD-mode combination controls**

| Control | What it does |
|---|---|
| **CF Frequency** | Sets the transmission frequency of the CD or PD mode image.<br>▸ At the bottom of the touch panel, tap **CF Frequency**, if it is not already active for switch menu button 5 (the rocker button beneath it).<br>▸ Press the up- or down-arrow side of switch menu button 1 to raise or lower the value.<br>▸ Select the transmission frequency for these images.<br>**Note:**<br>You cannot change the transmission frequency when the image is frozen. |
| **Gate Size** | Sets the cursor's gate size.<br>**1** At the bottom of the touch panel, tap **Gate Size**, if it is not already active for switch menu button 4 (the rocker button beneath it).<br>**2** Press the up- or down-arrow side of the rocker button to increase or decrease the gate size.<br>**Note:**<br>You cannot set the gate size when the image is frozen. |

The following control is on the control panel

**Table 4-19: CD- and PD-mode control panel**

| Control | What it does |
|---|---|
| **C button** | Shows or hides the region of interest (ROI), when either the PD mode or CD mode image is showing and is frozen. |

For more information on working with controls in CD and PD modes, see the following:

- "Adjusting the depth and gain of the image" on page 111
- "Using the M or D cursor" on page 159

  The information available for the M or D cursor includes setting its gate size, steering angle, and cursor angle.

- "Viewing in Dual-screen mode" on page 155 and "Viewing in Simultaneous Dual-screen mode" on page 158.

## Working in CD and PD modes

**To work in CD and PD modes**

**1** To activate the CD mode, press the **C** button.

The CD mode image appears on the examination screen, and the **C** button turns orange.

**2** To move between CD mode and PD mode while in either, in the touch panel, tap **CD** or **PD** in the **Mode** area according to which mode you want to view.

Or, if you have assigned activation of the PD mode to a function button, press that function button.

**Caution** Note that to activate the CD mode while in another mode, you press the C button. To activate the PD mode, you press the function button that you have assigned to activate the PD mode.

**3** To change the size or position of the color ROI:

**a** Use the trackball to adjust the size of the image width or the position of the image.

**b** To toggle between the size setting and the position setting, press the **SET** button (

).

**4** To freeze the image, press the **FREEZE** button ( ).

When the image is frozen, you cannot use the following functions:

- CF Frequency
- A Output
- Filter
- Scale
- Focus Depth

**5** As necessary, save the image or perform measurements.

For details on saving a frozen image or a cine loop, see "Storing examination images" on page 195.

# PW, CW, and TDI modes

Use the PW, CW, and TDI modes to display information on the blood flow in the heart or in blood vessels, and the movement of cardiac muscle tissue.

## The PW-, CW-, and TDI-mode examination screen

The scroll display of PW, CW, or TDI mode indicates that the PW/CW/TDI mode strip is displayed. It turns light blue when a live image is displayed, and it turns gray when a frozen image is displayed.

The PW, CW, or TDI cursor appears on the 2D-mode image. It indicates the position of the PW/CW/TDI mode strip. When the PW mode is active, the **D** button is orange.

## PW-, CW-, and TDI-mode controls

The following are controls that operate from the touch panel:

**Table 4-20: PW-, CW-, and TDI-mode controls**

| Control | What it does |
|---|---|
| **Imaging Preset** | For selecting the imaging preset appropriate for your examination, on the touch panel.<br>For information on working with imaging presets, see "Working with imaging presets" on page 147. |
| **Format** | Enables changing the display sizes of the 2D mode and PW, CW, or TDI mode images relative to each other.<br>For details, see "Sizing mode images relative to each other" on page 117. |
| **ECG** | Enables using and configuring the ECG waveform display.<br>For more information, including on setting the sweep speed, see "Displaying and configuring the ECG waveform" on page 161. |
| **Invert** | For inverting the color map that indicates the blood-flow direction and the strip display direction of the Doppler spectrum.<br>The blood-flow direction is relative to the transducer: toward or away from it.<br>Tap **Invert**. |

**Table 4-20: PW-, CW-, and TDI-mode controls**

| Control | What it does |
|---|---|
| **Update area** | Selects an image for updating in real time.<br>Beside **Update**, tap either **B**, **D**, or **Simul**, according to which image or images you want updated.<br><br>▸ **B**: Update only the live 2D-mode image. The spectral trace of PW, CW, or TDI mode is not updated when the image parameter (for example, cursor steer) is adjusted.<br><br>▸ **D**: Update only the live PW/CW/TDI-mode strip.<br><br>▸ **Simul**: Update both the live 2D-mode image and the live PW-mode strip.<br><br>You can specify image updates only in PW mode (*not* CW or TDI modes).<br>**Note:**<br>You can specify image updates only when a live image is on screen. |

The following are controls that combine the touch panel and dial menu buttons.

**Table 4-21: PW-, CW-, and TDI-mode combination controls**

| Control | What it does |
|---|---|
| **Quick Angle** | Changes the cursor's gate angle.<br>To change the angle to plus or minus 45°, 60°, or 0°, tap **Quick Angle**, and then turn dial menu button 1 (the dial to the right of **Quick Angle**).<br>The angles with the upper end of the graphic to the left are positive; the angles with the upper end of the graphic to the right are negative. |
| **A Output** | Sets the transmission output level.<br>For details, see "Setting the transmission-output level" on page 113.<br>**Note:**<br>You cannot change the transmission output level when the image is frozen. |

**Table 4-21: PW-, CW-, and TDI-mode combination controls**

| Control | What it does |
|---|---|
| **Scale** | Expands or contracts the velocity scale of the PW/CW/TDI mode strip.<br>**1** On the right-hand side of the touch panel, tap **Scale**, if it is not already active for the dial menu button to its right.<br>**2** Turn the dial menu button to grow or shrink the color scale.<br>**Note:**<br>▸ You cannot change the velocity scale when the image is frozen.<br>▸ The velocity scale can be expanded or contracted also by **FREQUENCY** button. To change the frequency in 2D (B) mode, press the 2D (B) button to return to 2D (B) mode, and then press the **FREQUENCY** button. |
| **Cursor Steer** | Changes the cursor's steering angle.<br>To specify the steering angle, rotate dial menu button 1 (the dial menu button to the right of **Cursor Steer**).<br>**Note:**<br>▸ You can set the Cursor Steer angle only when a linear transducer is connected.<br>▸ The steer angle can be set to 30 degrees only when the HFL38xp or HFL50xp transducer is connected. |
| **Audio Volume** | Sets the audio volume level.<br>▸ On the touch panel, tap **Audio Volume**, and then turn dial menu button 1 (the dial menu button to the right of **Audio Volume**).<br>You can set an audio volume from 0 to 100.<br>**Note:**<br>This control is not available in TDI mode. |

The following are controls that combine the touch panel and switch menu buttons.

**Table 4-22: PW-, CW-, and TDI-mode combination controls**

| Control | What it does |
|---|---|
| **Baseline** | Moves the baseline for discriminating the blood flow direction (forward or reverse).<br>**1** At the bottom of the touch panel, tap **Baseline**, if it is not already active for switch menu button 1 (the rocker button beneath it).<br>**2** Press the up- or down-arrow side of the rocker button to move the baseline.<br>As you press the rocker button, the baseline moves up or down in the display. |
| **Map** | Selects the map for adjusting the tone of the PW, CW, or TDI mode image.<br>The possible maps are:<br>▸ Grayscale: G1 to G8<br>▸ Pseudo color: I1 to I4<br>For details, see "Adjusting image tone" on page 114. |
| **Filter** | Sets the cutoff frequency of the filter for removing clutter in the PW, CW, or TDI mode image persistence.<br>The range of values is 1 through 12. The smaller the number, the lower the cutoff frequency, and the less clutter.<br>For details, see "Setting the filter cutoff frequency" on page 116.<br>**Note:**<br>You cannot change the filter level when the image is frozen. |
| **Gate Size** | Sets the cursor's gate size.<br>**1** At the bottom of the touch panel, tap **Gate Size**, if it is not already active for switch menu button 4 (the rocker button beneath it).<br>**2** Press the up- or down-arrow side of the rocker button to increase or decrease the gate size.<br>**Note:**<br>▸ This control is not available for the CW mode.<br>▸ You cannot set the gate size when the image is frozen. |
| **DR** | Adjusts the dynamic range in the image.<br>The dynamic range is the range of contrast in the image.<br>Increase or decrease the dynamic range in increments of 5. The range of values is 40 to 100.<br>For details, see "Setting the range of contrast" on page 114. |

**Table 4-22: PW-, CW-, and TDI-mode combination controls**

| Control | What it does |
|---|---|
| **Sweep Speed** | Sets the sweep speed in number of seconds per sweep.<br>For details, see "Setting the sweep speed" on page 112. |
| **D Frequency** | Sets the transmission frequency of the PW-, CW, or TDI-mode strip.<br>**1** At the bottom of the touch panel, tap **Gate Size**, if it is not already active for switch menu button 4 (the rocker button beneath it).<br>**2** Press the up- or down-arrow side of the rocker button to increase or decrease the gate size.<br>**Note:**<br>You cannot change the transmission frequency when the image is frozen. |

For more information on working with controls in CD and PD modes, see the following:

- "Adjusting the depth and gain of the image" on page 111
- "Using the M or D cursor" on page 159

  The information available for the M or D cursor includes setting its gate size, steering angle, and cursor angle.

- "Viewing in Dual-screen mode" on page 155 and "Viewing in Simultaneous Dual-screen mode" on page 158

## Working in PW, CW, and TDI modes

**To work in the PW, CW, and TDI modes**

**1** To change modes among PW, CW, and TDI, do one of the following:

- On the touch panel, beside **Mode**, tap PW, CW, or TDI, according to which mode you want to activate.
- To activate the PW mode, press the **D** button.
- To activate the CW or TDI mode, do one of the following:
  - If the function for activating CW or TDI mode is not already assigned to a function button, assign it to one of them.
  - Press the function button assigned to activate CW or TDI mode.

**2** To correct the angle of the PW or TDI cursor, rotate the multi dial ( ).

You can specify an angle between -88 and +88 degrees.

| Caution | When the Doppler angle exceeds 60 degrees, the margin of error progressively increases. Doppler angles greater than 60 degrees are displayed in red. |
|---|---|

**3** To freeze the image, press the **FREEZE** button ( ).

When the image is frozen, the following functions (virtual buttons) are inactive.

- D Frequency
- A Output
- Filter
- Gate Size
- Scale
- Update

**4** As necessary, save the image or perform measurements.

For details on saving a frozen image or a cine loop, see "Storing examination images" on page 195.

# Controlling the image

## Showing or hiding data on the monitor

You can show or hide the following elements on the monitor:

- Grayscale or color scale bar
- The transducer name
- AP (acoustic output)
- Parameters for each imaging mode

**To show or hide data on the monitor**

1 In any mode, tap **Others**. The **Others** screen appears.

2 Tap **Remove Data Fields**.

# Magnifying the image

**To change the magnification of the image**

1 If the **DEPTH/ZOOM** button ( ) is blue, press it to turn it orange.

The initial level of magnification is 1.25 times.

2 To increase or decrease the magnification, press the up- or down-arrow side of the rocker button ( ) below the **DEPTH/ZOOM** button.

The available magnifications range from 1.25 times to 4.0 times.

When the image is magnified, the magnification ratio shows at the bottom left of the monitor.

3 To move the magnified image, use the trackball.

4 To return the image to normal size, press the **DEPTH/ZOOM** button again.

# Adjusting the depth and gain of the image

**To change the depth of the image**

1 If the **DEPTH/ZOOM** button ( ) is orange, press it to turn it blue.

2 To increase or decrease the depth of the image, press the up- or down-arrow side of the rocker button ( ) below the **DEPTH/ZOOM** button.

**To change gain**

- Do one of the following:

- Turn the outer ring of the **FREEZE** button ( ) to the right to increase the gain or to the left to decrease the gain.

- To increase or decrease gain for a certain depth of field within the image, slide the appropriate DGC key to the right (to increase the gain) or to the left (to decrease the gain).

Figure 4-1: DGC (Depth Gain Control) keys

- Tap **Optimize** and specify settings.

For more information on specifying gain and sound speed settings, see "Optimizing the image" on page 116

# Setting the sound speed

**To set the sound speed**

1 On the right-hand side of the touch panel, tap **Sound Speed**, if it is not already active for the dial menu button to its right.

2 Turn the dial menu button to raise or lower the sound speed.

**To optimize the sound speed for 2D mode**

1 On the **B** tab, tap **Optimize**.

2 In the **Optimize** screen, make sure that **Sound Speed** is selected (orange).

3 Tap **Close**.

# Setting the sweep speed

You can set the rate at which the waveform progresses.

**To raise or lower the sweep speed**

1 Along the bottom of the touch panel, tap **Sweep Speed**, if it is not already active.

2 Press the up- or down-arrow side of switch menu button 1 (the rocker button below **Sweep Speed**) to raise or lower the speed.

The range of values is from 1 to 7, inclusive.

## Setting the transmission frequency

The transmission frequency influences resolution and the penetration of the image.

**To set the transmission frequency**

- On the **FREQUENCY** button ( ) on the control panel, press the upward-pointing arrow to raise the frequency, or the downward-pointing arrow to lower it.

**Note** In CD, PD, PW, CW, and TDI (PW) modes, this button toggles to the function to change the scale in PRF (pulse repetition frequency).

## Setting the transmission-output level

**Note** You cannot change the transmission-output level when the image is frozen.

**To set the transmission-output level**

1 On the right-hand side of the touch panel, tap **A Output**, if it is not already active for the dial menu button to its right.

2 Turn the dial menu button to raise or lower the transmission output level.

## Raising or lowering the emphasis of edges

**To raise or lower the emphasis of edges**

1 Along the bottom of the touch panel, tap **Edge**, if it is not already active.

2 Press the up- or down-arrow side of switch menu button 1 (the rocker button below **Edge**) to raise or lower the value.

The range of values is 0 to 4.

## Raising or lowering the level of sharpness

**To raise or lower the level of sharpness**

1 Along the bottom of the touch panel, tap **Sharpness**, if it is not already active.

2 Press the up- or down-arrow side of switch menu button 1 (the rocker button below **Sharpness**) to raise or lower the value.

The range of values is 0 to 4.

## Adjusting image tone

**To select the map for adjusting the tone of the 2D mode image**

1 Along the bottom of the touch panel, tap **Map**, if it is not already active.

2 Press the up- or down-arrow side of switch menu button 2 (the rocker button below **Map**) to cycle through and select the type of tone and its value:

- Grayscale: G1 to G11
- Pseudo color: I1 to I4
- Single color: C1 to C3

## Adjusting persistence

Persistence is frame correlation, which tends to suppress noise in the image as it increases. As you increase the value, the image becomes smoother.

**To increase or lower persistence**

1 Along the bottom of the touch panel, tap **Persistence**, if it is not already active.

2 Press the up- or down-arrow side of switch menu button 3 (the rocker button below **Persistence**) to raise or lower the value.

The range of values is 0 to 4.

## Setting the range of contrast

An image's dynamic range is the range of contrast.

**To adjust the dynamic range in the image**

1 Along the bottom of the touch panel, tap **DR**, if it is not already active.

2 Press the up- or down-arrow side of switch menu button 4 (the rocker button below **DR**) to raise or lower the value.

You can increase or decrease the dynamic range in increments of 5. The range of values is 40 to 100.

## Setting the focus depth

**Note** You cannot change the focus depth when the image is frozen.

**To raise or lower the focus depth**

1 At the bottom of the touch panel, tap **Focus Depth**, if it is not already active.

2 Press the up- or down-arrow side of switch menu button 5 (the rocker button below **Focus Depth**) to raise or lower the depth of focus.

As you raise or lower the depth of focus, the depth-of-focus marker (a blue triangle on the examination display) rises or falls accordingly.

## Setting the color scale

**Note** You cannot change the color scale when the image is frozen.

**To set the scale**

1 On the right-hand side of the touch panel, tap **Scale**, if it is not already active for the dial menu button to its right.

The color scale can be set also by **FREQUENCY** button.

2 Turn the dial menu button to grow or shrink the color scale.

As you turn the dial menu button, the change is reflected in the color scale at the upper-left of the main monitor.

## Setting the filter cutoff frequency

This filter removes clutter in the CD or PD mode image persistence.

**Note** | You cannot change the cutoff frequency when the image is frozen.

**To set the frequency of the filter cutoff**

1 At the bottom of the touch panel, tap **Filter**, if it is not already active.

2 Press the up- or down-arrow side of switch menu button 3 (the rocker button below **Filter**) to raise or lower the frequency for eliminating clutter.

For the range of values specific to the mode, see "CD and PD modes" on page 99 and "PW, CW, and TDI modes" on page 105. Lowering the value lowers the cutoff frequency and reduces clutter.

## Optimizing the image

This section explains how to control gain, sound speed, and the portions of the image to which they are applied.

**To optimize the image**

1 On the **2D** screen (**B**), tap **Optimize**.

The **Optimize** screen appears.

2 To enable the optimization feature, tap **Optimize Update**.

3 If **Optimize Update** is disabled (gray and unavailable), the optimization feature is already disabled.

4 To specify that gain be adjusted automatically:

- For the entire image, tap **Gain**.
- In the direction of depth, tap **DGC**.
- In the lateral direction, tap **LGC**.

5 To specify the calculation position of sound speed correction, in the **Sound Speed** area, tap either **Full Screen** or **ROI** ("region of interest").

6 To minimize the deterioration of the resolution caused by the offset of the sound velocity, tap **Sound Speed** or **Auto Focus**.

| | |
|---|---|
| **Caution** | You can select **Auto Focus** only when you have selected **ROI** in the **Sound Speed** area. |

The 2D-mode image stops temporarily, and the system adjusts the sound velocity, after compensation.

7 To specify the gain offset value:

**a** Tap **Set Offset**.

**b** To adjust the gain offset precisely, press the up arrow or down arrow side of the rocker button below the **Gain Offset** box in the bottom-left corner of the touch panel.

8 To cancel the **Gain Offset** setting, tap **Reset Offset**.

9 To update the image with the settings that you have just specified, tap **Optimize Update**.

10 To close the **Optimize** screen, tap **Close**.

On the main monitor, the optimized values appear in green.

| | |
|---|---|
| **Caution** | If a small ROI is specified, the estimated sound velocity value for image optimization may decrease. For information on sizing the ROI, see "2D mode" on page 89, "CD and PD modes" on page 99, and "PW, CW, and TDI modes" on page 105.<br>When you use the 2D Steer function, the estimated sound velocity value for image optimization may decrease. The estimated sound velocity value is used for optimizing the image quality. Accordingly, it may be different from the sound velocity value of the target of examination.<br>Sound speed compensation is applied only to the live 2D mode image.<br>Button operation and image condition and boot timing of auto image cannot display suitable image. In that case, reboot auto image function by double clicking **AUTO IMAGE** button to disenable this function and clicking again to enable. |

# Sizing mode images relative to each other

**To change the display sizes of two mode images relative to each other**

1 On the touch panel, tap **Format**.

The **Format** selection screen appears.

2 Tap the button for the desired relative sizes of the two images:

- **1:1** ( ): the two mode images occupy equal parts of the screen.
- **2:1** ( ): the upper mode image occupies twice the vertical screen space as the lower mode image.
- **1:2** ( ): the upper mode image occupies half the vertical screen space as the lower mode image.

The image appears in the selected display format on the main monitor.

# Examination procedures

With the FC1, each examination has the following sequence.

1 Enter patient information.

Enter patient information (such as patient ID). When you have selected the examination type, the system displays the most appropriate transducer and preset for the selected examination.

For more information on entering patient information, see"Entering patient information" on page 124.

2 Start the examination.

Starting an examination creates a new examination file.

3 End the examination.

For more information on ending an examination, see "Ending an examination" on page 209.

4 Restart the examination.

The examination can be restarted. However, if the set period of reexamination expires, it is not possible to add a new image or data file to the examination. For more information on the period of reexamination, see "Restart setting (reexamination setting)" on page 70.

For more information on restarting an examination, see "Restarting an examination" on page 140.

# Imaging modes and exams available by transducer

**WARNING**

To prevent misdiagnosis or harm to the patient, understand your system's capabilities before using it. The diagnostic capability differs for each transducer, exam type, and imaging mode. In addition, transducers have been developed to meet specific criteria, depending on their physical application. These criteria include biocompatibility requirements.

The transducer that you use determines the exam types that are available, and the exam type you select determines the imaging modes that are available. The following table relates the imaging modes to the transducer type and exam. The table uses these abbreviations:

- Abd
- Abdomen
- Bre
- Breast
- Crd
- Cardiac
- Gyn
- Gynecology
- Msk
- Musculoskeletal
- Neo
- Neonatal
- Nrv
- Nerve
- OB
- Obstetrical
- SmP

- Small Parts
- Vas
- Vascular

**Table 4-23: Imaging modes and exams available by transducer**

| Transducer | Exam type | Imaging mode | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2D M Mode | Color | CPD | PW Doppler | CW Doppler | TDI PW Doppler |
| C60xf | Abd | ✓ | ✓ | ✓ | ✓ | — | — |
| | Gyn | ✓ | ✓ | ✓ | ✓ | — | — |
| | Vas | ✓ | ✓ | ✓ | ✓ | — | — |
| | Msk | ✓ | ✓ | ✓ | ✓ | — | — |
| | Nrv | ✓ | ✓ | ✓ | ✓ | — | — |
| | OB | ✓ | ✓ | ✓ | ✓ | — | — |
| HFL38xp | Abd | ✓ | ✓ | ✓ | ✓ | — | — |
| | Bre | ✓ | ✓ | ✓ | ✓ | — | — |
| | Msk | ✓ | ✓ | ✓ | ✓ | — | — |
| | Nrv | ✓ | ✓ | ✓ | ✓ | — | — |
| | SmP | ✓ | ✓ | ✓ | ✓ | — | — |
| | Vas | ✓ | ✓ | ✓ | ✓ | — | — |

**Table 4-23: Imaging modes and exams available by transducer**

| Transducer | Exam type | Imaging mode | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2D M Mode | Color | CPD | PW Doppler | CW Doppler | TDI PW Doppler |
| HFL50xp | Abd | ✓ | ✓ | ✓ | ✓ | — | — |
| | Bre | ✓ | ✓ | ✓ | ✓ | — | — |
| | Vas | ✓ | ✓ | ✓ | ✓ | — | — |
| | MSK | ✓ | ✓ | ✓ | ✓ | — | — |
| | Nrv | ✓ | ✓ | ✓ | ✓ | — | — |
| | SmP | ✓ | ✓ | ✓ | ✓ | — | — |
| L25xp | Msk | ✓ | ✓ | ✓ | ✓ | — | — |
| | Abd | ✓ | ✓ | ✓ | ✓ | — | — |
| | SmP | ✓ | ✓ | ✓ | ✓ | — | — |
| | Nrv | ✓ | ✓ | ✓ | ✓ | — | — |
| | Bre | ✓ | ✓ | ✓ | ✓ | — | — |
| | Vas | ✓ | ✓ | ✓ | ✓ | — | — |

**Table 4-23: Imaging modes and exams available by transducer**

| Transducer | Exam type | Imaging mode | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2D M Mode | Color | CPD | PW Doppler | CW Doppler | TDI PW Doppler |
| P21xp | Abd | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Crd | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | OB | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Gyn | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Vas | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| C35xp | Abd | ✓ | ✓ | ✓ | ✓ | — | — |
| | SmP | ✓ | ✓ | ✓ | ✓ | — | — |
| | OB | ✓ | ✓ | ✓ | ✓ | — | — |
| | Gyn | ✓ | ✓ | ✓ | ✓ | — | — |
| | Vas | ✓ | ✓ | ✓ | ✓ | — | — |
| | Msk | ✓ | ✓ | ✓ | ✓ | — | — |
| | Nrv | ✓ | ✓ | ✓ | ✓ | — | — |

**Table 4-23: Imaging modes and exams available by transducer**

| Transducer | Exam type | Imaging mode | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2D M Mode | Color | CPD | PW Doppler | CW Doppler | TDI PW Doppler |
| C11xp | Abd | ✓ | ✓ | ✓ | ✓ | — | — |
| | SmP | ✓ | ✓ | ✓ | ✓ | — | — |
| | Crd | ✓ | ✓ | ✓ | ✓ | — | — |
| | Gyn | ✓ | ✓ | ✓ | ✓ | — | — |
| | Vas | ✓ | ✓ | ✓ | ✓ | — | — |
| | Nrv | ✓ | ✓ | ✓ | ✓ | — | — |
| ICTxp | OB | ✓ | ✓ | ✓ | ✓ | — | — |
| | Gyn | ✓ | ✓ | ✓ | ✓ | — | — |
| L38xp | Abd | ✓ | ✓ | ✓ | ✓ | — | — |
| | SmP | ✓ | ✓ | ✓ | ✓ | — | — |
| | Vas | ✓ | ✓ | ✓ | ✓ | — | — |
| | Bre | ✓ | ✓ | ✓ | ✓ | — | — |
| | Msk | ✓ | ✓ | ✓ | ✓ | — | — |
| | Nrv | ✓ | ✓ | ✓ | ✓ | — | — |

# Entering patient information

Patient information may be edited after the exam is ended and before it is exported or archived. Information imported from a worklist cannot be edited.

**Caution**

- During the examination, the patient information cannot be edited while exporting (output/input to USB memory, and/or DICOM storage transfer) and/or when using a worklist.
- After the examination, **Edit** cannot be used after exported (output/input to USB memory, and/or DICOM storage transfer).
- In case you do not want to edit the patient information nor start a new examination, you can tap **Modify** and press the PATIENT button to cancel the operation.

The **Patient Info** screen on the touch panel also appears on the monitor. As you enter data on the touch panel, it appears on the monitor. For information on hiding the patient's personal information, see the following procedure.

**Caution** You cannot enter Kanji characters in the **Name** field.

You can obtain the following patient information from the bar-code reader or a card reader:

- Bar code: Patient ID and Accession No.
- Card reader: Patient ID, Accession No., DOB, and Gender. For information on how to do so, see "Obtaining patient information by bar code or card reader" on page 129.

**To enter patient information**

**1** Press the **PATIENT** button ( ).

The **Patient Info** screen appears.

**2** If you do not see the **Patient Info** screen, tap the **Patient Info** tab at the upper left of the touch panel.

**3** Complete the information for each field of the screen.

- For information on the information needed for each field, see "Patient information fields" on page 126.
- You can type information with either the virtual keyboard on the touch panel or with a USB keyboard. For information on using the virtual keyboard, see the following procedure.

- To select values from a drop-down list, tap the downward-pointing green arrow ( ).
- For some fields, such as the DOB (date of birth) fields, the cursor automatically moves from one field to the next.
- For more information on completing the fields, see the following:
  - For all examinations, "Patient information fields" on page 126
  - "Gynecological examinations" on page 129
  - "Cardiovascular examinations" on page 129

**4** To manually select a different transducer:

**a** Tap **transducer**; then, on the transducer selection screen that appears, tap the transducer that you will use.

**b** Tap **Close**.

| Caution | The selection screen is displayed even if the transducer is not connected to the FC1. However, you will not be able to change the transducer selection.<br>You also cannot change the transducer selection if there is only one transducer physically attached to the FC1 system. |
|---|---|

**5** To prevent the patient's personal information from appearing on the monitor, make sure that **Hide Info** is selected (orange).

Or, if you have assigned **Hide Pt Bar** to a function button, press that button.

**6** When you have finished entering all data, on the **Patient Info** screen, tap **OK**.

The FC1 system is ready to begin the examination.

**To type using the virtual keyboard**

**1** On the **Patient Info** screen or another -panel screen that requires manual data entry, on the touch panel, tap one of the following:

- The **Keyboard** virtual button
- The field in which you need to enter data

**2** Type the information, using the keyboard-switching virtual buttons as necessary.

**3** When you have finished typing the data, tap **Close**.

Or:

- To move to the next field without leaving the keyboard, tap the » key.
- To move to the previous field without leaving the keyboard, tap the « key.

# Patient information fields

Patient information fields include the following:

## General information fields

Those patient information fields common to all examinations

**Table 4-24: Patient information buttons**

| Item | Description |
|---|---|
| Patient Info | Displays the “Patient Info screen”. |
| Exam Info | Displays the “Exam Info” screen for entering alphanumeric characters. |
| Hide Info | Displays or hides personal information of patients on the upper side of examination screen. |
| Keyboard | Displays the virtual keyboard. |
| Patient Log | Displays the patient list stored in the FC1. When a patient is selected from the list, information on the patient appears in the “Patient Info screen”. |
| Worklist | Displays the worklist. |
| Exam List | Displays the examination list stored from the USB memory to the FC1. By using the examination data displayed in the list, the patient information can be entered in the “Patient Info screen”. |
| OK | Saves the input data and starts an examination. |

**Table 4-25: General patient information fields**

| Field | Data required |
|---|---|
| **ID** | Patient identification number |
| **Accession No.** | Patient accession number |

**Table 4-25: General patient information fields**

| Field | Data required |
|---|---|
| **Name** | Patient name |
| **YYYY**, **MM**, and **DD** (to the right of **DOB**) | Year, month, and date of patient's birth<br>If the language setting is set to Japanese, the Japanese calendar date format can be used. The date format can be configured in the System Setup menu. |
| **AGE** | Patient age<br>This field is automatically completed when you complete the DOB fields.<br>If the patient is less than one year old, the system enters 0 (zero) for the patient's age.<br>You can enter the patient's age manually, before entering his or her birth date. |
| **Gender** | Patient gender<br>Possible values:<br>▸ **M** for male<br>▸ **F** for female<br>▸ **O** for others<br>▸ **U** for unknown<br>When the patient's gender should not be registered, select **U**. |
| **Exam Type** | Type of examination<br>The available examination types include: ABDOMEN, SMALL PARTS, CARDIAC, OB, FETAL HEART, GYN, VASCULAR, CAROTID, THYROID, BREAST, MUSCSKEL, PED, PED HEART, NERVE, URO, OB TWIN.<br>These examination types are divided into smaller groups that have certain Patient Info screen fields in common.<br>Changing the **Exam Type** value automatically changes the **Preset** value to match, and vice-versa.<br>The **transducer** field automatically changes to display the desired transducer type for the chosen exam type (only when using Triple Transducer Connect (TTC)). |
| **Preset** | The preset for the examination type.<br>Changing the **Preset** value automatically changes the **Exam Type** value to match, and vice-versa. The only time to manually select the preset is when it has been changed for the exam type. |
| **Probe** | The desired transducer type for the chosen exam type. This field changes automatically to reflect your choice of exam type (only when using Triple Transducer Connect (TTC)). The only time when you manually select the transducer is when it has been changed for the exam type. |

**Hint**

- When **Gender** is not to be registered, tap **U: unknown.**
- Tap **Probe** only when the probe set in **Exam Type** is changed to another one.
- Tap **Preset** only when the preset set in **Exam Type** is changed to another one.

## OB, Fetal Heart, or OB Twin examinations

**Table 4-26: Patient information fields for OB, Fetal Heart, or OB Twin exams**

| Field | Data required |
|---|---|
| **LMP**, **EGA**, or **BBT** | **LMP** (patient's last menstrual period), **EGA** (date of previous examination and week of pregnancy at that time), or **BBT** (estimated ovulation date)<br>To choose, tap , and then complete the **YYYY**, **MM**, and **DD** date boxes.<br>If you have selected **EGA**, then the **EGA MA** appears, meaning week of pregnancy at the time of the last exam, with fields **w** and **d**. |
| **EDD** | Estimated date of delivery<br>You can complete this field manually, but entering a date for **LMP**, **EGA**, or **BBT** completes it automatically. |
| **MA** | Current week of pregnancy<br>You can complete this field manually, but entering a date for LMP or EGA completes it automatically. |
| **Fetuses** | Number of fetuses<br>The system can measure at most five fetuses, regardless of the value that you enter. For an OB Twin examination, this field's value is **2**, by default. |
| **G** | The gravidity of the patient |
| **P** | The parity of the patient |
| **A** | The number of abortions that the patient has had |
| **E** | The number of ectopic pregnancies that the patient has had |

## Gynecological examinations

**Table 4-27: Patient information fields for Gynecological exams**

| Field | Data required |
|---|---|
| **LMP** or **BBT** | The patient's last menstrual period (**LMP**) or estimated ovulation date (**BBT**)<br>To choose, tap , and then complete the **YYYY**, **MM**, and **DD** date boxes. |
| **Day of Cycle** | The day of the patient's menstrual cycle |

## Cardiovascular examinations

For the purposes of completing patient information, cardiovascular examinations include Cardio, Vascular, Carotid, and Thyroid examinations.

**Table 4-28: Patient information fields for Cardiovascular exams**

| Field | Data required |
|---|---|
| **H** | The patient's height<br>Maximum number of digits: 6 |
| **W** | The patient's weight<br>Maximum number of digits: 6 |
| **BSA** | The patient's body surface area, automatically calculated from the patient's height, weight, and body classification.<br>To select the patient's body classification, tap , and then select the body type that most closely matches the patient. |
| **BP** | The patient blood pressure. Enter the systolic value and the diastolic value. |

# Obtaining patient information by bar code or card reader

The patient information that you get from the bar code or card reader is entered automatically in the **Patient Info** screen.

After you use the barcode reader, be sure that patient information is correct. If it is not correct, you can modify it manually.

**WARNING** Adding incorrect patient information could result in potential misdiagnosis / mistreatment, thus potentially harming the patient.

**Caution** You cannot enter Kanji characters in the **Name** field.

# Entering examination information

As with the **Patient Info** screen, changes that you make on the **Exam Info** screen on the touch panel appear on the main monitor as well.

### To enter examination information

**1** Press the **PATIENT** button ( ) and then, on the touch panel, tap the **Exam Info** tab (or **Exam Info (Kanji)**) tab.

The **Exam Info (Kanji)** tab is available only when the language is set to Japanese.

The **Exam Info** screen appears.

**2** In the text boxes, using either the virtual keyboard or a USB keyboard, type the appropriate information, as described in the following table.

**Table 4-29: Exam information fields**

| Field | Data required |
|---|---|
| **Study ID** | The ID number of the study |
| **Operator** | The name of the operator (as shown) |
| **Phys** | The name of the attending physician (as shown) |
| **Ref. Phys** | The name of the referring physician (as shown) |
| **Rep. Phys** | The name of the reporting physician (as shown) |
| **Req. Phys** | The name of the requesting physician (as shown) |
| **Department** | The name of the department |
| **Residence** | The residence of the patient |
| **Occupation** | The occupation of the patient |
| **Patient History** | The medical history of the patient |
| **Study Description** | Details of the study |
| **Patient State** | The patient's symptoms |
| **Comment** | Comments regarding the patient, with a maximum of 50 characters |

**3** Tap the downward-pointing green arrow ( ) to the right of **Body Part Examined**, and then tap one of the following buttons: **BREAST**, **ABDOMEN**, **PELVIS**, **HIP**, **HEAD**, **HEART**, **NECK**, **LEG**, or **ARM**.

**4** To save the data and continue with the examination, tap **OK**.

**5** After entering all the necessary items, to save the information, tap **OK** or press the **FREEZE** button ( ).

**Caution**

If you press the **PATIENT** button without tapping **OK** or pressing the **FREEZE** button, the items entered in the **Patient Info** screen or **Exam Info** screen are not stored.

**6** Make sure that the correct patient name and preset are displayed on the examination screen.

You are ready to start the examination.

## Precautions before starting an exam

Before starting a new examination, be sure to register the following:

- On the **Patient Info** screen, the patient information such as the patient ID, attribute data, examination date, and clinical special items
- On the **Exam Info** screen, examination information such as the accession number and the referring physician

These pieces of information are required to correctly start an examination or preset, and to correctly save examination data and images. The identifiers for patient information and examination information registered on the FC1 are patient ID, patient name, and examination date.

With the DICOM connection function (Optional), you can save images to the DICOM network storage device (archive server).

**Caution**

When examining a new patient, be sure to register and save the patient ID and name, and to check that you have selected the correct examination type and preset. Performing an examination without entering and saving the patient ID and name may result in the data's being mixed with that of another patient, resulting in misdiagnosis.

Saving an image without your having entered and saved the patient ID and name results in a patient ID's being assigned automatically to the image. You cannot then add or edit the patient name and other data afterward.

To ensure correct measurements, be sure to set the correct time before performing an examination.

Once Patient data is entered from Patient and Exam Info screen, the patient and exam data can not be modified. Please make sure that correct Patient an Exam information are entered.

# Opening a patient's existing record from Patient Log

**To view a patient's record**

**1** Press the **PATIENT** button ( ).

**2** Tap **Patient Log.**

**3** In the **Patient ID** column, tap the ID of the patient whose record you want to work with, and then tap **Open.**

# Opening an existing examination record from USB memory

The examination list shows the examination records stored from the USB memory to the FC1. You can use the examination data displayed in the examination list to enter the patient information in the **Patient Info** screen.

**To view an examination record**

**1** Press the **PATIENT** button ( ).

**2** Tap **Exam List.**

**3** To choose the data by which you want to order the list of examinations, to the right of **Search Key**, tap the downward-pointing green arrow ( ).

**4** Tap either **Patient ID**, **Patient Name**, or **Accession No.**

The touch panel returns to the **Exam List** screen.

**5** Tap the examination record that you want.

# Starting an examination from the DICOM work list

You can obtain the patient information for a new examination from the DICOM work list. You select the items of patient information to be used on the **Worklist** screen.

**Caution** | MPPS is not supported and cannot be used at present.

On the **Patient Info** screen, tap **Worklist** to display the **Worklist** screen. The **Worklist** screen can also be displayed by pressing the F-key to which the function for displaying the **Worklist** screen is assigned.

**Caution** When the F-key to which the function for displaying the Worklist screen is assigned is pressed during an examination, a confirmation message is displayed.

When you tap **OK**, the current examination ends and the **Worklist** screen appears.

When the connection with the DICOM worklist is enabled, if the desired patient information is obtained and stored successfully, it is displayed on the **Worklist** screen.

If the connection with the DICOM worklist is disabled, or if the FC1 has failed to obtain or store the patient information for some reason, the patient information already stored appears, or no patient information appears..

**Table 4-30: Worklist fields and controls**

| Item | Description |
|---|---|
| **Search key** | Tap the search key to display a selection screen for “Patient ID”, “Patient Name”, “Accession No.”, “Scheduled Procedure Step Start Date-Time”, “Scheduled Procedure Step Description” and “Requested Procedure ID”. |
| **String** | Enter the keyword for retrieving the patient information. Enter it using the virtual keyboard. |
| **Sort buttons** | Displays the examination list in ascending or descending order. The display order changes when the buttons are tapped. |
| **Examination list** | Each item of patient information is displayed.<br>The items to be displayed are as follows.<br>▸ Patient ID<br>▸ Patient Name<br>(Displayed in Japanese only when the language setting is set to Japanese.)<br>▸ Accession No.<br>▸ SPS Start Date-Time<br>▸ SPS Description<br>▸ Requested Procedure ID<br>▸ Requested Procedure Description |
| **Select All** | All items in the examination list are selected. |

**Table 4-30: Worklist fields and controls**

| Item | Description |
|---|---|
| **Find** | Updates the worklist. |
| **First/Last** | Displays the first and last pages of the list alternately. |
| **L/R Scroll** | Scrolls the list to display the hidden items. The display can be scrolled horizontally by operating the switch menu button 2. |
| **Page** | Displays the next or previous page. The page can also be switched by operating the switch menu button 3. The current page number and the total number of pages of the list are displayed on the lower side. |
| **Open** | Displays the **Patient Info** screen with the selected patient information entered.<br>If DOB is included in the selected information, the patient age is calculated again before displaying it.<br>If no item is selected in the examination list, or if multiple items are selected, this button is disabled. |
| **Query** | Displays the search condition setting screen. By setting a search condition, the patient information that meets the specified condition is obtained from the DICOM worklist and stored in the FC1.<br>For details, see "To find patient information in connected DICOM storage" on page 136. If the DICOM MWM is not available, this button is disabled. |
| **Delete** | Deletes the selected patient information. When this button is tapped, a confirmation message is displayed. Tap **OK** to delete the selected patient information. Tap **Cancel** to cancel the deletion.<br>Multiple items in the examination list can be selected and deleted.<br>If no patient information is selected in the examination list, this button is disabled. |
| **Search** | Starts retrieving the patient information based on the entries in "**Search key**" and "**String**", and displays the search result in the examination list. |
| **Close** | Closes the **Worklist** screen without saving the settings. |

## Using the DICOM worklist to start an examination

When you have enabled the connection with the DICOM worklist, patient information that is obtained and stored successfully appears on the **Worklist** screen.

If the connection with the DICOM worklist is disabled, or if the FC1 system cannot obtain or store the patient information, the worklist shows only the patient information that has been stored on the FC1 system.

In the **DICOM Worklist** screen, there are two ways to find a patient's information that you want to start the examination with.

**To start a new exam from the DICOM Worklist**

**1** Press the **PATIENT** button ( ).

**2** On the **Patient Info** screen, tap **Worklist**.

Or

If you have assigned the function for displaying the **Worklist** screen to a function button, press the button to which it is assigned.

**Caution** If you press the button that you have assigned the function for displaying the **Worklist** screen during an examination, you are prompted to confirm that you want to end the current exam.

**3** Select an examination from the list and tap **Open**.

**To find patient information in the DICOM database**

**1** Open the **Worklist**.

To open the **Worklist**, see the procedure above "To start a new exam from the DICOM Worklist."

**2** To select the field to search on:

**a** Tap the downward-pointing green arrow ( ) to the right of **Search Key**.

**b** On the selection screen that appears, tap the field in which you want to search: **Patient ID**, **Patient Name**, **Accession No.**, **Start Date**, **Req Proc ID**, **Sched Desc**, or **RP Desc**.

**3** To search on a string within the selected field:

**a** In the text box next to **String**, using the virtual keyboard, type the string (or keyword) of interest.

**b** Tap **Close**.

**4** Tap **Search**.

**Caution** When you obtain patient information from the optional barcode reader or card reader, the patient ID that you have obtained appears in **Patient ID** on the search condition setting screen.

The patient information is retrieved based on the criteria you have specified in **Search key** and **String**, and the search result appears in the examination list.

## Finding patient information in connected DICOM storage

Finding patient information in the Worklist **Query** screen retrieves the patient information from the DICOM worklist and stores it in the FC1.

**To find patient information in connected DICOM storage**

**Note** If you want to display less information from the records you found, you can search by **Search Key** and **String** instead of the **Query** screen.

1 Open the **Worklist**.

For the procedure for opening the **Worklist**, see "Starting an examination from the DICOM work list" on page 132.

2 Tap **Query**.

The **Query** screen opens.

3 To define a search condition, type data in the following fields, as needed:

**Table 4-31: Worklist query fields**

| Field | Action |
|---|---|
| **Patient ID** | Enter the patient ID. |
| **Last Name** | Enter the last name of the patient. |
| **First Name** | Enter the first name of the patient. |
| **Middle Name** | Enter the middle name of the patient. |
| **Accession Number** | Enter the accession number. |
| **Requested Procedure ID** | Enter the requested procedure ID. |
| **Scheduled Station AE Title** | Enter the scheduled station AE title. |
| **Find** | Starts retrieving the patient information based on the above items. The FC1 system obtains the patient information that meets the specified condition from the DICOM worklist, stores it in the FC1 system, and displays it on the **Worklist** screen. |
| **Close** | Closes the screen without performing the search, and returns to the **Worklist** screen. |

## Deleting patient information from the DICOM worklist

You can select and delete multiple items in the examination list.

**To delete patient information from the DICOM worklist**

1 Find the patient information that you want to delete.

For more information, see "Starting an examination from the DICOM work list" on page 132.

2 Tap **Delete**.

3 When you are prompted to confirm the deletion, tap **OK** to delete the selected patient information.

Or, to cancel the deletion, tap **Cancel**.

# Starting an examination from the Patient Log screen

You can start a new examination with the patient information obtained from the archived examinations. You can access these archived exams on the **Patient Log** screen.

**To start a patient exam**

1 On the **Patient Info** screen, tap **Patient Log** to display the **Patient Log** screen. You can also display the **Patient Log** screen by pressing the F-key to which the function for displaying the **Patient Log** screen is assigned.

| | |
|---|---|
| **Caution** | When the F-key to which the function for displaying the **Patient Log** screen is assigned is pressed during an examination, the confirmation message "Start an examination with a new patient?" appears. |

2 When you tap **OK**, the current examination ends and the **Patient Log** screen appears.

Hint: After the patient information is selected on the **Patient Log** screen, a new examination can be started by correcting the displayed patient information and examination information.

## Starting an examination from patient information (Optional, Japan only)

You can start a new examination using patient information managed by C@RNACORE. For details about the information that can be obtained from C@RNACORE, see the C@RNACORE Reference Guide.

| | |
|---|---|
| **WARNING** | Use our C@RNACORE product only with this function. |

**To start an examination from patient information**

1 Enter the C@RNACORE patient ID in **ID** at the right of the patient information link button ( ) on the **Patient Info** screen.

**Note** | Enter a patient ID managed by C@RNACORE.

2 Tap the patient information link button ( ).

The patient information based on the ID that you have entered is obtained from C@RNACORE and displayed on the **Patient Info** screen.

After using patient information link, make sure that the patient information is correct. If it is not correct, you can change it manually.

3 Either tap **OK** or press the **FREEZE** button ( ).

4 After the examination starts, make sure that the correct patient name, presets, and other items appear in the upper section of the "examination screen".

The examination can now be started.

**Hint**

This function presumes that patient information entered using C@RNACORE in another location is opened on the FC1.

The link with C@RNACORE must be configured to use patient information link. For more information about the settings, see "Server connection settings" on page 44.

If you tap the patient information link button ( ) without entering an ID, the patient information currently displayed on C@RNACORE is obtained.

# Starting an examination from orders (Optional, Japan only)

You can start an examination on the FC1 by orders created by C@RNACORE. For details about the information that can be obtained from C@RNACORE, see the C@RNACORE Reference Guide.

**WARNING**

Use our C@RNACORE product only with this function.

To avoid misdiagnosis or erroneously influencing the diagnosis results of the patient, end the examination before using order link. The previous patient's data may be combined with the current patient's data if order link is used without ending the examination. For details on how to end an examination, see "Ending an examination" on page 209.

After using order link, make sure that the patient information is correct. If the patient information is not correct, a misdiagnosis or treatment failure may occur and negatively affect the patient.

IHE multiple hospital patient id (PIX) is not supported and cannot currently be used.

**To start an examination from an order**

**Caution**

Because this function uses a work list, patient information cannot be corrected by the FC1.

To start an examination using the correct patient information, enter the patient information manually. For details, see "Entering patient information" on page 124.

1 Start the FC1.

2 Examinations can now be started from order link. Start examinations from C@RNACORE.

3 If an examination is started from C@RNACORE, a confirmation message appears asking whether to start the examination using order content. To start the examination, tap **OK**.

**Note**

Make sure that the patient ID and patient name on the message screen are correct.

4 After the examination starts, make sure that the correct patient name, presets, and other items appear in the upper section of the "examination screen".

The examination can now be started.

**Hint**

This function presumes that an examination on an FC1 installed nearby is started from C@RNACORE.

The DICOM connection function (Optional) must be activated to use order link. The link with C@RNACORE must also be set. For more information about the settings, see "Server connection settings" on page 44.

It is required to configure the examination if you want to start the examination with a preset and the appropriate transducer selected from multiple transducers when using Triple Transducer Connect (TTC). For more information about the settings, see "Configuring examination defaults (Exam Type Setting)" on page 67.

# Restarting an examination

Add new data files in any time before the period of reexamination; files cannot be added when exceeded. For more information on the period of reexamination, see "Restart setting (reexamination setting)" on page 70.

**To restart the examination**

1 Press the **PATIENT** button ( ).

2 On the **Patient Info** screen, tap **Patient Log**.

3 Navigate to the name of the patient whose examination you want to restart.

For information on searching for a patient's record, see "Opening a patient's existing record from Patient Log" on page 132.

4 Tap the patient's record to select it, and then tap **Restart**.

**Restart** can be enabled any time before the period of reexamination.

# Working with the Patient Log screen

You can find, edit, and delete patient records using this screen.

**Caution**

With automatic image deletion, the images are deleted automatically but the patient logs remain.
Up to 8000 patient logs can be recorded.
To avoid exceeding the maximum number of logs, delete patient information periodically.
To delete patient logs individually, use the Patient Log screen.
If you want to delete all patient logs, see "Resetting user configuration" on page 74.

# Finding patient records in the Patient Log screen

**To work with examinations on the Patient Log screen**

**1** On the **Patient Info** screen, tap **Patient Log**.

Or, press the F-key to which you have assigned the function to display the **Patient Log** screen.

**Caution** When you use the F-key to open the **Patient Log** screen during an examination, you are prompted to confirm that you want to start a new examination.

**2** To end the current examination and open the **Patient Log** screen, tap **OK**.

The **Patient Log** screen appears, showing the following fields:

- **Lock**

  Records that are locked appear with a representation of a padlock

- **Patient ID**

  The patient's identification number

- **Patient Name**

  If the language setting is Japanese, the name appears in Japanese only.

- **Size (MB)**
- **Data Count (S/L/R/D)**

  The number of images in the examination. (**S** stands for still images, **L** for clips, **R** for raw data images, and **D** for setup screens.)

- **Study Date Time**

  The date and time that the examination started

- **Study Last Date Time**

  The date and time that the examination completed

- **Accession**

  Patient accession number

**3** Locate the patient examination record of interest by searching and navigating in the examination list.

Searching and navigating in the Patient Log is the same as navigating the examination list in the **Exam List** screen. For information on examination-list searches and navigation, see "Working with the Examination List screen" on page 143.

The search results appear in the examination list.

4 To lock or unlock one or more patient records, select the record or records, and then tap **Lock**.

When you lock a patient record, the record cannot be modified or deleted. The lock icon appears by the Patient ID for the record. For more information, see "Locking archived examinations" on page 190.

5 To close the **Patient Log** screen, tap **Close.**

## Acquiring logs

You can get logs created between certain dates, or all logs.

**To acquire logs**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 4/4, tap **Get Log**. The **Get Log** screen appears.

3 Tap any part of the dates to see up arrows and down arrows, which you can use to change those values, and tap **Start**.

You are prompted to confirm your request. To confirm it, tap **OK**. To cancel it, tap **Cancel**.

## Deleting logs

You can delete all logs in one step.

**To delete logs**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 4/4, tap **Delete Log**. The Delete Log screen appears.

3 Tap **Start**. You are prompted to confirm your request. To confirm it, tap **OK**. To cancel it, tap **Cancel**.

## Editing patient examination records

**To edit examination records**

1 To open a patient's examination record, in the examination list, tap the patient's record, and then tap the **Open** button.

With the patient's record open, you can change the information in it.

2 To close the patient's record and return to the **Patient Log** screen, tap **Patient Log**.

## Deleting patient examination records

**Note**

By deleting the record here, you also delete it in the Examination List.
You cannot delete a record that is locked.

**To delete a patient examination record**

- In the examination list, tap the patient's record, and then tap **Delete**.

When you are prompted to confirm that you want to delete the record and its exam and images, tap **OK**.

# Working with the Examination List screen

You can start a new examination by using the patient information stored in the USB memory. You select the examination records of patient information to be used on the **Exam List** screen.

**To view and work with patient information on the Exam List**

1 On the **Patient Info** screen, tap **Exam List**.

Or, if you have assigned the function for displaying the **Exam List** screen to an F-key, press that key.

**Caution**

If an examination is in progress when you press the F-key to display the **Exam List** screen, you are prompted to confirm that you want to end the exam. To do so, tap **OK**.

The **Exam List** screen appears, showing the following fields:

- **Patient ID**

The patient's identification number

- **Patient Name**

  If the language setting is Japanese, the name appears in Japanese only.

- **Accession**

  Patient accession number

**2** To search the records in the examination list:

**a** To select the field to search on, tap the downward-pointing green arrow ( ) to the right of **Search Key** and, in the selection screen that appears, tap the records field on which you want to search.

**b** To search on a string within the selected field, in the text box next to **String**, using the virtual keyboard, type the string (or keyword) of interest, and then tap **Close**.

**c** Tap the **Search** virtual button.

The search results appear in the examination list.

**3** To sort the records in ascending or descending order on a field, tap the header for the field.

The visual indicator changes between and according to whether the sort order is descending or ascending, respectively.

**4** To navigate within the examination list:

- To go to the first or last page in the list (according to the last sort order), press the up or down arrow on switch menu button 1 (the rocker button underneath **First/Last**).

- To view more fields in the patient records (such as **Accession**) by scrolling to the left or right, press the up or down arrow on switch menu button 2 (the rocker button underneath **L/R Scroll**).

- To move from page to page in the examination list, press the up or down arrow on switch menu button 3 (the rocker button underneath **Page**).

**5** To select all the patient records in the examination list, tap **Select All**.

**6** To lock or unlock one or more patient records, select the record or records, and then tap **Lock**, to either lock or unlock them.

When you lock a patient record, the record cannot be modified or deleted. The lock icon appears by the Patient ID for the record.

**To delete an examination record**

1 Find and select the record or records that you want to delete, as in the above procedure, "To view and work with patient information on the Exam List."

2 Tap **Delete**.

3 When you are prompted to confirm that you want to delete the record and its exam and images, tap **OK**.

Or, to cancel the deletion, tap **Cancel**.

**Note**

By deleting the record here, you also delete it in the Patient Log.
You cannot delete a record that is locked.

**To edit an examination record**

1 To open an examination record, in the examination list, select the record by tapping it, and then tap **Open**.

With the examination record open in the **Patient Info** screen, you can edit it.

2 To close the examination record and return to the Exam List, tap **Exam List**.

**To start a new examination from the Exam List**

❖ With the record open for a patient, correct the displayed patient information and examination information.

**To close the Exam List screen**

❖ Tap **Close**.
Note that any settings are not saved.

# Obtaining patient information from USB memory

Loading the patient information stored in the USB memory onto the FC1 loads all the patient information and displays it in the examination list.

**Caution**

When you load the USB memory, any patient information that is already loaded from the USB memory is overwritten.

**To load all the patient information from USB memory to the FC1**

1 Press the **PATIENT** button ( ).

2 Tap **Exam List** and then, in the **Exam List** screen, tap **Load**.

If the USB memory is not connected to the FC1, this button is disabled.

# Selecting the preset

Selecting a preset for an examination retrieves the optimal examination settings and image quality adjustment values for the intended use and the body part to be examined, which reduces the examination time. Selecting the type of examination on the **Patient Info** screen selects the transducer and preset most appropriate for the examination, enabling you to automatically obtain optimal examination images.

You can change the preset in the middle of an examination.

You can also select the desired preset on the **Preset Change** screen.

You cannot change the preset at the following times:

- While changing system settings
- When the **Patient Info** screen is displayed
- While reviewing examination images (whether current or archived)

**To select a preset**

1 Press the **PRESET** button (

).

The **Preset** screen appears.

If a live image is displayed on the main monitor at that time, the image is frozen.

2 Tap the preset that you want to use.

The preset name displayed on the upper side of the main monitor changes to the name of the selected preset.

# Displaying or hiding a preset

Use the **Touch Panel Layout** screen to change the presets that are available on the **Preset** screen.

**To show or hide presets on the Preset screen**

1 Press the **PRESET** button (

).

| Caution | If you press the **PRESET** button while the **Preset** or **Touch Panel Layout** screen is open, the screen is closed and the settings that you have chosen on it are not saved. |
|---|---|

The **Preset** screen appears.

2 Tap **Touch Panel Layout**.

The **Touch Panel Layout** screen appears, with all available presets showing.

3 Make sure that each preset that you want to appear on the **Preset** screen is selected (orange).

If a preset that you want to appear is black, tap it to make it orange.

4 To save your changes, tap **OK**.

Or, to close the screen without saving changes, tap **Close**.

# Working with imaging presets

Imaging presets are sets of image-processing parameters. Available imaging presets vary depending on the type of examination and the transducer to be connected.

There are two types of imaging presets:

- Factory imaging presets registered at the factory
- Imaging presets that the user registers

You can add, delete, or modify imaging presets, except for the factory imaging presets.

You cannot change imaging presets at the following times:

- While changing system settings
- When the **Patient Info** screen is open
- When examination images (of the current or an archived examination) are on screen

On the **Imaging Preset [presetname]** screen, you can:

- Modify the imaging preset for a preset and connected transducer

  For information on modifying an imaging preset, see "Modifying an imaging preset" on page 150.

- Create a new imaging preset

  For information on creating an imaging preset, see "Creating an imaging preset" on page 149.

- Set an imaging preset as the default

  For information on setting an imaging preset as the default, see "Setting a default imaging preset" on page 150.

**To access the imaging presets for a preset**

**1** To change the imaging presets for the current preset when a live image is displayed, tap **Imaging Preset**, or:

To change the imaging presets for any preset:

**a** Press the **PRESET** button (

).

**b** Select a preset.

**c** Tap **Imaging Preset**.

The **Imaging Preset** screen appears, and the live image displayed on the main monitor is frozen. (Note, however, that **Imaging Preset** is not available when an image is already frozen.)

Factory imaging presets appear in the top half of the screen, and user-created imaging presets appear in the bottom half.

**2** To work with one of the imaging presets for the preset, tap the imaging preset that you want.

**3** To access a different imaging preset for the same preset, return to the screen by tapping **Imaging Preset**.

**4** Tap **Close** at any time to close the imaging preset screen without making any of your changes effective.

**5** To return to the **Preset** screen from the **Imaging Preset** screen, press the **PRESET** button.

## Renaming an imaging preset

Factory imaging resets cannot be modified, so you can rename only user-created imaging resets.

**To rename or change the parameters of an imaging preset**

1 Tap **Imaging Preset** on the touch panel.

The **Imaging Preset** screen appears.

2 Tap **Management**.

3 Press the switch menu button 1 (the rocker button under **Change Category**) to display the **User** screen.

4 Under **Imaging Preset Name**, tap the name of the imaging preset.

The virtual keyboard appears.

5 Change the name, using the virtual keyboard (or the USB keyboard).

6 Tap **Close**.

The name is finalized and displayed on the **User** screen.

**Note** You cannot rename an imaging preset with a name that has already been registered. In addition, if you have not entered a name, an error message appears.

## Creating an imaging preset

You can create a new imaging preset from the imaging parameters of the current imaging preset.

Restrictions on creating an imaging preset:

- You can create a new imaging preset only when a live image is on-screen.
- The system supports a maximum of 10 enabled imaging presets. If 10 imaging presets have been enabled, the **Create** button is not available, and you cannot open the **Create** screen.

**To create a new imaging preset**

1 While a live image is on-screen, tap **Imaging Preset**.

Or, if you have assigned the function of displaying the **Create** screen to a function button, press that button.

The **Imaging Preset Change** screen appears, and the live image displayed on the main monitor is frozen.

2 On the **Create** screen, tap the **New Imaging Preset Name** text box.

3 Type a name for the new imaging preset, using the virtual keyboard or the USB keyboard.

4 To change the settings of the new or renamed imaging preset, see "Modifying an imaging preset" on page 150.

5 To register the new preset in the system and return to the **Imaging Preset [presetname]** screen, tap **OK**.

Or, to discard the name you just typed and return to the **Imaging Preset [presetname]** screen, tap **Close**.

## Modifying an imaging preset

You can change image-processing parameters only for user-created imaging presets; for factory imaging presets, the **Modify** virtual button is not available.

**To modify a user-created imaging preset**

1 While a live image is on-screen, tap **Imaging Preset** on the touch panel.

The **Imaging Preset** screen appears, and the live image displayed on the main monitor is frozen.

2 Tap the user-created imaging preset you want to change.

The touch panel returns to the 2D (**B**) mode screen.

3 Make changes to the parameters in the 2D (**B**) mode screen.

Or, to make changes to the imaging preset in other modes, press the **C**, **D**, or **M** button on the control panel, and then make changes on those screens.

4 Tap **Imaging Preset** on the touch panel.

5 Tap **Modify**.

6 When you are prompted to confirm that you want to modify the imaging preset, tap **OK**.

The system overwrites the imaging preset that is in use with the changes you have made to the image-processing parameters.

## Setting a default imaging preset

**To set an imaging preset as a default**

1 In the **Imaging Preset** screen, tap the imaging preset that you want to set as the default.

2 Tap **Imaging Preset**.

In the **Imaging Preset** screen, a small yellow dot in the upper-left corner of the button for the imaging preset of interest shows that it is selected.

**3** To make it the default, tap **Set Default**.

## Displaying or hiding an imaging preset

You can specify the imaging presets that appear on the **Imaging Preset** screen.

Press the switch menu button 1 (the rocker button under **Change Category**) to select factory imaging presets on the **Factory** screen, or user-created imaging presets on the **User** screen.

The **User** screen displays user-created imaging presets that are registered in the FC1 system.

**To specify the imaging presets that appear on the Imaging Preset screen**

**1** To manage the current imaging preset when a live image is displayed, tap **Imaging Preset**.

Follow the procedure below if you want to manage a preset different from the current preset.

**a** Press the **PRESET** button (

).

**b** Select a preset.

**c** Tap **Imaging Preset**.

The **Imaging Preset** screen appears, and the live image displayed on the main monitor is frozen.

**2** Tap **Management**.

**3** To move up or down a page in the list of imaging presets, press switch menu button 2 (the rocker button under **Page**).

If you don't see the imaging preset that you want to manage in one of the screens (categories), switch to the other.

**4** To switch the **Imaging Preset** screen category between **Factory** and **User**, press switch menu button 1 (the rocker button under **Change Category**).

The current preset and all the imaging presets for the connected transducers registered in the FC1 are displayed on those two screens.

In the **E/D** (enable/disable) column, an orange check mark means that the imaging preset is visible (and so available for selecting) in the **Imaging Preset** screen.

5 To enable or disable an imaging preset for selection on the **Imaging Preset** screen for a preset, tap the imaging preset's check box to place or remove the orange check mark.

You can enable no more than ten imaging presets. If more than ten imaging presets are checked and you tap **OK**, an error message appears. Tap **OK**, and then decrease the number of selected imaging presets to ten or fewer.

6 To save your settings, close the screen, and return to the **Imaging Preset** screen, tap **OK**.

Or, to close the screen without putting your changes into effect, tap **Close**.

If you have saved your changes, the imaging presets that you have selected appear on the **Imaging Preset** screen.

## Deleting an imaging preset

You can select and delete multiple imaging presets.

You can also delete an imaging preset that is currently in use. If you subsequently restart an examination for which you were using the deleted imaging preset, select the imaging preset General.

**To delete an imaging preset**

1 To delete the current imaging preset when a live image is displayed, tap **Imaging Preset**.

Or, to delete an imaging preset for any preset:

**a** Press the **PRESET** button (

).

**b** Select a preset.

**c** Tap **Imaging Preset**.

The **Imaging Preset** screen appears, and the live image displayed on the main monitor is frozen.

2 Tap **Management**.

3 If the **Factory** screen is visible, press switch menu button 1 (the rocker button under **Change Category**) to display the **User** screen.

4 In the **Check** column, tap the check box to place a check for the imaging preset that you want to delete.

5 Tap **Delete**.

6 When you are prompted to confirm that you want to delete the imaging preset, tap **OK**.

# Selecting a transducer

Transducers are also called *probes;* the **transducer** selection screen displays all the transducers that are currently connected to the FC1 system. You can select one of the connected transducers for use.

When you select a different transducer, you can also select the preset to use.

## Precautions when connecting or disconnecting a transducer

If a live image is displayed on the main monitor, disconnecting a transducer from the FC1 or the FC series stand erases the image.

When a transducer is connected, a live 2D-mode image shows on the main monitor, and the 2D-mode menu screen appears on the touch panel.

| | |
|---|---|
| **Caution** | Before attaching or removing TTC, turn off the FC1 system. |

While the **transducer** selection screen shows in the touch panel, note the following:

- When a transducer is connected to an empty transducer port on the FC series stand:
  - The display content of the **transducer** selection screen does not change.
  - Closing and then opening the **transducer** selection screen updates the display content.
- When a transducer is disconnected from the FC1 or FC series stand:
  - The display content of the **transducer** selection screen does not change.
  - Tapping the disconnected transducer on the touch panel, however, displays a message and closes the **transducer** selection screen.
  - Closing and then opening the **transducer** selection screen updates the display content.
- When you connect another transducer to the FC1 or FC series stand:
  - The display content of the **transducer** selection screen does not change.
  - Tapping the previous transducer on the touch panel, however, displays a message and closes the **transducer** selection screen.
  - Closing and then opening the **transducer** selection screen updates the display content.
- If you select a transducer not applicable to the current preset, the preset changes to the priority preset of the selected transducer.

Note the following:

- While a transducer or preset is selected on the touch panel, you cannot use the following functions:
  - Current view
  - Cine
  - Body mark display
  - Annotation display
  - Basic measurement
  - Preset-specific measurement
  - Patient information correction
  - User settings
- You can display the **transducer** selection screen even if no transducer is connected to the FC series stand.
- The image of each transducer on the **transducer** selection screen varies depending on the transducer type.

| Image on button | Transducer type |
|---|---|
| | Convex |
| | Linear |
| | Sector |

**To select a transducer**

**1** Press the **Probe** button (

).

The **transducer** selection screen appears, and the transducer in use is turned on.

If a live image shows on the main monitor, the image is frozen.

**2** To specify that the system use the current preset after you change the transducer, make sure that **Preset Lock** is selected (orange).

All the presets displayed below the transducers disappear.

Or, to change the preset when the transducer is changed:

**a** Make sure that **Preset Lock** is not selected (that is, it is black).

**b** Tap the current preset.

The **Preset** change screen appears.

For details on changing the **Preset**, see"Selecting the preset" on page 146.

On the **Preset** change screen, only the presets for the connected and selected transducer are turned on.

**c** Tap the preset that you want to use.

The screen returns to the **transducer** selection screen, and the preset that you selected is displayed under the transducer.

**Note**

After you change the preset for a transducer that is not in use, if you close the **transducer** selection screen without selecting the transducer, the settings on the **Preset** change screen are not saved.

Pressing the **Probe** button before saving changes closes the **transducer** selection screen without saving changes.

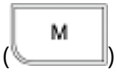
**3** Tap the transducer that you want to use.

# Viewing in Dual-screen mode

Dual-screen mode displays two images side by side on the main monitor. There are two types of Dual screen mode:

- Normal Dual-screen mode
- Simultaneous Dual-screen mode

Both types of Dual-screen modes are enabled in the 2D, CD, and PD modes. They are not enabled for the M or D mode.

When you are in a Dual-screen mode and press the **M** button ( 

) or **D** button (

), the Dual-screen mode is terminated and operation switches to the selected screen mode.

In the normal Dual-screen mode:

- One of the two images displayed on the screen is *active*: live, selected, and updated. The index on the active image mark is green, and the functions available for the active image appear on the touch panel.
- The other image is *inactive*: not live, not selected, and not updated. Its probe orientation mark is gray.

In discussion of Dual-screen mode, we refer to the left-hand image as *image A* and the right-hand image as *image B*.

## Controlling the display of images in Dual-screen mode

Two Dual-screen mode buttons affect the monitor display:

- The left-hand button ( )
- The right-hand button ( )

**To view one or both images in Dual-screen mode**

**1** To view the left-hand or right-hand image, press the left- or right-hand button, respectively.

**2** To return to a single-image display, press either button twice.

The effect of pressing either button varies with the current state of the display. The following table tells the effect on each screen according to:

- The current state of the display

- Which Dual-screen mode button you press

| In this state | When you press the left button | | When you press the right button | |
|---|---|---|---|---|
| | This happens in the left screen | This happens in the right screen | This happens in the left screen | This happens in the right screen |
| Single display with a live image | The live image is displayed and becomes active. | Nothing is displayed. | Nothing is displayed. | The live image is displayed and becomes active. |
| Single display with a frozen image | The frozen image is displayed and becomes active. | The frozen image is displayed. | The frozen image is displayed. | Nothing is displayed. |
| Dual- screen mode<br>Left: Frozen image (active)<br>Right: Non-display | The frozen image is displayed in the single screen mode. | | The frozen image is displayed. | The same frozen image is displayed and becomes active. |
| Dual- screen mode<br>Left: Live image (active)<br>Right: Non-display | The live image is displayed in the single screen mode. | | The live image is switched to the frozen image. | The live image is displayed and becomes active. |
| Dual- screen mode<br>Left: Non-display<br>Right: Live image (active) | The live image is displayed and becomes active. | The live image is switched to the frozen image. | The live image is displayed in the single-screen mode. | |
| Dual- screen mode<br>Left: Non-display<br>Right: Frozen image (active) | The same frozen image is displayed and becomes active. | The frozen image is displayed. | The frozen image is displayed in the single-screen mode. | |
| Dual- screen mode<br>Left: Frozen image<br>Right: Frozen image (active) | The frozen image becomes active. | The frozen image becomes inactive. | The right-hand frozen image is displayed in the single-screen mode. | |
| Dual- screen mode<br>Left: Frozen image<br>Right: Live image (active) | The frozen image is switched to the live image and becomes active. | The live image is switched to the frozen image and becomes inactive. | The right-hand live image is displayed in the single-screen mode. | |

| In this state | When you press the left button | | When you press the right button | |
|---|---|---|---|---|
| | This happens in the left screen | This happens in the right screen | This happens in the left screen | This happens in the right screen |
| Dual- screen mode<br>Left: Live image (active)<br>Right: Frozen image | The left-hand live image is displayed in the single-screen mode. | | The live image is switched to the frozen image and becomes inactive. | The frozen image is switched to the live image and becomes active. |
| Dual- screen mode<br>Left: Frozen image (active)<br>Right: Frozen image | The left-hand frozen image is displayed in the single-screen mode. | | The frozen image becomes inactive. | The frozen image becomes active. |

## Viewing in Simultaneous Dual-screen mode

In Simultaneous Dual-screen mode, both the left-hand (A) and right-hand (B) images are updated.

You cannot change the view to Simultaneous Dual-screen mode when:

- A frozen image is displayed.
- You are using the Trapezoid function on one of the images in the Dual-screen mode.
- Any of the following are different between the images in the Dual-screen mode:
  - Angles of linear steer
  - On or off settings of the spatial compound
  - Magnification ratios
  - Depths

**To view the examination in Simultaneous Dual-screen mode**

❖ Tap **Simul Dual** on the touch panel.

To turn off Simultaneous Dual-screen mode, tap **Simul Dual**.

When the Simultaneous Dual-screen mode is activated while in the Dual-screen mode, the active image displayed on the Dual-mode screen also becomes active on the Simultaneous Dual-mode screen. When the Simultaneous Dual-screen mode is activated while in the single-screen mode, the image is displayed on both sides and the left-hand image becomes active.

Tapping **Simul Dual** again while in the Simultaneous Dual-screen mode does the following:

- It terminates the Simultaneous Dual-screen mode and returns to the normal Dual-screen mode.
- The active image on the Simultaneous Dual-mode screen becomes the active image on the Dual-mode screen.

# Using the M or D cursor

The M and D cursors, which represent a sample volume gate, are available when you are in 2D, CD, or PD mode.

**To use the M or D cursor**

1 With one of the modes selected for which the M/D cursor is enabled, on the touch panel, tap **M/D Cursor**.

2 To move the cursor to the right or left or up or down within the region of interest (ROI), roll the trackball.

When the cursor reaches the boundary of the ROI, continuing to roll the trackball moves the ROI in the direction that you roll the trackball.

3 To increase or decrease the width of the sample volume gate, on the 2D, CD, or PD screen in the touch panel:

**a** If **Gate Size** is not selected, tap it.

**b** Press the up or down arrow on switch menu button 4 (the rocker button below **Gate Size**) until the gate size is what you want.

4 To change the steering angle of the CD/PD mode image for the D cursor, tap **Cursor Steer**, and then rotate dial menu button 1 (the dial to the right of **Cursor Steer**).

**Caution**

You can change the steering angle only when using a linear transducer.

The steering angle can be set to 30 degrees only when the HFL38xp or HFL50xp transducer is connected.

5 To change the angle to plus or minus 45°, 60°, or 0°, tap **Quick Angle**, and then turn dial menu button 1 (the dial to the right of **Quick Angle**).

**6** To change the angle of the M or D cursor in 1° increments, turn the multi dial ( ).

The angles with the upper end of the graphic to the left are positive; the angles with the upper end of the graphic to the right are negative.

**Caution** You can change the angle only when the M or D cursor is turned on.

# Viewing the ECG waveform display

You can view the ECG (electrocardiogram) waveform in every screen mode and in any display format (single-image display, Dual-screen mode, or Simultaneous Dual-screen mode). In all the display formats, the ECG waveform is displayed on the live image, not on the frozen image.

**WARNING** To prevent misdiagnosis, do not use the ECG waveform display function for the diagnosis of heart rhythms. The optional ECG function of the FUJIFILM SonoSite ultrasound system is not intended for diagnostic use.

To prevent electromagnetic interference with aircraft devices, do not use the ECG cable on aircraft. Electromagnetic interference may affect the safety of aircraft.

**Caution** Use only the accessories recommended by FUJIFILM SonoSite, Inc. Connecting any other accessory to the FC1 system may damage the system.

After defibrillation is performed, it may take about 1 minute until the ECG waveform becomes stable.

## The ECG waveform and display formats

In single-screen mode or Simultaneous Dual-screen mode, the ECG waveform is updated from the left end to the right end. When the leading end of the ECG waveform reaches the right end, it returns to the left end and continues. When you freeze and then unfreeze an image, the ECG waveform is cleared and then resumes from the left-hand end.

In the Dual-screen mode, the ECG waveform appears for each image active image.

**Note** When you switch an active image to the inactive state, the ECG waveform is retained. Making an inactive image active clears the ECG waveform.

**To display the heart rate in the ECG waveform**

- On the **Worksheet** screen, manually input the heart rate.

Or, perform the HR measurement.

For information on performing the HR measurement, see the "HR" measurement in the M mode and D mode tables under "Basic measurement" on page 238.

## Displaying and configuring the ECG waveform

The ECG waveform continuously displays the patient's heartbeat only when the image is live, not frozen. Therefore, you can turn on the ECG waveform display only when a live image is on screen.

**To display and configure the ECG waveform**

1 To show the ECG waveform and open the **ECG** screen, in any display mode screen, tap **ECG**.

Or, if you have assigned the function for displaying the ECG waveform to a function button, press that function button.

On the left side of the ECG waveform, the heart rate appears. (In the Dual-screen mode, the heart rate appears on each live image.)

You can set the sweep speed of the ECG waveform. For details, see "Setting the sweep speed" on page 112.

2 To hide the ECG waveform and close the **ECG** screen, tap **Exit**.

Or, to close the **ECG** screen but leave the ECG waveform visible, tap **Close**.

You can adjust the settings **ECG Position**, **ECG Gain**, and **Sweep Speed** regardless of whether the image is live or frozen.

3 To raise or lower the ECG waveform in the display, turn the dial menu button to the right of **ECG Position**.

4 To set the gain for the ECG waveform, turn the dial menu button to the right of **ECG Gain**.

The setting range is from 0 to 100. The current value appears below the label **ECG Gain**.

5 To set the scrolling speed of the ECG waveform, press the up or down arrow on switch menu button 2 (the rocker button underneath **Sweep Speed**).

Sweep speed can range from 1 to 7 seconds.

**Caution**

In the M, PW, CW, or TDI mode, you can change the sweep speed of the screen mode. The sweep speed of the ECG waveform is synchronized with that of the screen mode. For information on changing the sweep speed for a mode, see "Setting the sweep speed" on page 112.

**6** To show or hide the ECG waveform:

While the image is frozen, do one of the following:

- Tap **Display**, and then press the rocker button under **Display**.
- When the ECG waveform is not showing, unfreeze the image.

**7** To hide the ECG waveform, do one of the following:

- Tap **Exit** on the touch panel.
- Press the function button to which you have assigned the function for displaying the ECG waveform.

## Performing cine search while the ECG waveform is on-screen

**To perform a Cine search while the ECG waveform is on-screen**

**1** Press the **CINE** button (

).

A cursor indicating the position of the image display appears on the ECG waveform.

**2** To move the ECG waveform display area, move the cursor by rotating the trackball.

Changing the position of the image display within the ECG waveform display area does not change the ECG waveform. However, when the cursor indicating the position of the image display is at the left or right end of the ECG waveform display area, moving it farther away from center moves the ECG waveform display area to the other end of the waveform display.

# Using triplex mode

You can view the 2D mode image, CD or PD mode image, and the PW or CW mode image simultaneously. This is called the *triplex mode.* You can also view images of the following modes simultaneously.

- 2D mode, CD mode and PW mode images: CD/PW mode
- 2D mode, PD mode and PW mode images: PD/PW mode

**Note** The triplex mode is not available in TDI mode.

# Performing a needle procedure

You can display the needle guideline (a line that guides insertion of the needle into the patient's body) on the 2D mode image, depending on the transducer that is connected to the FC1.

The needle guide assists the placement of the needle. The ultrasonic image of the anatomical region of interest and that of the needle show on the examination screen to help carry out the procedure.

When you connect a transducer with an attached needle guide to the ultrasound system, two guidelines appear on the image, indicating the expected insertion path of the needle. The guidelines and the depth marks assist in the procedure.

The guidelines are not intended for freehand needle procedure.

## Preparing for a needle procedure

**WARNING**

To avoid injury to the patient:

- Use only the needle brackets, guides, supplies, components and accessories specified by FUJIFILM SonoSite, Inc or CIVCO. Other brands may not properly fit on FUJIFILM SonoSite transducers.
- Use only the bracket compatible with the ultrasound system and transducer that you are using.
- Make sure that the bracket is attached properly.
- When using a multi-angle bracket, make sure that the angle setting (A, B, or C) of the bracket is the same as that of the ultrasound system.

**Caution**

You can use the needle guideline display function only with a transducer that is equipped with a single-angle or multi-angle needle guide bracket.

The needle guideline cannot be displayed on a frozen image.

Because this is an optional function that guides the needle, this function is available only for certain types of transducer. For more information, see the "Puncture user guide" or "L25 needle guide kit user guide" issued by FUJIFILM SonoSite, Inc

When you tap **Needle Guide** on the touch panel on the 2D mode (B tab) screen, the needle guideline appears on the 2D mode image, and the **Needle Guide** screen appears on the touch panel.

## Needle procedure precautions

**WARNING**

To avoid damage or reduce the risk of infection to the patient, observe the following:

- Reusable needle guides must be sterilized after use.
- If the bracket needle guide or needle breaks during the procedure, verify that all pieces of the equipment are recovered.

**Caution**

To avoid damage to the transducer, use only gels recommended by FUJIFILM SonoSite. Using gels other than those that FUJIFILM SonoSite recommends can damage the transducer and void the warranty. If you have questions about gel compatibility, contact FUJIFILM SonoSite or your local representative.

During the procedure, observe the following precautions:

- For proper acoustic coupling, you must use acoustic coupling gel. Apply a liberal amount of gel between the transducer and the body. Although most gels provide suitable acoustic coupling, some gels are incompatible with some transducer materials. FUJIFILM SonoSite recommends Aquasonic gel and provides a sample with the needle guide kit.
- Use sterile gel when performing an invasive procedure.
- If the needle is not displayed at the target, ensure that you have selected the correct needle guide and have correctly attached the bracket and needle guide.
- The guide is intended to provide only an indication of the expected path of the needle. Identify the actual position of the needle with the ultrasound image of the needle on the screen.

## Verifying the needle path

Verify the needle path before the procedure to make sure that the relationships between the system, transducer, and needle guide are correct.

**WARNING**

Before the needle path verification, inspect all the parts to make sure that they are not damaged.

Perform the needle path verification before the procedure to ensure that the bracket, needle guide, and the needle are installed properly.

Use a straight, new needle for each verification procedure to help get an accurate projection of the needle.

Do not use a needle that has been used for any verification procedure.

Do not use the needle guide if the needle is not following the intended path.

To verify the needle path, you need the following devices and instruments.

- Biopsy transducer
- Bracket

  This is reusable; the type of the bracket varies depending on the transducer you want to use it with.
- Needle guide kit (single use only)

  The following transducers are supported with needle guidance, for the needle guides listed after each transducer type:

  - C60xf (multiple fixed angle)

- C35xp (multiple fixed angle, variable angle)
- ICTxp (fixed angle)
- HFL50xp (fixed angle, variable angle)
- HFL38xp (multiple fixed angle, variable angle)
- L38xp (multiple fixed angle, variable angle)
- L25xp (variable angle, transverse angle)
- P21xp (fixed angle)

- Ultrasound system
- Tank filled with test object fluid (All World Scientific code 3480)

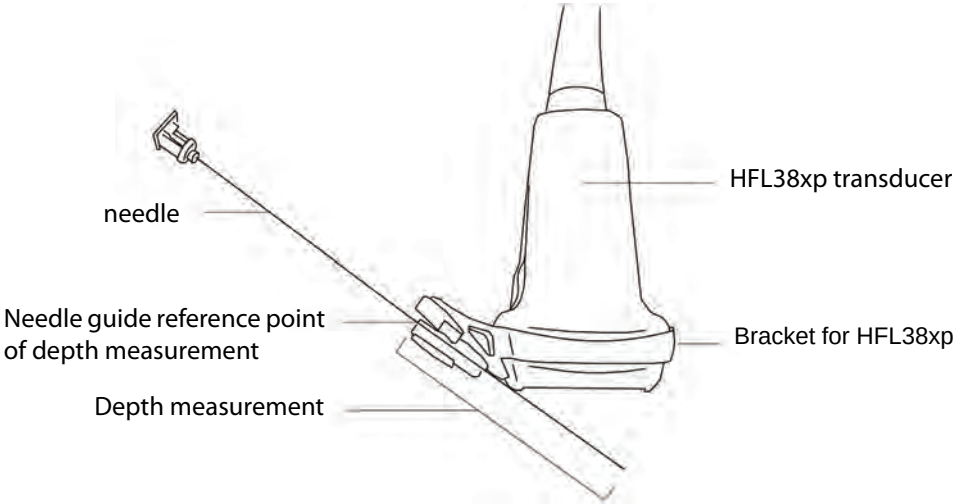



Figure 4-2: HFL38xp transducer with needle guide and needle attached

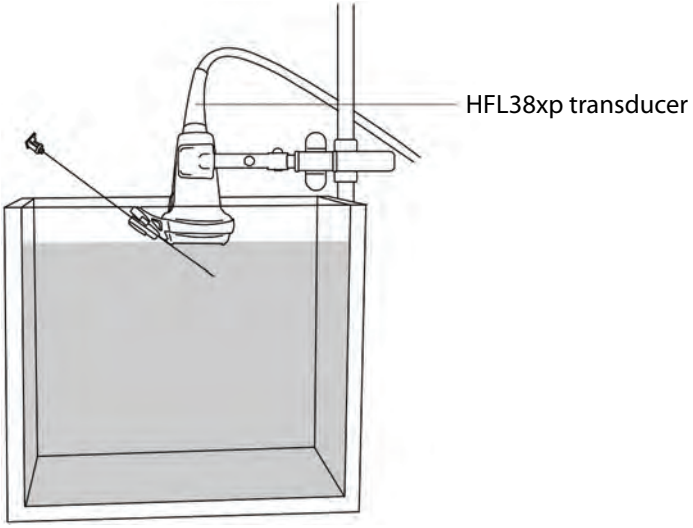



Figure 4-3: HFL38xp transducer set up on tank filled with test object fluid.

**To verify the needle path**

**1** Attach the bracket to the transducer, and install the appropriate needle guide for the needle gauge.

See the user guide specific to your needle bracket for information on attaching the bracket and needle guide.

**2** Set up the tank and transducer, and then insert the needle into the needle guide.

**3** Immerse the transducer and needle no more than 1/4 to 1/2 inch (6.35 to 12.7mm) into the tank of test fluid (or distilled water).

**4** Connect the transducer and turn on the ultrasound system.

**5** Show the needle guideline.

For more information, see "Using the needle guide" on page 169.

**6** Move the needle into the tank of test fluid until its ultrasound image is visible on the system display.

**7** Verify that the needle, as seen on the system display, passes between the two guidelines.

The guideline is intended to provide only an indication of the expected path of the needle.

**WARNING**

To avoid injury to the patient, if the displayed needle is protruding in an unexpected direction, make sure that the bracket and the needle guide are installed properly and that the direction of the transducer is correct.

If the needle does not pass between the two guidelines even after verification, do not use the needle guide. Contact FUJIFILM SonoSite or your local representative.

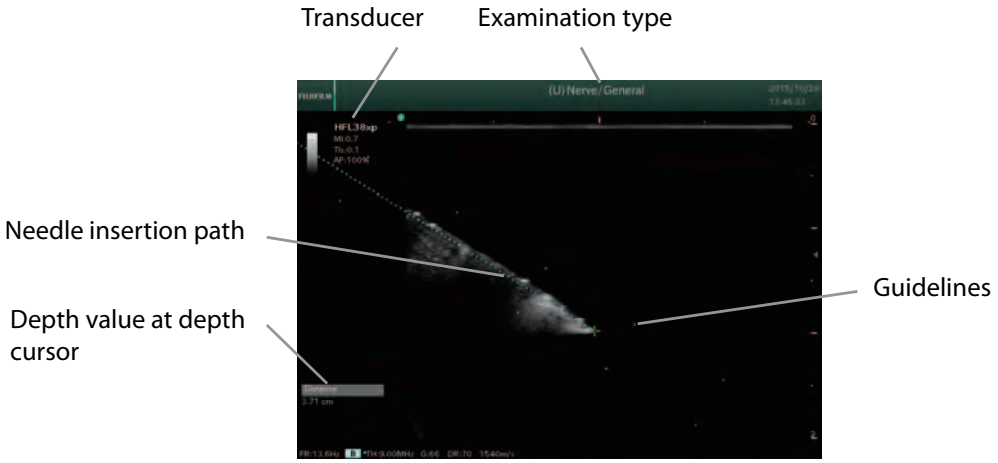



Figure 4-4: Example of needle insertion screen

**Caution**

The depth value at the depth cursor, as labeled in Figure 4-4, "Example of needle insertion screen" on page 168, is the measured distance between the reference point of depth measurement on the needle guide and the tip of the needle.

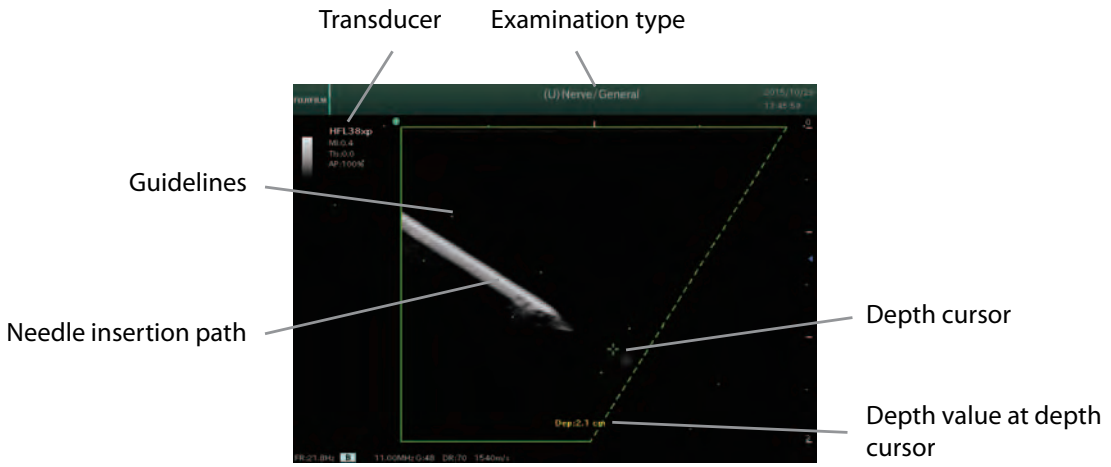



Figure 4-5: Example of biopsy guideline

**Caution** The depth value at the depth cursor is the measured distance between the reference point of depth measurement on the needle guide and the tip of the needle

# Using the needle guide

**To use the needle guide**

**1** On the touch panel, with the **2D** tab showing, tap **Needle Guide**.

**Caution** You can select the needle guide only when a live image is on screen. (Note, however, that if the needle guide is on screen and you freeze the image, the needle guide remains on screen.)

The **Needle Guide** screen appears.

**2** To select an angle, beside **Angle**, tap an available angle.

The angles that you can select vary depending on the transducer.

Once you select an angle, the guideline and area line of the selected angle appear on the examination display.

**3** To select the display method of the needle guideline, beside **Line Display**, tap **Area**, **Center**, or **Display OFF**.

**Note** **Display Off** is available only when a frozen image is on screen.

In the following step, needle distance is length of the needle from its insertion point to the location of a caliper that you are using for that measurement.

**4** To show needle distance in the examination display, start a measurement, as described in "Starting a measurement" on page 214.

The distance measurement caliper appears. You can operate this caliper in the same way as the caliper for one of the measurement functions that measure distance (for details, see "Measurement overview" on page 211).

The start point of the caliper becomes the start point of the guideline on the side of the transducer direction marker.

The starting point of the guideline varies depending on the transducer connected to the FC1.

The color of the guideline and area line varies depending on the status of the image (live or frozen).

When the angle is 90 degrees, the guideline and area line are displayed at the center of the transducer.

**Caution**

Before inserting the needle, check the position of the insertion pathway relative to the transducer, the needle guide, and the equipment.

Before inserting the needle, ensure that the needle guide that you are using is free from damage.

Insert the needle in a vertical direction to the guide line for the sake of emphasizing the needle position *in vivo* when using the transverse needle.

When you insert the needle into the body, it may bend.

Check the position of the needle on the ultrasound image

When you are in dual mode, the needle guideline does not appear on the screen.

When using a multi-angle needle guide, to avoid injury, match the angle of ultrasound system with that of the needle guide.

Because the tip of needle inserted into the body is hard to see, check the position by moving the needle or by injecting fluid.

**5** To save the current needle guide setting as the default, tap **Set Default**.

The setting is applied the next time that the needle guideline is displayed.

**6** To hide the needle guide and return to 2D mode, tap **Exit**.

**7** To close the **Needle Guide** screen and show the 2D mode screen (**B** tab) on the touch panel, tap **Close**.

# Needle profiling (Optional)

If you choose, you can use needle profiling, which makes needle guidance easier during the placement of catheters and during nerve-block procedures. This technology enhances linear structures within an outlined area on the screen. These linear structures are best enhanced when they are perpendicular to the angle guide.

**Note**

Linear structures are enhanced only in an outlined portion of the image. The area outside the outline remains unchanged.

Needle profiling is available for the following probes and presets:

| Probe | Nrv | Msk | SmP |
|---|---|---|---|
| HFL38xp | ✓ | ✓ | |
| HFL50xp | ✓ | ✓ | ✓ |
| L25xp | ✓ | ✓ | |
| L38xp | ✓ | | |

**To use needle profiling**

1 On the touch panel, tap **Needle Profiling**.

2 On the touch panel, tap **Target Depth**.

The depth cursor appears on the monitor.

3 Use the trackball to move the depth cursor. The value of the depth at the position of this cursor appears (for example, **Dep:1.9cm**).

4 To invert the ROI horizontally, tap **Invert** on the touch panel. To turn it back, tap **Normal**.

5 To position the needle and the dashed angled line so that they are facing each other perpendicularly, in the **ROI** section, tap **Shallow**, **Medium**, or **Steep**.

**6** Tap **Close**.

**Caution**

Avoid setting the gain too high when you use Needle Profiling, as unnecessarily high gain can cause artifacts in the image. In addition, respiratory and cardiac movement in the image may cause bright pulsating artifacts.

**Note**

When a live image is displayed, the depth cursor and the angled ROI line appear in green. When a frozen image appears, they appear in light blue.

You can select **Normal/Invert** and **ROI** only when a live image is displayed.

Use the **Shallow**, **Medium**, and **Steep** settings to make the needle and dashed angled line perpendicular to each other. The more perpendicular they are to each other, the more the linear structure is enhanced. Likewise, the more parallel the linear structure is to the angled line, the less it is enhanced.

It is recommended to use a 17- to 25-gauge needle. Enhancement results can depend on the type and brand of needle used. For more information, consult the medical literature on needle visibility in ultrasound-guided procedures

You can angle the needle up to 50 degrees from the transducer surface. Beyond 50 degrees, the needle may enhance less. (Needle profiling has little or not benefit in out-of-plane procedures. It is intended to plane procedures only.).

# Using Cine mode

You can save raw data in the cine memory for re-accessing and playing back.

Pressing the **CINE** button (

) after freezing raw data displays the **Cine** screen on the touch panel, for playing back raw data. (This status is called *Cine mode.*)

The **CINE** button is active only when the image is frozen.

When you terminate Cine mode while playing back raw data, the playback status is retained the next time that the Cine mode is activated.

# Cine search

To see frames from earlier in the examination, you can change the play position of raw data.

Raw data obtained from the cine memory is played back, in the range that you specify. When the playback reaches the frame specified as the end position, playback returns to the start position and starts again.

The playback condition varies depending on the display format and the screen mode, as shown below.

- Dual-screen mode: Only the active raw data is played back.
- Simultaneous Dual -screen mode: Both sides of raw data are played back.
- M, PW, CW, or TDI mode: Only the raw data and waveform being updated are played back.

**Caution** Note that performing a cine search erases any measurement results or calipers that are displayed on the main monitor.

**To perform a cine search**

**1** Press the **CINE** button (

).

The **Cine** screen appears.

**Caution** If the playback range is only one frame, you cannot select this item.

**2** To set the range of the playback, tap one of the following:

- **All**

Plays all the frames saved in the cine memory.

- **Last Half**

The last half of the raw data (the middle frame to the last frame saved in the cine memory) plays back.

Or, to set start and end points:

**a** Use the trackball to move the cursor displayed on the cine memory, and then tap **Set Start**.

The cursor position becomes the playback start position.

**b** Use the trackball to move the cursor displayed on the cine memory, and then tap **Set End**.

The cursor position becomes the playback end position.

**3** To move the play position:

- In 2D, CD, or PD mode, rotate the trackball to the right to move the play position forward, and to the left to move the play position backward.
- When you rotate the trackball left at the first frame, the play position returns to the last frame.

- In the M, PW, CW, or TDI mode, rotate the trackball to the right to move the play position backward, and to the left to move the play position forward.

**4** To start playback, tap **Play**.

**5** To pause playback, rotate the trackball any direction. (To restart playback, tap Play again.)

**6** To stop playback, tap the **Stop** button ( ).

**7** To terminate the Cine mode, do one of the following:

- Press the **CINE** button.
- On the touch panel, tap **Close**.

  The **Cine** screen on the touch panel closes, and the touch panel screen of the current mode reappears.

# Annotating images

You can add four types of annotations to live and frozen images of an examination that is in progress:

- Freeform text

  You can enter text freely, using the virtual keyboard. For more information, see "Creating text annotations" on page 175.

- Arrow

  You can enter up to 15 arrows on the screen and move and turn them freely. For more information, see "Creating arrow annotations" on page 179.

- POT

  POT menus are fixed sets of annotations.

- List item

  You can specify terms to enter for each application as list items. You do so by using the **List 1**, **List 2**, and **List 3** menus.

**Note**

The names of the list-item menus may change according to the preset. For example, for the Cardiac preset, the names are Card 1, Card 2, and Card 3.

For more information, see, in "Creating text annotations" on page 175, the procedure for entering list items.

**Caution** When the examination is terminated, or when the transducer or preset is changed, the input annotations are erased.

# Creating text annotations

This section describes the procedures for entering annotations.

Each examination supports a maximum of 15 text blocks.

The maximum number of characters per text block is 64.

## Starting an annotation

**To start an annotation**

1 To enter text-annotation mode, press the **ANNOTATE** button.

Or, if you are using a USB keyboard, press the SPACE key.

The **Annotation Mode** screen appears on the touch panel, and a yellow text cursor appears on the main monitor.

If an arrow appears on the main monitor, tap the Text tab to display a yellow text cursor. (The default annotation type, text or arrow, depends on the preset.)

2 Use the trackball to move the text cursor to the desired position, where you can now create an annotation.

Or, to return the text cursor to the home position, tap **Home**.

3 Tap **Keyboard** and then, on the virtual keyboard, type to enter text.

By default, capital-letter entry is set for the virtual keyboard.

You can also use the USB keyboard to enter text.

4 To fix your text in place as a text block, move the text cursor.

The text you have fixed turns white.

**Note** When the keyboard appears on the screen, the only actions you can perform are storing images and switching between insert and overwrite mode.

## Creating an additional text annotation

**To enter text at another position**

- In text-annotation mode, use the trackball to move the text cursor to the desired position, type text, and then complete the procedure in "Starting an annotation" on page 175.

## Changing text annotations

**To delete characters**

1 In text-annotation mode, use the trackball to move the text cursor to the characters to be deleted.

2 Tap **Delete Text.**

The character on the left side of the text cursor is deleted.

**To delete a text annotation**

1 In text-annotation mode, use the trackball to move the text cursor below the text annotation to be deleted.

2 Tap **Delete Word**, or press the **DELETE** button (

).

The word block on which the text cursor is placed is deleted.

**Caution**

Tapping **Delete Word** or pressing the **DELETE** button when the text cursor is not on a text annotation deletes the text annotation on the immediate left in the same line (or, if there is none on the left in the same line, the text annotation at the right end of the line above it).

**To correct text**

1 In text-annotation mode, use the trackball to move the text cursor to the text block to be corrected.

The text color changes to yellow.

2 To switch the input mode between insert and overwrite, press the **SET** button (

).

- In insert mode, the text cursor is yellow.
- In overwrite mode, the text cursor is green.

3 In the text box of the virtual keyboard, tap the point at which you want to start correcting.

4 Use the virtual keyboard to correct the text.

5 To finalize the text correction, move the text cursor.

The corrected text turns white.

**To move a text block**

1 In text-annotation mode, use the trackball to move the text cursor to the text block that you want to move.

2 Press the **SET** button (

) twice rapidly.

The text turns red.

3 Use the trackball to move the text cursor to the desired position.

4 Press the **SET** button.

The text appears in yellow, and the position is finalized.

## Adding POT menu items or list items to a text annotation

The four POT menus are arrayed along the bottom of the touch panel:

- **Rt/Lt**
  Indicating orientation: Right or Left
- **Prx/Mid/Dst**
  Indicating position: Proximal, Mid, or Distal
- **Long/Trans**
  Indicating Longitudinal or Transverse
- **Sag/Cor**
  Indicating Sagittal or Coronal

The three list item menus are **List1**, **List2**, and **List3**.

In each text block, you can enter at most:

- Four POT items (one for each menu)
- Three list items (one for each menu)

After you add a POT item to an annotation, you can change it—until you move the text cursor from the entered-text box, at which point you cannot change it.

**To add a POT menu item or list item to an annotation**

1 In text-annotation mode, use the trackball to move the text cursor to the desired position.

To add a POT menu item or list item:

**a** Tap the desired POT menu or list (**List1**, **List2**, or **List3**) to select it as required.

**b** Press the POT menu or list switch menu button to cycle through the POT menu or list items to the one you want to add to the annotation.

If the POT menu item or list item that you want to add already appears, press the down-arrow side of the menu switch menu button.

2 To resume adding text, tap **Keyboard.**

3 In the text box, the text cursor remains at its position following your last addition of a POT menu or list item.

**To correct a POT or list item**

1 To change a POT or list item that you have added to an annotation, tap the appropriate switch menu button (below the POT menu or list).

2 To erase a POT or list item, do one of the following:

- On the touch panel, tap **Delete Text.**
- On the virtual keyboard, use the BACK SPACE key.

3 To finalize the annotation, move the text cursor.

**Note** When you move the text cursor from the annotation, you can no longer change a POT menu or list item.

## Moving the annotation's home position

**To move the annotation's home position**

1 To move the home position, move the text cursor to the desired location of the new home position, and then tap **Set Home**.

2 The current text cursor position becomes the new home position.

## Deleting all annotations

**To delete all the displayed annotations and arrows**

- Tap **Delete All.**

**Note** This action does not delete the body pattern.

## Creating arrow annotations

You can add up to 15 arrows to a live or frozen image. When you have created them, you can move them and rotate them freely.

**To add arrow annotations**

**1** Press the **ANNOTATE** button (

).

On the touch panel, the annotation screen appears.

**2** If the **Arrow** tab is not already selected, tap it.

A green arrow appears at the center of the image area.

**Caution** When an arrow is green, switching from the **Arrow** tab to the **Text** tab deletes the arrow.

**3** Use the trackball to move the arrow to the desired position.

**4** Use the multi dial ( ) to rotate the arrow to the desired angle.

**5** Press the **SET** button (

) to fix the position of the arrow.

The arrow that you just fixed turns white, and a new arrow appears.

**Caution** Pressing the **DELETE** button erases the fixed arrows in the reverse order from that in which you created them.

Once the arrow is fixed, you cannot change its angle.

**6** To enter additional arrows:

**a** Do one of the following, depending on your last action:

- If you created an arrow, rotate the trackball, to move the new arrow off the location of the arrow you have just fixed, to the location where you want the new arrow to be.
- Or, to move the arrow to the center of the image area, tap **Home**.
- If you created a text annotation, tap the **Arrow** tab.

**b** Repeat steps 3 through 5.

## Deleting arrow annotations

**To delete an arrow annotation**

- To erase the fixed arrows in the reverse order from that in which you created them, press the **DELETE** button (

).

**To delete all annotations and arrows**

- Tap **Delete All**.

  All annotations are deleted, the text cursor is returned to the home position, and the arrow is returned to the center of the image area.

# Closing the annotation screen

**To close the annotation screen**

- Do one of the following:
  - Press the **ANNOTATION** button.
  - Tap **Close.**
  - If the USB keyboard is connected, press the **TEXT** key.

  Text that is not yet finalized is finalized, all arrows that are not yet finalized are deleted, and the annotation screen is closed.

  Finalized annotations remain displayed on the main monitor.

## Displaying annotations

**To display annotations**

- If you have assigned the display-annotations function to the **FREEZE** button ( ), press it.

  For details on assigning a function to the **FREEZE** button, see "Assigning a function to the FREEZE button" on page 63.

# Using body marks

Use body marks to record the position and orientation of the transdducer to the patient's body during an examination. Control body marks using the buttons on the **Body Mark** screen on the touch panel and those on the control panel of the FC1.

Ending the examination or changing a transducer or preset deletes the body marks.

## Displaying a body mark

When you press the **BODY MARK** button while a live or frozen image is on the main monitor, the **Body Mark** screen appears on the touch panel.

You can display a body mark in both images in the Dual-screen mode or in the Simultaneous Dual-screen mode. For information on configuring the display of body marks, see "Positioning the body-mark display" on page 53.

Body marks available for the current examination appear in the touch panel.

**To display, change, and move body marks**

1 To show the **Body Mark** screen, press the **BODY MARK** button.

  If you have assigned body-mark display to the **FREEZE** button ( ), you can display body marks by pressing this button. For details on assigning a function to the **FREEZE** button, see "Assigning a function to the FREEZE button" on page 63.

  By default, the body mark appears in the lower left side of the examination image, with a green transducer mark on the body mark.

2 To move the body mark, tap **Move**. Use the trackball to move the body mark and transducer mark together.

In the Dual- or Simultaneous Dual-screen mode, when one body mark is displayed for each image, you can move the body mark only within the area of the active image. When only one body mark is displayed, you can move it across both images.

3 To return the body mark to the home position, tap **Home**.

The home position varies, depending on the screen mode.

4 To finalize the position of the body mark, tap **Move** again.

After you finalize the position of the body mark, the trackball can move only the transducer mark.

**To change the body mark that is displayed**

1 In the touch panel, on the **Body Mark** screen, tap the body mark that you want to change the body mark to.

**To change to a body mark that is not showing in the Body Mark screen:**

1 On the **Body Mark** screen, tap **Library**.

2 Tap the collection of body marks that contains the one you want to use.

The body-mark collections are as follows: Abdominal, Breast, Cardiac, Gyn/OB, Uro/Genital, Vascular, MSK, Other.

In the selected body-mark collection, tap the body mark that you want to show.

The selected body mark appears in the image area.

**To remove a body mark and transducer mark**

- When a body mark is displayed, tap **Blank**.

The displayed body mark and transducer mark are hidden.

**To rotate a transducer mark**

- When a body mark is displayed in the image area, rotate the multi dial ( ) to rotate the transducer mark to the desired angle.

## Selecting body marks registered in a preset

Body marks are registered for each preset. You can select the body mark to be displayed in the image area from among all the registered body marks.

**To select from body marks registered in a preset**

1 On the **Body Mark** tab, tap **Library**.

2 On the **Library** tab, tap an examination type.

3 Tap the icon of the body mark that you want displayed in the image area.

4 To move the body mark, tap **Move**, and then move the body mark and transducer mark with the trackball.

5 To return the body mark to its home position on the examination screen, tap **Home**.

6 To remove the body mark from the examination screen, tap **Blank**.

7 To return to the **Library** tab, tap **Back**.

Or, to return to the display mode screen, press the **BODY MARK** button (

).

## Closing the Body Mark screen

**To close the Body Mark screen**

- Press the **BODY MARK** button (

).

All displayed body marks are finalized, and the **Body Mark** screen is closed.

# Switching the TI type

The type of thermal index (TI) used as the standard of acoustic output appears on screen.

During an examination, you can change the type of thermal index.

**Caution** When a new examination is started, or when the transducer, preset or Imaging Preset is changed, the TI type is switched to the default.

**To change the TI type during an examination**

1 Tap the **Others** tab.

2 Press switch menu button 2 (the rocker button below **Change TI**) to cycle through the thermal-index types.

For more information on TI types, see "Selecting the standard of acoustic output" on page 65.

# Playing clips back

Clips can be played back only when the image display format is 1 x 1.

However, when the image display format is 2 x 2, tapping an image twice rapidly displays it by itself on-screen (that is, in the 1 x 1 image display format).

**To play a clip back**

1 Press the **CURRENT VIEW** button ( ).

2 Select a clip.

With a clip selected, you can use the trackball to perform a cine search.

3 Press the **FREEZE** button ( ).

The clip is played back.

4 To stop the playback, press the **FREEZE** button again.

# Displaying a raw-data image

You can annotate and measure raw-data images (that is, images played back from raw data). Raw data handled on the FC1 is IQ data.

**Note**

To add annotations or measure against raw-data images of archived examinations, restart the examination and follow the procedure from step 1. For details on how to restart examinations, see "Restarting an examination" on page 140.

**To display a raw-data image**

**1** Press the **CURRENT VIEW** button ( ).

**2** Select a raw data image.

**3** Tap **Raw Data Process**.

The information that was recorded when you stored the raw-data image appears on the main monitor, and the screen corresponding to the screen mode used when storing the raw image data appears on the touch panel.

When a raw data image is not displayed or when the image display format is 2 x 2, **Raw Data Process** is not available.

You can use the following functions with a raw-data image:

- **Cine**

  For more information, see "To use needle profiling" on page 171.

- **Body mark display**

  For more information, see"Using body marks" on page 181.

- **Annotation entry**

  For more information, see "Annotating images" on page 174.

- **Basic measurement**

  For more information, see "Basic measurement" on page 238.

- **Preset-specific measurement**

- **Storage** (frozen image or clip)

  For more information, see "Storing examination images" on page 195.

- **Print**

  For more information, see"Printing exam images" on page 198.

- **Network transfer** (frozen image or clip)

4 To finish working with raw data images, tap **Raw Data Process** again.

## Deleting raw-data images

**To delete a raw-data image**

1 Press the **CURRENT VIEW** button ( ).

2 Display and then tap the raw data image that you want to delete.

3 Tap **Delete Raw**.

If you do not select (tap) a raw data image, **Delete Raw** is not available.

A trash-can icon appears on the image, indicating that the image is to be deleted.

**Note** The image deletion settings (marks of trash cans) are retained even when you change pages.

4 To remove the deletion mark from an image, tap **Delete**.

5 To mark multiple images for deletion, repeat steps 2 and 3.

6 To finish marking examination images for deletion and delete the marked images, press the one of the following buttons, all of which exit review of current images:

- **CURRENT VIEW**
- **2D**
- **PATIENT**

7 When you are prompted to confirm deletion of the images that you have marked for deletion, tap **OK**.

Or, to cancel the deletion and remove the deletion mark (the trash can) from the image, tap **Cancel**.

What you see on the screen after deleting the image depends on which button you pressed for the exit operation.

If you cancel the deletion, the system still leaves current-image review, but without deleting the image.

# Transferring images via a network

You can transfer images via the network only when the image display format is 1 x 1.

For details on how to assign a transfer destination to the Store button, see "Configuring Store buttons" on page 29.

**To transfer an image over a network**

1 Press the **CURRENT VIEW** button ( ).

2 Display the image that you want to transfer over the network.

3 Press the Store button whose function is to transfer an image to the desired destination.

The system moves the displayed image to the destination assigned to the Store button.

# Printing images

Images can be printed on one sheet in 1 x 1, 1 x 2, 2 x 1, or 2 x 2 print formats. However, you can print only when the image display format is 1 x 1.

You can configure the number of images and the orientation of paper with the system setup. For details, see "Adjusting printer settings" on page 40.

For details on how to assign the print function to a Store button, see "Configuring Store buttons" on page 29.

If the printing of some images is suspended, printing starts automatically when the examination is finished.

When you print a frozen image, the time that the image was saved appears both inside and outside the image.

**To print an image**

1 Connect the printer to the FC1.

2 Press the **CURRENT VIEW** button ( ).

3 Display and select the image you want to print.

4 To select multiple images, repeat Steps 2 and 3.

5 Press the Store button to which the print function is assigned.

6 Press the **CURRENT VIEW** button again.

7 When you are prompted to confirm printing, tap **OK**.

# Working with archived examinations and their images

When you end an examination, it is automatically archived, and therefore is accessible on the **Archive** screen.

## The Archive screen and controls

Some of the touch-panel controls are described in the following table. Those that are not listed are covered in the subsequent procedures.

| Control | Description |
|---|---|
| **Upper: First/Last Lower: First/Last** | To move to the first or last page of one of the lists, tap **Upper: First/Last** (for the examination list) or **Lower: First/Last** (for the image list), if it is not already selected. Then press switch menu button 1 (the rocker button below this control). |
| **Upper: L/R Slide Lower: L/R Slide** | To shift the view of one of the lists to the right or left in order to see fields that are off the touch panel, tap **Upper: L/R Slide** (for the examination list) or **Lower: L/R Slide** (for the image list), if it is not already selected. Then press switch menu button 2 (the rocker button below this control). |
| **Upper: Page Lower: Page** | To move to the next or previous page in one of the lists, tap **Upper: Page** (for the examination list) or **Lower: Page** (for the image list), if it is not already selected, and then press switch menu button 3 (the rocker button below). The current page number and the total number of pages are displayed on the lower side. |
| **Select All** | To select all the examinations in the examination list, tap **Select All**. |
| **Close** | Closes the **Archive** screen. |

## Selecting archived examinations

**To select archived examinations**

**1** Press the **ARCHIVE** button ( ).

The **Archive** screen appears.

**2** On the **Archive** screen, select an archived examination.

Or, to narrow the list of exams to review:

**a** Tap the downward-pointing green arrow ( ) to the right of **Search Key**.

**b** In the selection screen that appears, tap the records field in which you want to search.

You can select **Patient ID**, **Patient Name**, or **Accession No.**

**c** To search on a string within the selected field, in the text box next to **String**, using the virtual keyboard, type the string (or keyword) of interest, and then tap **Close**.

**d** Tap the **Search** virtual button.

The search results appear in the examination list, the upper box on the **Archive** screen that contains the list of archived examinations.

Following are the fields for each examination in the examination list:

- **Lock** - If an examination is locked, this field contains a lock icon. You can sort examinations by whether they are locked or not.
- **Patient ID**
- **Patient Name**
- **Size (MB) -** Image size.
- **Data Count (S/L/R/D) -** The number of images in the examination. The number of images is displayed for each image type: S (Still image), L (Clip), and R (Raw data image).
- **Study Start Date Time -** The start time of the examination.
- **Study Last Date Time -** The time the examination was completed.
- **Accession No. -** The accession number.
- **Import -** Contains an icon indicating that the image is imported from the external memory media. You can sort based on whether an image is imported or not.
- **Export -** Contains an icon indicating that the image has been exported to the external memory media. You can sort based on whether an image is exported or not.
- **Storage -** Contains an icon indicating that the image is stored on the DICOM network storage.
- **Print -** Contains an icon indicating that the image has been printed. You can sort based on whether an image has been printed or not.

**3** To sort the listed examinations in ascending or descending order on a field, tap the header for the field.

The visual indicator on that field header toggles between a backward slash (\) and a forward slash (/) according to whether the sort order is descending or ascending, respectively.

4 To select one or more examinations, tap the examination(s) of interest.

## Locking archived examinations

Locking an examination prevents it from being deleted.

**To lock an archived exam**

1 Select one or more archived exams, as described in "Selecting archived examinations" on page 188.

2 Tap **Lock**.

3 To unlock one or more locked examinations, select the examinations you want to unlock, and then tap **Lock** again.

If your selection of multiple examinations includes both locked and unlocked examinations, tapping **Lock** locks all the examinations.

If no examination is selected, **Lock** is unavailable.

## Exporting archived examinations

For information on exporting archived examinations, see "Exporting examination data" on page 203.

## Deleting archived exams

**Caution** | You cannot restore deleted examinations.

**To delete an archived exam**

1 Select one or more archived examinations, as described in "Selecting archived examinations" on page 188.

2 Tap **Delete**.

3 When prompted to confirm the deletion, tap **OK**.

Or, to cancel the deletion, tap **Cancel**.

**Note** | If no examination is selected or if a locked examination is selected, **Delete** is unavailable.

Only a raw-data image can be deleted from the examination that includes the raw data image.

# Viewing archived exam images

When the image of an archived examination is on-screen, the following functions are unavailable:

To add annotations or measure against archived exam images, see "Displaying a raw-data image" on page 184

- Storage
- Network transfer
- Export
- Body mark operation
- Annotation entry
- Basic measurement
- A preset-specific measurement (except for the report display)

**To view archived exam images**

**1** Select an archived examination, as described in "Selecting archived examinations" on page 188.

The examinations are highlighted, and their stored images are listed in the image list under the examination list.

The image (or images) taken from the first of the selected examinations appears first in the image list.

The images are listed with the following fields:

- **Preset**

  The type of examination

- **Single/Multiple**

  The type of image: Still or Clip

- **Size (MB)**

  The image size

- **Date Time**

  The date and time that the image was captured

**2** To sort based on one of the fields in the image list box, tap the field header.

3 To invert the sort order for a field header, tap the header again.

4 To remove the selection of an examination, tap the examination again.

The examination's images are removed from the image list below.

5 With an examination selected in the examinations list, tap **Open**.

Images stored during the examination selected in the examination list appear on the main monitor.

You can tap **Open** only when a single examination is selected in the examination list. When multiple examinations are selected, **Open** is unavailable.

For details on what you can do with archived images, see the following sections.

6 To finish reviewing the images, tap **Back**, and then press the **ARCHIVE** button ( ).

A live 2D mode image shows on the screen.

You can also finish reviewing the images of archived examinations by pressing the **PATIENT** or the **2D** button (

).

## Deleting an archived raw-data image

**To delete a raw-data image**

1 Select one or more archived examinations, as described in "Selecting archived examinations" on page 188

2 Tap **Delete Raw**.

3 When prompted to confirm the deletion, tap **OK**.

Or, to cancel the deletion, tap **Cancel**.

All the raw-data images in the selected examination are deleted. Images other than the raw-data images are not deleted.

**Note** If no examination is selected or if an examination including a raw-data image is not selected, **Delete Raw** cannot be selected.

# Printing archived images

When you print an archived image, it is put into the print queue. It prints after you have exited Archive mode.

**Note**

When you print a cine clip:

- You cannot print multiple frames in a clip.
- If you start printing an image (including raw-data images) and then try to delete it, the deletion is not carried out until after it has printed.

**To print all images in an examination**

1 Confirm that the printer you want to use is connected to the FC1.

2 Press the **ARCHIVE** button.

The **Archive** screen appears.

3 Select the examination containing the images you want to print and tap **Print**.

The printer selection screen appears.

4 Select a printer and tap **Print**. A confirmation message appears. Tap **OK**.

The printing starts.

**To select and print images from examinations**

1 Assign the printer you want to use to a Store button.

For the procedure for assignment to Store buttons, see "Configuring Store buttons" on page 29.

2 Press the **ARCHIVE** button.

The **Archive** screen appears.

3 Select an examination containing images you want to print and tap **Open**.

4 Press switch menu button 3 (the rocker button under **Page**) to browse the page until the image you want to print is displayed.

5 Press the Store button to which the printer has been assigned in step 1.

The printer icon appears on the top left corner of the screen and the image is scheduled for printing.

**Note** If the **Store** button to which the printer has been assigned is pressed again, the printer icon disappears, and the print job is cleared.

**6** Repeat the steps 4 and 5 to schedule for printing all images you want to print.

**7** Press the **ARCHIVE** button. A confirmation message appears.

8 Tap **OK**.

The printing of all images scheduled for printing starts.

## Moving archived examinations over a network

**To move an archived examination over a network**

**1** Select one or more exams for transfer over the network, as described in "Selecting archived examinations" on page 188.

**2** Tap **Store**.

The **Archive Store** screen appears.

If you have not selected an examination, **Store** is unavailable.

**3** To re-sort the list of destinations based on any of the column headings in the list:

**a** Tap the header on which you want to sort the list.

**b** To reverse the sort order for that header, tap it again.

**Caution** If the IP address or port number is not specified, **N/A** appears in the appropriate column.
For information on setting the transfer destinations to be displayed in this list, contact your local dealer.

**4** To view the next page of destinations, press menu switch button 3 (the rocker button under **Page**).

**5** Tap the desired destination in the destination list.

You can select only one destination.

**6** To remove the selection, tap the destination again.

7 To transfer the examination(s) to the selected destination, tap **Send**.

If no destination is selected, **Send** is unavailable.

8 When you are prompted to confirm the transfer, tap **OK**.

Or, to cancel the transfer, tap **Cancel**.

9 To return to the **Archive** screen, tap **Back**.

## Importing archived examinations

**To import an examination**

1 Press the **ARCHIVE** button ( ).

2 Tap **Import**.

After the system creates the import list, the **Exam Import** screen appears.

3 Tap the examination or examinations that you want to import, and then tap **Import**.

4 When you are prompted to confirm that you want to complete the import, tap **OK**.

Or, to cancel the import, tap **Cancel**.

5 If you see a message that some images were not imported because they already reside in internal memory, tap **OK**.

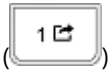
The touch panel returns to the **Archive** screen.

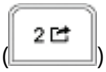
# Storing examination images

When you store an image from the current examination, whether a still image or a cine loop, you are saving it to a file, which you access through the **CURRENT VIEW** button ( ).

If there are no stored images from the current examination, then when you press **CURRENT VIEW** button, a message appears, telling you that there is no current view.

The following occurs by default:

- The **Store 1** button (  ) stores still images.

- The **Store 2** button (  ) stores cine loops.

**To store an examination image**

- To store a still image, press the **Store 1** button.

  Or, to store a cine loop, press the **Store 2** button.

## Reviewing examination images

You can review images that have been stored during the current examination.

**To review examination images**

**1** Press the **CURRENT VIEW** button ( ).

If there are no stored images, then when you press **CURRENT VIEW** button, a message appears, telling you that there is no current view.

Images stored during an examination are displayed in the 1 x 1 (a single image on the screen) or 2 x 2 (four images on the screen) image display format. In the 2 x 2 format, the order of images from newest to oldest is left-to-right, top-to-bottom.

The 1 x 1 image display format displays the last image stored during the examination.

**2** To switch the image display format between 1 x 1 and 2 x 2, press switch menu button 4 (the rocker button under **View**).

**3** To change the sort order of stored images:

Press switch menu button 2 (the rocker button under **Sort**), which cycles through the following sort orders:

- Stored date time in descending order and then ascending order
- Image format in descending order and then ascending order

Image format in ascending order is as follows (descending is the reverse):

- Still images
- Clips

- Raw images

  Within each type of images, the images are sorted with the newest image at the top.

  The current display order shows below **Sort**.

**4** To select an image, tap the image on the touch panel.

The frame of the selected image turns green.

**5** To finish reviewing examination images, press the **CURRENT VIEW** button again.

A live image shows on the main monitor, and the screen mode menu appears on the touch panel.

The following table describes other controls on the touch panel that are available when you are viewing stored images.

**Table 4-32: Stored image controls**

| Control | Description |
|---|---|
| **First/Last** | To toggle between first and the last stored image, press switch menu button 1 (the rocker button under **First/Last**). |
| **Sort** | To change the sort order of examination images, press switch menu button 2 (the rocker button under **Sort**). |
| **Page** | To show the next page of images, press switch menu button 3 (the rocker button under **Page**). |
| **Raw Data Process** | To display the information recorded when storing the raw-data image, tap **Raw Data Process**.<br>**Raw Data Process** is available only when the image display format is 1 x 1. |

# Deleting images

You can delete images that are stored in the FC1.

**Caution** | You cannot restore deleted images.

**To delete an image**

**1** Select one or more images, as described in "Reviewing examination images" on page 196.

2 Tap **Delete**.

A trash-can icon appears on the image(s), marking them for deletion.

**Note**

The deletion marks remain even when you change pages.

In the 1 x 1 image display format, the displayed image is deleted.

In the 2 x 2 image display format, the selected image (the one with a green frame) is deleted.

3 To remove the deletion mark from an image, tap **Delete** again.

4 To delete the marked images, press the one of the following buttons, all of which exit the review of current images:

- **CURRENT VIEW** ( )
- **2D** (

)
- **PATIENT** ( )

5 When you are prompted to confirm deletion of the images that you have marked for deletion, tap **OK** to confirm that the images should be deleted.

Or, to cancel the deletion and remove the deletion mark (the trash can) from the image, tap **Cancel**.

What you see on the screen after deleting the image depends on which button you pressed to exit.

If you cancel the deletion, the system still leaves the current image review, but without deleting the image.

## Printing exam images

All the images of the selected examination can be printed.

Access any examination images for printing through the **Archive** screen, even those you have stored from the current examination. Therefore, for the procedure for printing images, see "Changing printers" on page 202.

# Managing the output queue of examinations and images

You can view and manage examinations and images that you want to print or move over the network. You can also see the status of and information for the examinations and images.

Each image or examination is output to the printer or storage device that you set as the destination for printing or storage. For information on setting printers and storage devices, see "Changing the transfer destination" on page 200 or "Changing printers" on page 202.

**To view and manage images and examinations for printing or moving over the network**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Output Manage**. The **Output Management** screen appears

**Caution**

To move examinations over the network, there must be at least one destination (DICOM server) in the **Destination** field.

To print images, there must be at least one printer in the **Destination** field.

Servers and printers are represented in the field by the following:

- Destination storage: **S** (storage device)
- Printer: **P**

3 Use the following controls to manage the queue:

| Control | Description |
|---|---|
| **First/Last** | To move to the first or last page of the output queue, press switch menu button 1(the rocker button below **First/Last**). |
| **L/R Scroll** | To scroll the list horizontally, press switch menu button 2 (the rocker button below **L/R Scroll**). |
| **Page** | To move to the next or previous page, press switch menu button 3 (the rocker button below **Page**). |
| **Select All** | To select all the examinations in the list, tap **Select All**. |

| Control | Description |
|---|---|
| **Close** | Closes the **Output Management** screen. |

**4** To sort based on one of the fields in the image list box, tap the field header.

**Caution** The statuses are **Stand by**, **Suspend** (waiting for the end of an examination before starting the examination transfer), **Wait**, **Output**, and **Error**.

**5** To invert the sort order for a field header, tap the header again.

**6** To delete the image or examination, tap **Delete**.

**7** To start moving examinations over the network or printing the images in the output queue, tap **Start**.

Examinations are moved and images are printed in the chronological order in which they were added to the list, regardless of the sorting order based on **Patient ID** or **Patient Name**.

When a transfer or print request is complete, the examination or image is deleted from the output queue.

**Note**

While you are moving data over the network or while printing, **Destination** and **Delete** are unavailable.

If an error has occurred during the transfer or printing of an examination or image, only the transfer or printing of the examination or image is stopped. The transfer or printing of other examinations and images continue.

**8** To stop a transfer or print job, tap **Start** again.

## Changing the transfer destination

**To change the destination storage device**

**1** Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

**2** On page 1/4, tap **Output Manage**. The **Output Management** screen appears.

**3** Check that **Start** is disabled (gray and unavailable), and then tap one or more examinations for which you want to change the storage destination.

(That is, tap one or more records whose destination has an **S** prefix in the **Destination** field.)

**4** Tap **Destination** at the upper right of the touch panel.

> **Note** If multiple records are selected and if they have different destination printers, **Destination** is unavailable.

The **DICOM Destination** screen appears.

The following table describes controls in the **DICOM Destination** screen, in addition to those otherwise described in this procedure.

| Area or control | Description |
|---|---|
| Destination list | Contains the transfer destination of the examination from this list.<br>The list can hold a maximum of 10 destinations. |
| **Page** | To show the next page of images, press switch menu button 3 (the rocker button under **Page**). |

**5** To re-sort the list of destinations based on any of the column headings in the list:

**a** Tap the header on which you want to sort the list.

**b** To reverse the sort order for that header, tap it again.

> **Caution** If the IP address or port number is not specified, **N/A** appears in the appropriate column.
> For information setting the transfer destinations to be displayed in this list, contact your local dealer.

**6** In the list of destinations, tap the desired transfer destination.

**7** Tap **Send**.

Any examinations that are selected on the **Queue Administration** screen are moved to the selected destination.

Or, to close the **DICOM Destination** screen without saving changes and returning to the **Queue Administration** screen, tap **Back**.

When the transfer is complete, the **DICOM Destination** screen is closed, and the touch panel returns to the **Queue Administration** screen.

# Changing printers

**To change the printer**

1 Press the **SYSTEM** button ( ).

The **User Setting** screen appears.

2 On page 1/4, tap **Output Manage.** The **Output Management** screen appears.

3 Tap one or more images for which you want to change the printer.

That is, tap one or more records whose destination has a **P** prefix in the **Destination** field.

4 Tap **Destination** at the upper right of the touch panel.

**Note** If multiple records are selected and if they have different destination printers, **Destination** is unavailable.

5 In the **Printer Destination** screen, tap the desired printer.

6 Tap **Print.**

Or, to close the screen without making any changes effective, tap **Back.**

# Deleting an examination or image from the queue

If you delete an examination or image from the queue, the examination or image remains in the rest of the system.

**To delete an examination or image from the queue**

1 In the queue, tap one or more examinations or images that you want to delete.

2 Tap **Delete.**

3 When prompted to confirm the deletion, tap **OK.**

Or, to cancel the deletion, tap **Cancel.**

# Exporting examination data

You can export examination image data (still images, clips, and raw-data images) from the FC1 system's internal storage media to external media (USB memory).

**Caution**

When exporting examination data, consider how much you are exporting. A large amount of examination data may take an extremely long time.

If it is necessary to store the images for a long period, export examination data periodically.

AVI files exported to the USB memory cannot be imported to the FC1.

### To export examination data

**1** Select an archived examination, as described in "Selecting archived examinations" on page 188.

**2** Tap **Export**.

The **Exam Export** screen appears, with the existing export queue listed.

In addition to the controls described in this procedure, the **Exam Export** screen has the following controls

**Table 4-33: Export exam controls**

| Control | Description |
|---|---|
| **Select All** | To select all the examinations in the list or (if all the examinations are selected) to cancel all selections in the list, tap **Select All**. |
| **Page** | To move to the next or previous page, press switch menu button 3 (the rocker button below **Page**). |
| **First/Last** | To move to the first or last page of the output queue, press switch menu button 1 (the rocker button below **First/Last**). |
| **L/R Scroll** | To scroll the list horizontally, press switch menu button 2 (the rocker button below **L/R Scroll**). |

The **Exam Export** screen also displays, beside **USB memory**, the total memory and available memory (in megabytes) in the external USB memory connected to the FC1.

**3** To re-sort the list of examinations based on any of the column headings in the list:

**a** Tap the header according to which you want to sort the list.

**b** To reverse the sort order for that header, tap it again.

**4** To select one or more examinations for exporting to external USB memory, tap the examinations.

Or, to remove the selection from an examination that you have selected, tap the examination again.

**5** To modify export settings:

**a** Tap **Export Setting**.

The **Export Config** screen appears.

**b** To select the file format of still images:

i Tap the right-arrow virtual button ( ) to the right of **Still Image File Format**.

ii In the Still Image File Format selection screen, tap the desired file format: **DICOM**, **TIFF**, or **JPEG**.

iii The screen returns to the **Export Config** screen.

iv If you have selected JPEG, then to the right of **JPEG Compression Quality**, tap the right- or left-arrow virtual button ( or ) to set the compression rate of JPEG images (80% to 100%).

When you specify the TIFF or JPEG file format, the system also stores images in the DICOM format.

**c** To specify the compression level for DICOM still images and for DICOM videos (DICOM clip images):

i Tap the button to the right of **DICOM Still Image Syntax**.

ii On the **DICOM Still Image Syntax** selection screen, tap **Implicit VR Little Endian**, **Explicit VR Little Endian**, or **JPEG Lossy**.

**d** To specify the compression level for DICOM videos (DICOM clip images):

i Tap the button to the right of **DICOM Clip Image Syntax**.

ii On the **DICOM Clip Image Syntax** selection screen, tap **Implicit VR Little Endian**, **Explicit VR Little Endian**, or **JPEG Lossy**.

**Note**

You can also use the **SYSTEM** button ( ) to access export settings for specifying them. For more information, see "Configuring archiving (image export)" on page 32.

**6** To export the archived examination, tap **Export**.

If there is no examination selected or if the external USB memory is not connected to the system, **Export** is unavailable.

If the examination that you are exporting is not in the DICOM format, a message tells you that the examination data can be exported but it cannot be imported.

**a** Tap **OK** to continue the export or **Cancel** to cancel the export.

If the examination that you are exporting already exists in the export destination, you are prompted to confirm that you want to overwrite the examination at the destination.

**b** Tap **OK** to continue the export or **Cancel** to cancel the export.

If the free space on the selected external USB memory is insufficient, a warning message appears.

**c** Tap **OK** to return to the **Exam Export** screen.

**d** Delete data in the external USB memory to increase the free space.

**e** Resume this procedure.

**7** When you are prompted to confirm the export, tap **OK**.

Or, to cancel the export, tap **Cancel**.

The screen displaying the progress of the exporting process appears. When the exporting process is complete, the screen is closed.

Disconnecting the external USB memory from the FC1 while the export process is in progress cancels the export. A message appears, telling you that the export process has been canceled.

**8** To return to the **Archive** screen, tap **Back**.

# Importing examination data

You can import examination image data (still images, clips, and raw data images) from external media (USB memory) to the internal storage media of the FC1.

Note the following requirements for importing examinations:

- The image data must be from examinations performed with the FC1.
- The examinations must be in the DICOM format.

| | |
|---|---|
| **Caution** | When importing examination data, consider how much you are importing. A large amount of examination data may take an extremely long time. |

Details on the menu displayed on the touch panel for importing examination data are described below.

**To import examination data**

**1** Connect the external memory media in which the examination data is stored to the system.

**2** Press the **ARCHIVE** button ( ).

**3** Tap **Import**.

If no external USB memory is connected to the FC1, **Import** is unavailable:

After the system creates the import list, the **Exam Import** screen appears, listing the examinations that reside on the external memory.

In addition to the controls mentioned in this procedure, the **Exam Import** screen contains the following items

**Table 4-34: Exam import controls**

| Item | Description |
|---|---|
| **Select All** | Selects all the examinations in the list or, if all the examinations are selected, cancels all selections in the list. |
| **Page** | The switch menu button below **Page** opens the next or previous page. |
| **First/Last** | The switch menu button below **First/Last** shows the first or last page of the output queue. |
| **L/R Scroll** | The switch menu button below **L/R Scroll** scrolls the list horizontally. |

**4** To select the external media, if you have more than one connected to the system:

**a** Tap **Source Drive**.

**b** On the selection screen that appears, tap the external USB memory from which you want to import examinations.

**5** To re-sort the list of examinations based on any of the column headings in the list:

**a** Tap the header on which you want to sort the list.

**b** To reverse the sort order for that header, tap it again.

**WARNING** If the date and time that the examination was completed cannot be obtained from the examination data in the external media (USB memory), the **Study Last Date Time** field is left blank.

**6** To select one or more examinations for importing, tap the examination.

Or, to remove the selection from an examination that you have selected, tap the examination again.

**7** If you want to delete the examination or examinations that you have selected, tap **Delete**.

Otherwise, skip this step.

**8** To import the selected examination, tap **Import**.

Troubleshooting:

- If there is no examination selected, **Import** is unavailable.
- If the examination selected for import is not in the DICOM format or was not performed with the FC1, a message tells you that the examination cannot be imported.

  Tap **OK**, and then select another examination on the **Exam Import** screen.
- If the free space on the internal storage device of the FC1 is insufficient, a message tells you so.

  Tap **OK** to return to the **Exam Import** screen.

  Delete data in the FC1 to increase the free space on the internal storage device.
- If the examination that you want to import already resides in the internal storage device of the FC1, you are prompted to confirm that you want to overwrite the copy in internal storage.

  Tap **OK** to overwrite the copy stored in internal storage with the copy that you are importing.

  Or, to cancel importing the examination, tap **Cancel**.

**9** When you are prompted to confirm the import, tap **OK**.

Or, to cancel the import, tap **Cancel**.

**10** To return to the **Archive** screen, tap **Back**.

If the external media (USB memory) is disconnected from the FC1while the import process is in progress, a message advises you of what has happened, and the import process is canceled.

# Using a USB keyboard

**To use the USB keyboard**

**Caution** When the virtual keyboard is displayed, do not connect the USB keyboard to the FC1.

**Table 4-35: USB keyboard mapping**

| Key | Name | Function |
|---|---|---|
| F1 | NEW PATIENT | Displays the "Patient Info screen". To return to the examination screen, press this key again. |
| Prt Scr | Current Exam | Exam images of the current examination can be displayed. |
| PgDn | Pg Back | When this key is pressed while reviewing exam images, the previous image is displayed. When the first image is displayed, this key does not work. |
| PgUp | Pg Fwd | When this key is pressed while reviewing exam images, the next image is displayed. When the last image is displayed, this key does not work. |
| Insert | First/Last | Displays the first and last images of the current examination alternately. |
| Del | Delete | The function of this key is the same as that of the Delete button on the control panel. |
| Num Lock | Format | When this button is pressed while reviewing exam images, the display format is switched. |
| Pause | Archive | Exam images of archived examinations can be displayed. |
| Esc | End Exam | When this button is pressed during an examination, the examination ends. |
| F10 | DICOM Queue | Displays the "Queue Administration screen". |
| F2 | Del Word | Deletes the word on the left side of the text cursor. |
| F3 | Del Text | Deletes the character on the left side of the text cursor. |
| F4 | Set Home | Specifies the home position of the text cursor. |
| Space | SPACE | While entering text, a space is entered. In other cases, an arrow mark or annotation can be entered. |
| F5 | Long/Trans/Sag/ Cor (for POT input) | Inputs "Long", "Trans", "Sag," and "Cor" in order. |

**Table 4-35: USB keyboard mapping**

| Key | Name | Function |
|---|---|---|
| F6 | Rt/Lt (for POT input) | Inputs “Rt” and “Lt” alternately. |
| F7 | Prox/Mid/Dst (for POT input) | Inputs “Prx”, “Mid,” and “Dst” in order. |
| F8 | List 1 | Inputs the items registered in List 1 in order. |
| F9 | List 2 | Inputs the items registered in List 2 in order. |
| Tab | Tab | Proceeds to the next input item. |
| Shift | Shift | When a character key is pressed while pressing this key, another character assigned to the character key is entered. |
| F11 | Body Mark | When this key is pressed while pressing the Fn key (25), the body marks for the current examination are displayed. |
| F12 | Annotation | When this key is pressed while pressing the Fn key (25), an arrow mark or annotation can be entered. |
| Scroll Lock | Needle Guideline | When this key is pressed while pressing the Fn key (25), the needle guideline can be displayed. |
| Fn | Function | Regular function key |
| Windows logo | Full width/half width | For the Japanese keyboard: toggle between full width and half width |

# Ending an examination

**To end an examination**

**1** Press the F-key to which you have assigned **End Exam** or **Worklist**.

Or, press the **PATIENT** button ( ).

**2** When you are prompted to confirm that you want to end the examination that is in progress, tap **New**.

**Caution**

In case you do not want to edit the patient information nor start a new examination, you can tap **Modify** and press the PATIENT button to cancel the operation.

CHAPTER 5

# Chapter 5: Measurements and Calculations

## Measurement overview

Before you can perform measurements, you must freeze the image.

There are two types of measurements:

- Basic
- Specific to a preset

You can check the results of application-specific measurements on the **Report** screen, and edit the measurement values on the worksheet.

Note the following:

- The numerical data of application-specific measurements can be stored/exported/imported in image format.
- Imported data can be viewed on the FC1.
- Measurement results can be displayed/edited with the Report function of the FC1.
- To store measurement results in the displayed format, capture the Report screen (in the JPEG/DICOM format) by pressing the STORE button.
- To view the numerical data of application-specific measurements with the Report function, use the Restart function or select an examination on the "Archive screen." Assign the Report function to a function button before using the Report function.
- Some of the measurement procedures described below are available only for application-specific (or preset-specific) measurements. These are accessible if you are working in the relevant preset, through the **CALCS** button ( ). For more information on particular measurements, see the following sections:
  - **"Basic measurement" on page 238**

- "Cardiac measurement" on page 279
- "Vascular measurement" on page 373
- "Auto IMT (intima-media thickness) measurement (Optional)" on page 403
- "Abdominal Measurement" on page 416
- "Urological Measurement" on page 442


**WARNING**

When making measurements, display an appropriate image and use the appropriate measurement function. With regard to the measurement methods and measurement results, exercise proper clinical judgment.

At the time of diagnosis, evaluate the previous examination results described in medical records in addition to the measurement and calculation results for comprehensive judgment.

**Caution**

You cannot save only the measurement result. To save the measurement result, you must save in addition at least one image used for the measurement.

# User interface for measurement

## Control panel elements

When working with measurements, use the following buttons on the control panel.

**Table 5-1: Control panel buttons**

| Button name | Image | Function |
|---|---|---|
| **D**, **C**, **M**, and **2D** | | Switch between imaging modes. |
| **MEASURE** | | Performs basic measurements. |
| **CALCS** | | Performs measurements that are specific to a preset.<br>The preset that you choose determines the functionality. |
| **Trackball** | | Moves the measurement caliper. |

**Table 5-1: Control panel buttons**

| Button name | Image | Function |
|---|---|---|
| **SET** | | Fixes the position of the measurement caliper. |
| **Multi dial** | | Rotates the measurement caliper. |
| **FUNCTION** | | Function: Changes the function of the trackball. |
| **DELETE** | | Deletes a measurement result.<br>Holding **DELETE** down deletes all measurement results. |

## Touch panel screen elements

The touch panel elements that are common to all the modes have the following uses:

- The **2D** (**B**), **C**, **M**, and **D** tabs

  Switch among modes for the image to be measured

- **Report**

  Displays reports for measurements that are specific to a preset

- **Next**

  Application-specific; takes you to the next measurement, depending on the setting

- **Measure tool**

  Change measurement tools

- **Set Default**

  Sets the selected Measure tool as the tool that is by default selected when you press the **MEASURE** button

  ( )

- **Beat**

  Specifies the heart rate for measurement

**Result Display**

Displays or hides measurement results

**Result Position**

Changes the display position of measurement results

**Trace Level**

Adjusts the trace level during the automatic Doppler measurement

**Trace Type**

Switches the trace type during the automatic Doppler measurement

# Built-in measurement functions

## Measurement operation overview

You can perform various types of measurements with the following operations:

**Table 5-2: Measurement operations**

| Operation | Type | Description |
|---|---|---|
| Point | Single point | Measurement at a single point |
| | Multiple points | Measurement at multiple points |
| Trace | Free | Measurement with tracing |
| Figure | Circle | Approximation with a circle or sphere |
| | Ellipse | Approximation with an ellipse or spheroid |
| | Area length | Area-Length method |
| | Disk | Disk method |
| Line | Multiple | Measurement with crossed line segments |
| Auto Trace | Range specification | Automatic tracing of Doppler waveform within a specified range |

## Starting a measurement

The way that you start a measurement depends on what you want to do and the mode that you are working in.

The mode screens contain the following measurement items:

- 2D (**B**): Distance, Area, Trace, %Steno Dist, %Steno Area, Volume, Ratio Dist, Ratio Area, Angle
- **C**: Point Vel, Area Vel (both are unavailable when you press the **MEASURE** button [

])
- **D**: Velocity, Trace, PI, Time, Accel, Decel, RI, Vol Flow (MnV), Velocity Trace, Vessel Diam, HR
- **M**: Distance, Time, Slope, HR

**To start a measurement**

**1** Press one of the following buttons:

- To perform basic measurements, press the **MEASURE** button.
- To perform preset-specific measurements, press the **CALCS** button ( ).
- Depending on the preset, you may be able to press the **FREEZE** button ( ).

**2** Tap one of the measurement buttons on the touch panel:

The measurement buttons that appear depend on the mode that you are working in.

Or, if you pressed the **CALCS** button and the default measurement item has not been assigned, change the preset to perform an application-specific measurement.

## Continuous measurement

In continuous measurement, fixing one caliper in place simultaneously creates the next caliper.

**To initiate the next measurement by completing the current measurement**

- Press the **SET** button (

).

**Caution**

You must configure the **SET** button to display the next caliper. For information on setting this configuration, see "Configuring measurements for all modes" on page 56.

Depending on the measurement item, you may not be able to perform continuous measurement.

## Switching modes

In the CD, M, PW or triplex mode, you can use the prepared measurement functions for the displayed image.

**To change the mode**

- Tap the appropriate tab on the touch panel.

# Measuring at points

## Measuring at a single point

Single-point measurement measures the value at the position of the caliper. It can evaluate the following:

**Table 5-3: Image modes and measurements**

| Image mode | Measurement |
|---|---|
| 2D (B) | --- |
| CF | Flow velocity |
| M | --- |
| Doppler waveform | Flow velocity, time |

**To measure at a single point**

1 To display the start-point caliper, press either the **MEASURE**(

) or **CALCS**( ), button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 Use the trackball to adjust the start point.

3 Press the **SET** button (

) to fix the start point.

Depending on the setting, you can perform this measurement continuously.

If you are measuring continuously, every time you fix a point, the next-point caliper is superimposed directly on the previous caliper. To set the next point, repeat steps 2 and 3.

## Measuring at multiple points

In multiple-point measurement, you specify multiple calipers, and can evaluate the following values:

**Table 5-4: Measurements at multiple points**

| Image mode | Measurement |
|---|---|
| 2D (B) | Length, Angle |
| CF | --- |
| M | Length, Velocity, Time, HR |
| Doppler waveform | Velocity difference, Time, HR, RI, PG, etc. |

For an example, the following procedure is for a basic measurement, in 2D mode, measuring distance.

**To measure at two points (distance)**

1 Press the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 To display the start-point caliper, in the mode screen, tap the button (in this case, **Distance**) for the measurement that you want to take.

3 Use the trackball to adjust the start point.

4 Press the **SET** button ( ) to fix the start point.

The end-point caliper is superimposed directly on the start point.

5 Use the trackball to adjust the end point, and then press the **SET** button to fix the start point.

Depending on the setting, you can perform this measurement continuously.

## Multiple points (distance)

The number of points that you set varies, depending on what you are measuring.

The following procedure is illustrated for 2D mode.

**To measure at two points (distance)**

1 Press the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 To display the start-point caliper, in the mode screen, tap the button (in this case, **Distance**) for the measurement that you want to take.

3 Use the trackball to adjust the placement of the start point, and then press the **SET** button ( ) to fix the start point.

The second point is superimposed on the start point.

4 Use the trackball to adjust the second point, and then press the **SET** button to fix the second point.

The end point is superimposed on the second point.

5 Use the trackball to adjust the end point, and then press the **SET** button to fix the end point.

## Three points (angle)

The following procedure is illustrated for 2D mode.

**To measure at three points that form an angle**

1 Press the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 To display the start-point caliper, in the mode screen, tap the button for the measurement you want to take (in this case, **Angle**, using the **3 Point** Measure tool).

3 Use the trackball to adjust the placement of the start point, and then press the **SET** button ( ) to fix the start point.

The second point is superimposed on the start point.

4 Use the trackball to adjust the second point, and then press the **SET** button to fix the second point.

Figure 5-1: The screen after you set two points

The third point is superimposed on the second point.

**5** Use the trackball to adjust the third point, and then press the **SET** button to fix the third point.

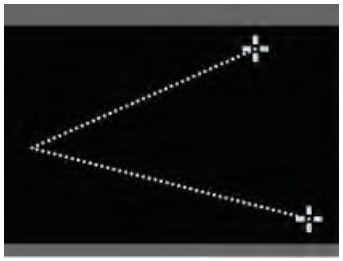


Figure 5-2: The screen after you set all three points

## Single point (M distance)

The following example is for measuring distance in M mode.

**To measure in M mode**

**1** Press the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

**2** To display a vertical line and the start-point caliper, in the mode screen, tap the button for the measurement that you want to take (in this case, **Distance**).

**3** Use the trackball to adjust the placement of the start point, and then press the **SET** button ( ) to fix the start point.

The end point is superimposed directly on the start point.

4 Use the trackball to adjust the end point, and then press the **SET** button to fix the end point.

Note that you are setting two points on the same line.

## Multiple points (M distance)

The following example is of cardiac measurement in M mode for LV diastole.

**To measure at a single point**

1 Press the **MEASURE**(

) **CALCS**( ) button.

2 To display a vertical line and the start-point caliper, in the mode screen, tap the measurement button of interest.

3 Use the trackball to adjust the placement of the start point, and then press the **SET** button (

) to fix the start point.

The second point is superimposed directly on the start point.

4 Use the trackball to adjust the second point, and then press the **SET** button to fix the second point.

The last point is superimposed directly on the second point.

5 Use the trackball to adjust the third point, and then press the **SET** button to fix the third point.

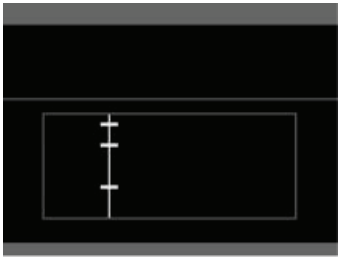


Figure 5-3: The screen after you set all three points

## Two points (RI)

The following example is for measuring distance for two points in D mode for RI.

**To measure two points in D mode for RI**

1 Press the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 To display a vertical line and the start-point caliper, in the mode screen, tap the button for the measurement that you want to take (in this case, **RI**).

3 Use the trackball to adjust the placement of the start point, and then press the **SET** button ( ) to fix the start point.

The end point is superimposed directly on the start point.

4 Use the trackball to adjust the end point, and then press the **SET** button to fix the end point.

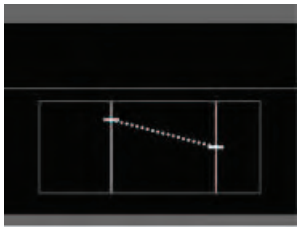


Figure 5-4: The screen after you set both points

## Two points (S/D)

The following example is for measuring distance for two points in D mode for Velocity.

**To measure two points in D mode for Velocity**

1 Press the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 To display a horizontal line and the start-point caliper, in the mode screen, tap the button for the measurement that you want to take (in this case, **Velocity**).

3 Use the trackball to adjust the placement of the start point, and then press the **SET** button ( ) to fix the start point.

The end point and its horizontal line are superimposed directly on the start point and line.

4 Use the trackball to adjust the end point, and then press the **SET** button to fix the end point.

## Two points (velocity)

The following example is for measuring distance for two points in D mode for Velocity.

**To measure two points in D mode for Velocity**

1 Press the **MEASURE**(

 ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 To display crossed lines (the start point caliper), in the mode screen, tap the button for the measurement that you want to take.

3 Use the trackball to adjust the placement of the start point (the intersection of the crossed lines), and then press the **SET** button (

 ) to fix the start point.

The next set of crossed lines is superimposed directly on the first set.

4 Use the trackball to adjust the second set of crossed lines, and then press the **SET** button to fix them.

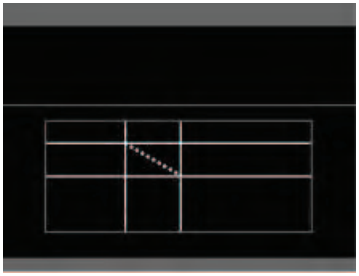


Figure 5-5: The end state of the measurement

## Two points (HR)

The following example is for measuring distance for two points in D mode for HR.

**To measure two points in D mode for HR**

1 Press the **MEASURE** button (

 ).

The examination screen displays a vertical line and the start-point caliper.

2 Use the trackball to adjust the placement of the start point, and then press the **SET** button (

) to fix the start point.

The second point is superimposed directly on the start point.

3 Use the trackball to adjust the second point and its vertical line, and then press the **SET** button to fix them.

# Trace

Measure a trace by drawing a tracing line from the start point to the end point.

Trace measurements can evaluate the following values:

**Table 5-5: Trace measurement values**

| Image mode | Measurement |
|---|---|
| 2D (B) | Length, area |
| CF | --- |
| M | --- |
| Doppler waveform | PI, VTI, average flow velocity, etc. |

There are three kinds of traces:

- Free trace
- Trace area
- Free trace (velocity)

## Free trace

The following example is for measuring distance on a free trace in 2D mode.

**To measure a free trace in 2D mode**

1 Press either the **MEASURE**(

) or **CALCS**(
) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 In the mode screen, to display the start-point caliper, tap the button for the measurement you want to make (in this case, **Trace**).

3 Use the trackball to adjust the placement of the start point, and then press the **SET** button ( ) to fix the start point.

The end point of the trace is superimposed on the start point.

4 Use the trackball to trace a line, and then press the **SET** button to fix the end point.

## Trace area

The following example is for measuring an area defined by a free trace in 2D (B) mode.

**To measure a free trace in 2D (B) mode**

1 Press either the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 In the mode screen, to display the start-point caliper, tap the button for the measurement you want to make (in this case, **Area**).

3 Press the switch menu button 2 (the rocker button beneath **Measure tool**) to select **Free.**

4 Use the trackball to adjust the placement of the start point, and then press the **SET** button ( ) to fix the start point.

5 Use the trackball to trace a line.

6 When the end point is where you want it, press the **SET** button to fix it.

If the start and end points are not at the same location, they are connected with a straight line. When the start and end points are close enough for the system to close it, the start caliper becomes smaller.

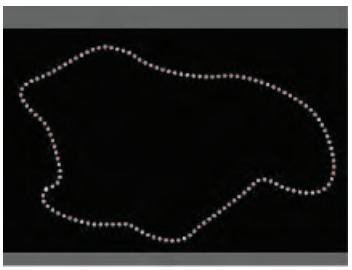


Figure 5-6: Completion of the traced area

## Free trace (velocity)

The following example is for measuring Velocity trace in D mode.

**To measure a free trace in D mode**

1 Press either the **MEASURE**(

 ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 In the mode screen, to display the start-point caliper, tap the button for the measurement you want to make (in this case, **Velocity Trace**).

3 Make sure that in the **Measure tool**, **Free** is selected (displayed).

If **Free** does not appear, press the switch menu button 2 (the rocker button beneath **Measure tool**).

4 Use the trackball to adjust the placement of the start point, and then press the **SET** button ( ) to fix the start point.

5 Use the trackball to trace a line.

6 When the end point is where you want it, press the **SET** button to fix it.

A caliper appears on the highest and lowest flow velocity values within the traced range.

Figure 5-7: The screen with calipers showing highest and lowest flow velocities

7 If necessary, use the trackball to adjust the caliper on the highest flow velocity value, and then fix it.

8 If necessary, repeat with the lowest flow velocity value.

Press the **SET** button to fix the end point.

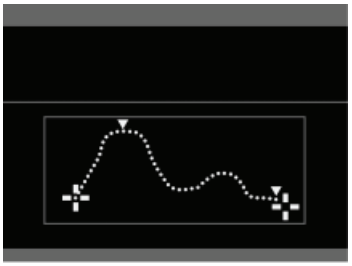


Figure 5-8: The screen with highest and lowest flow velocities adjusted

## Figure

To carry out the measurement, you trace a line or connect the start point and the end point.

Figure measurements can evaluate the following values:

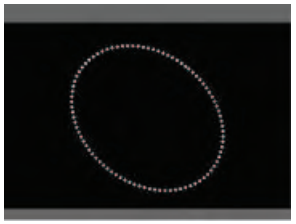
**Table 5-6: Figure measurement values**

| Image mode | Measurement |
|---|---|
| 2D (B) | Axial length, Area, Volume, Circumference |
| CF | Average flow velocity, Highest flow velocity |
| M | --- |
| Doppler waveform | --- |

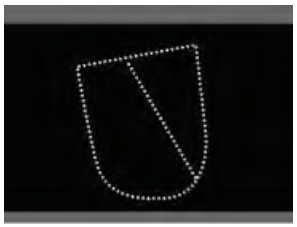
The figures that you can create are as shown here:

Circle

Ellipse



Area-Length



Disk (Simpson)

Figure 5-9: Examples of figures to create

## Circle

**To create a circle**

1 Press either the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 In the mode screen, to display the start-point caliper, tap the button for the measurement you want to make (in this case, **Area**).

3 Make sure that in the **Measure tool**, **Ellipse** is selected (displayed).

If **Ellipse** does not appear, press the switch menu button 2 (the rocker button beneath **Measure tool**).

4 Use the trackball to adjust the placement of the start point, and then press the **SET** button ( ) to fix the start point.

The end point is superimposed on the start point.

5 Use the trackball to enlarge or reduce the circle, and to move it.

- Moving the end point away from the start point enlarges the circle.
- Moving the trackball also rotates the circle around the start point. The circle always touches the start point.

6 When the end point is where you want it, press the **SET** button to fix it.

## Ellipse

Begin creating an ellipse by creating a circle.

**To create an ellipse for measurement purposes**

1 To start by creating a circle. Follow the procedure in "Circle" on page 227.

2 Use the trackball to stretch or squeeze the circle into an ellipse (that is, to elongate or reduce the diameter perpendicular to the one that you created in drawing the circle).

3 Press the **SET** button (

) to fix the ellipse.

## Area-length

**To measure the area enclosed by a trace**

1 Press either the **MEASURE**(

) **CALCS**(
) button, depending on the context for the measurement (such as whether it is specific to a preset).

2 In the mode screen, to display the start-point caliper, tap the button for the measurement that you want to make (in this case, area-length).

3 Use the trackball to adjust the placement of the start point, and then press the **SET** button (

) to fix the start point.

The end point of the trace is superimposed on the start point.

4 Use the trackball to trace a line, and then press the **SET** button to fix the end point.

The start and end points are connected. The start-point caliper is at the midpoint, and the end point is on the traced line farthest from the midpoint.

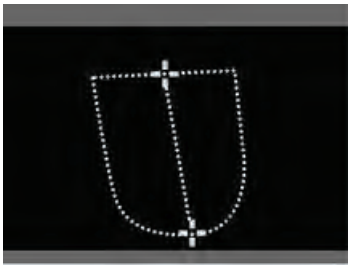


Figure 5-10: The completed traced area

**5** If necessary, use the trackball to move the end point on the traced line, and then press the **SET** button to fix the end point.

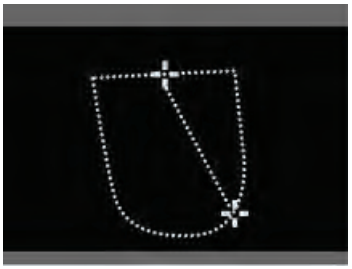


Figure 5-11: End point with its position adjusted

## Disk (Simpson)

**To measure the area of a disk (Simpson)**

**1** Press either the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

**2** In the mode screen, to display the start-point caliper, tap the button for the measurement you want to make (in this case, disk area).

**3** Use the trackball to adjust the placement of the start point, and then press the **SET** button ( ) to fix the start point.

The end point of the trace is superimposed on the start point.

4 Use the trackball to trace a line, and then press the **SET** button to fix the end point.

The start and end points are connected. The start-point caliper is at the midpoint, and the end point is on the traced line farthest from the midpoint.

The diameter in the perpendicular direction appears.

Figure 5-12: The completed traced area

5 If necessary, use the trackball to move the end point on the traced line, and then press the **SET** button to fix the end point.

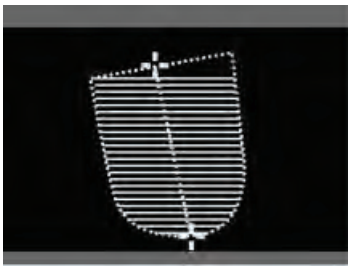


Figure 5-13: End point with its position adjusted

# Line

You can make this measurement only with the 2D-mode Angle measurement tool.

2 Line (Angle) 3 Line (Angle)

Figure 5-14: Example of line measurement

## Two line (angle)

**To measure two lines (angle)**

**1** Press either the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

**2** In the mode screen, to display the start-point caliper, tap the button for the measurement that you want to make (in this case, **Angle**).

**3** Make sure that in the **Measure tool, 2 Line** is selected (displayed).

If **2 Line** does not appear, press the switch menu button 2 (the rocker button beneath **Measure tool**).

The first line is horizontal.

**4** Use the trackball to move the first line, and the multi dial ( ) to rotate it.

**5** Press the **SET** button ( ) to fix the first line.

**6** Repeat steps 4 and 5 for the second line.

Allowing for variations in execution, the two lines look something like the following.

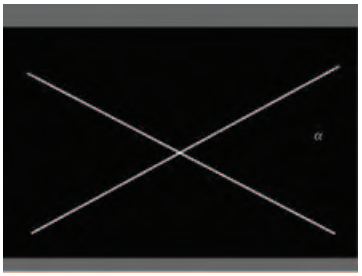


Figure 5-15: Two-line angle measurement

## Three line (angle)

**To measure three lines (angle)**

1 Press either the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 In the mode screen, to display the start-point caliper, tap the button for the measurement that you want to make (in this case, **Angle**).

3 Make sure that in the **Measure tool**, **3 Line** is selected (displayed).

If **3 Line** does not appear, press the switch menu button 2 (the rocker button beneath **Measure tool**).

The first line is horizontal.

4 Use the trackball to move the first line, and the multi dial ( ) to rotate it.

5 Press the **SET** button ( ) to fix the first line.

6 Repeat steps 4 and 5 for the second line and third lines.

Allowing for variations in execution, the second line looks something like the alpha line in the following.

Allowing for variations in execution, the three lines look something like the following (the third line is the beta line).

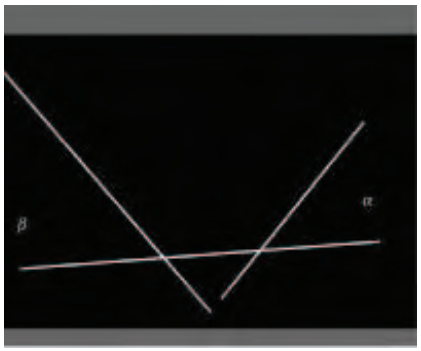


Figure 5-16: Three-line angle measurement

# Auto Trace

**Table 5-7: Auto Trace measurements**

| Image mode | Measurement |
|---|---|
| 2D (B) | --- |
| CF | --- |
| M | --- |
| Doppler waveform | Velocity, PI |

**Caution**

You can use Auto Trace in one heartbeat period. Do not use it in more than one heartbeat period.

## Auto Trace (range specification)

**To measure auto trace (range specification)**

1 Press either the **MEASURE**( ) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 In the mode screen, to display the start-point caliper and vertical line, tap the button for the measurement that you want to make, and then use the trackball to adjust their position.

3 Press the **SET** button ( ) to fix the first line.

Figure 5-17: The first auto-trace line

**4** Repeat steps 2 and 3 for the end-point caliper and its vertical line.

Automatic tracing of the Doppler waveform is performed within the range specified by the two lines.

A caliper appears on each of the maximum and minimum values.

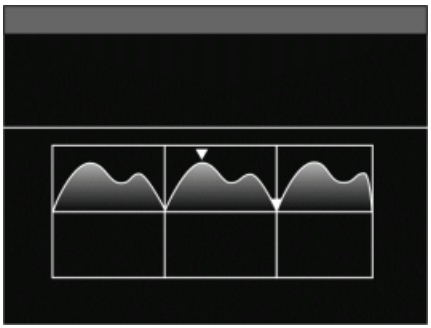


Figure 5-18: Auto-trace with maximum and minimum values marked

## Measurement using auxiliary lines

**Table 5-8: Image mode measurement**

| Image mode | Measurement |
|---|---|
| 2D (B) | IMT measurement |
| CF | --- |
| M | --- |
| Doppler waveform | --- |

## IMT measurement

**To perform IMT measurement**

**1** Press the **CALCS**( ) button. (IMT measurements are specific to the Carotid preset.)

**2** In the mode screen, to display the start point, tap the button for the measurement that you want to make, and then use the trackball to adjust its position.

**3** Use the multi dial ( ) to rotate the start point.

**4** Press the **SET** button ( ) to fix the location of the start point.

**5** Use the trackball to adjust the placement of the start point, and then press the **SET** button to fix the start point.

The end point is superimposed on the start point.

**6** Use the trackball to adjust the placement of the end point, and then press the **SET** button to fix the end point.

The start point caliper for the second measurement position appears.

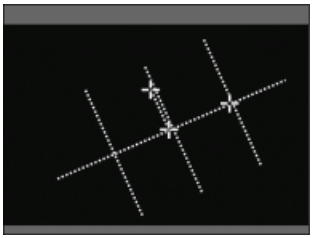


Figure 5-19: The start and end points of the first measurement position and the start point of the second

**7** Use the trackball to adjust the start point and press the **SET** button.

The end point caliper for the second measurement position is superimposed on the start point.

**8** Use the trackball to adjust the end point for the second measurement position and press the SET button.

The start-point caliper for the third measurement position appears.

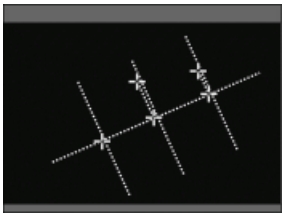


Figure 5-20: The start and end points of the first two measurement positions and the start point of the third

The end-point caliper for the third measurement position is superimposed on the start point.

**9** Use the trackball to adjust the end point for the third measurement position and press the **SET** button to fix it.

The start-point caliper for measuring the vessel diameter appears.

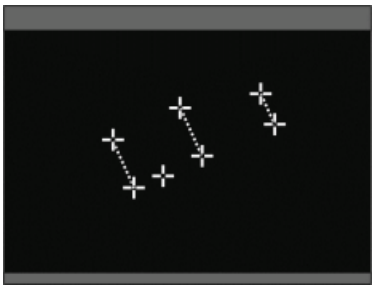


Figure 5-21: The start-point caliper for measuring the vessel diameter

**10** Use the trackball to adjust the start point and press the **SET** button to fix it.

**11** The end-point caliper for measuring the vessel diameter is superimposed on the start point.

**12** Use the trackball to adjust the end point and press the **SET** button to fix it.

## Deleting measurement tools

You can delete measurement-tool instances on the examination image.

**To delete measurement tools one by one**

**1** Press either the **MEASURE**(

) or **CALCS**( ) button, depending on the context for the measurement (such as whether it is specific to a preset, in which case you press the **CALCS** button).

2 In the mode screen, select the measurement tool that you want to delete, and then press the **DELETE** button (

).

**To delete all measurement tools simultaneously**

1 Press either the **MEASURE** or **CALCS** button.

2 With the mode screen showing in the touch panel, do one of the following:

- Tap **Delete All.**
- On the control panel, press and hold the **DELETE** button.
- On the control panel, press the **MEASURE** button to end basic measurement.

## Setting and using the Set and Next button

**To change Set/Next**

- In the **Setup** menu, select **Set/Next** for **Continuous Measurement Setup**.

  For details on setting **Set/Next** for **Continuous Measurement Setup**, see "Configuring measurements for all modes" on page 56.

  **Next** appears on the lower-left corner of the measurement screen.

**To use the Set/Next button**

1 When you press the **SET** button (

), measurement is not terminated. Rather, the start-point caliper is activated, and you can change its position again.

2 When continuous measurement is available, you can start the next measurement by tapping **Next**. If there are no subsequent measurements, the measurement result is finalized.

## Using the Set Default button

With **Set Default**, you specify the mode of the measure tool that is active when the user presses the **MEASURE** button (

).

## Specifying settings

Various settings are available in both basic measurement and preset-specific measurement.

Details on the settings for basic measurement are described in "Basic measurement" on page 238.

In application-specific measurement, you can select one of the following for the timing for registering measurement data:

- When the user taps **Enter**
- When one type of measurement is completed

By factory default, measurement data is registered when the user taps **Enter**.

# Basic measurement

## Functional overview

### 2D mode

**Table 5-9: 2D-mode measurements**

| Measurement item | Measure tool | Description | Remarks |
|---|---|---|---|
| Distance | --- | Measures the distance between the specified two points | |
| Area | Ellipse | Measures the diameter, circumference, and area by circling the target part | |
| | Free Trace | Measures the length of the trace line (the travel distance of the caliper) and the area circled with the trace line | |
| Trace | --- | Measures the length of the trace line (the travel distance of the caliper) | |

**Table 5-9: 2D-mode measurements**

| Measurement item | Measure tool | Description | Remarks |
|---|---|---|---|
| %Steno Dist | --- | Calculates the stenosis ratio by measuring the original vessel lumen diameter and the residual lumen diameter at the stenosis site with two lines | First line measures the original vessel lumen diameter. Second line measures the residual lumen diameter at the stenosis site. |
| %Steno Area | 2 Ellipse | Calculates the stenosis ratio by measuring the original vessel lumen area and the residual lumen area at the stenosis site with two ellipses | First ellipse measures the original vessel lumen area. Second ellipse measures the residual lumen area at the stenosis site. |
| | Ellipse/Trace | Calculates the stenosis rate by measuring the original vessel lumen area with Ellipse and the residual lumen area with Free Trace | Ellipse measures the original vessel lumen area.<br>Free Trace measures the residual lumen area at the stenosis site. |

**Table 5-9: 2D-mode measurements**

| Measurement item | Measure tool | Description | Remarks |
|---|---|---|---|
| Volume | --- | Calculates the volume of a spheroid by measuring the diameter in three different directions (long axis, short axis, and the longest diameter of cross-section perpendicular to the long axis) on two orthogonal cross-sections | The following do not cancel the measurement:<br>▸ The screen is unfrozen.<br>▸ The Dual-screen mode is activated.<br>▸ The CF mode is turned on or off.<br>The measurement value is held in memory until calculation becomes possible. |
| Ratio Dist | --- | Calculates the ratio between two lines | |
| Ratio Area | 2 Ellipse | Calculates the ratio between two areas measured with two ellipses | |
| | Ellipse/Trace | Calculates the ratio between the area measured with Ellipse and the one measured with Free Trace | |
| Angle | 3 Line | Calculates the angle at the intersection of three lines by adjusting their position and angle | |
| | 2 Line | Calculates the angle at the intersection of two lines by adjusting their position and angle | |
| | 3 Point | Specifies the starting, middle, and ending points; connects the starting and middle points, and the middle and ending points, with a line; calculates the angle at the middle point | |

## CF mode

**Table 5-10: CF-mode measurements**

| Measurement item | Measure tool | Description | Remarks |
|---|---|---|---|
| Point Velocity | --- | Measures the flow velocity at the position specified by the caliper | Available only when the image is frozen |
| Area Velocity | --- | Measures the flow velocity within the range specified by Ellipse | Available only when the image is frozen |

## M mode

**Table 5-11: M-mode measurements**

| Measurement item | Measure tool | Description | Remarks |
|---|---|---|---|
| Distance | --- | Calculates the distance between two points by specifying two calipers on the same time phase | |
| Time | --- | Measures the time between the specified two lines | |
| HR | --- | Measures the heart rate by specifying two lines and measuring the time between them | |
| Slope | --- | Specifies two calipers; connects the specified two points and measures the time, amplitude, and velocity based on the gradient of the line | |

## D mode

**Table 5-12: D-mode measurements**

| Measurement item | Measure tool | Description | Remarks |
|---|---|---|---|
| Velocity | --- | Measures the blood velocity at the two points specified with calipers and calculates the flow velocity difference and the flow velocity ratio based on the measured values | |

**Table 5-12: D-mode measurements**

| Measurement item | Measure tool | Description | Remarks |
|---|---|---|---|
| Velocity Trace | Free | When a waveform is traced, displays a caliper on the maximum and minimum flow velocity points within the range and then measures each item | |
| | Auto | ▸ Specifies the range of automatic tracing with two lines<br>▸ Displays a caliper on the maximum and minimum flow velocity points within the two lines and then measures each item | |
| Time | --- | Measures the time between the specified two lines | |
| HR | --- | ▸ Specifies the heart rate and two lines<br>▸ Measures the heart rate based on the number of heartbeats and the time between the two lines | |
| Acceleration | --- | Measures the acceleration between the two points specified with calipers | |
| Deceleration | --- | Measures the deceleration between the two points specified with calipers | |
| PI | Free | When a waveform is traced, displays a caliper on the maximum and minimum flow velocity points within the range and then measures the pulsatility index | |
| | Auto | ▸ Specifies the range of automatic tracing with two lines<br>▸ Displays a caliper on the maximum and minimum flow velocity points within the two lines and then measures the pulsatility index | |
| RI | --- | Measures the resistance index by specifying two points with calipers | |

## 2D/D mode

**Table 5-13: 2D/D-mode measurements**

| Measurement item | Measure tool | Description | Remarks |
|---|---|---|---|
| Volume Flow (MnV) | --- | ▸ Measures the mean velocity on the D-mode image<br>▸ Measures the cross-sectional area on the 2D-mode image<br>▸ Calculates the flow volume, based on the measured values | |

# Measurement results display

By default, the measurements that you obtain appear in the lower left of the examination screen (on the main monitor).

**To show or hide the measurement results**

1 If the measurement screen for the mode you are in is not already showing, on the control panel, press the **MEASURE** button (

).

2 To toggle between showing and hiding measurement results, press the switch menu button 4 (the rocker button under **Result Display**).

**To change the location of the measurement-results display**

1 If the measurement screen for the mode you are in is not already showing, on the control panel, press the **MEASURE** button (

).

2 To toggle between positions, press the switch menu button 5 (the rocker button under **Result Position**).

## LV mass

When A epi, A endo, and LVL are measured, the following items display

**Table 5-14: LV mass measurement items**

| LV mass | | | Measurement item |
|---|---|---|---|
| t | --.-- | cm | Mean LV myocardial thickness |

**Table 5-14: LV mass measurement items**

| LV mass | | | Measurement item |
|---|---|---|---|
| LVM | | g | LV mass |
| LVMI | | $g/ml^2$ | LV mass index |

## Cardiac measurement (D mode)

Pulmonary vein: When PVS, VTI, and PVD VTI are measured, the following item display

**Table 5-15: Pulmonary vein measurement item**

| Pulmonary vein | | | Measurement item |
|---|---|---|---|
| Pv SYS Frac | --.-- | % | PV systolic filling fraction |

## Cardiac measurement (aortic regurgitation)

Aortic regurgitant volume: PISA method

When the AR trace has already been measured, the following items display:

**Table 5-16: AR volume measurement items**

| AR volume | | | Measurement item |
|---|---|---|---|
| RV (PISA) | --.-- | ml | AR regurgitant volume flow |
| ERO (PISA) | | $cm^2$ | AR effective regurgitant orifice area |
| FR (PISA) | | ml/s | AR regurgitant fraction |

## Abdominal measurement (2D mode)

Pancreas size measurement: example of main monitor display)

**Table 5-17: Pancreas measurement items**

| Pancreas | | | Measurement item |
|---|---|---|---|
| head | --.-- | cm | Pancreas head diameter |
| body | | cm | Pancreas body diameter |
| tail | | cm | Pancreas tail diameter |

**Table 5-17: Pancreas measurement items**

| Pancreas | | | Measurement item |
|---|---|---|---|
| P-duct | | cm | Pancreas duct diameter |

Renal measurement (example of main monitor display)

**Table 5-18: Renal measurement item**

| Rt/ Renal-A | | | Measurement item |
|---|---|---|---|
| Dist | --.-- | mm | Renal artery diameter |

## Abdominal measurement (D mode)

## Aorta measurement (example of main monitor display)

**Table 5-19: Aorta measurement items**

| Aorta AP prox. | | | Measurement item |
|---|---|---|---|
| Peak V | --.-- | cm/s | Peak velocity |
| Max V | --.-- | cm/s | Maximum velocity |
| Min V | --.-- | cm/s | Minimum velocity |
| MnV | --.-- | cm/s | Mean velocity |
| PI | --.-- | | Pulsatility index |
| RI | --.-- | | Resistance index |
| S/D | | | S/D ratio |

Renal artery measurement

**Table 5-20: Renal artery measurement items**

| Rt. Renal Art. | | | Measurement item |
|---|---|---|---|
| Max V | --.-- | cm/s | Maximum velocity |
| Min V | --.-- | cm/s | Minimum velocity |
| MnV | --.-- | cm/s | Mean velocity |
| PI | --.-- | | Pulsatility index |

**Table 5-20: Renal artery measurement items**

| Rt. Renal Art. | | | Measurement item |
|---|---|---|---|
| RI | --.-- | | Resistance index |
| S/D | | | S/D ratio |

## Abdominal measurement (2D mode)

Hip angle measurement (example of main monitor display)

**Table 5-21: Hip angle measurement items**

| Hip angle right | | | Measurement item |
|---|---|---|---|
| α | --.-- | ° | Bony roof angle (angle alpha) |
| β | | ° | Cartilage roof angle (angle beta) |

## Urological measurement (2D mode)

Bladder volume measurement (example of main monitor display)

**Table 5-22: Bladder volume measurement items**

| Void volume | | | Measurement item |
|---|---|---|---|
| Pre-Post. | --.-- | ml | Void volume |

# 2D mode

With the factory settings of basic measurement for 2D mode, you can measure distance without tapping **Distance** on the touch panel.

## Distance

**To measure the distance between two points**

1 On the control panel, press the **MEASURE** button (

).

2 If **Distance** is not already selected on the measurement selection screen of the touch panel, tap it.

**Distance** is the factory default selection for selecting measurements.

The start-point caliper appears on the screen.

3 Use the trackball to move the start-point caliper (the + mark), and then, to fix it, press the **SET** button (

).

The end-point caliper appears, superimposed on the start-point caliper.

4 Use the trackball to move the end point, and then fix it by pressing the **SET** button.

The distance as measured between the two points appears in the lower left of the main monitor. The distance is measured from the first point to the second, so it is assigned to the first point.

To measure more than one straight-line distance at once, repeat steps 3 and 4.

5 Multiple measurements are listed each below the previous one.

The following illustration shows the examination image with three measurements. Note the display of the measurements in the lower left. Note also that the distance is reported for the starting point of each measurement. The distance is thus reported as the distance from the starting point.

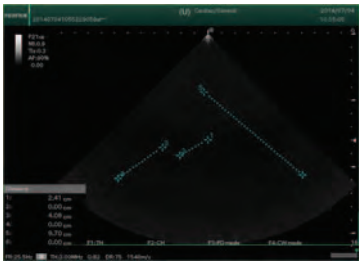


Figure 5-22: Three straight line measurements

## Trace

A trace measurement measures the length of the freehand line that you create with the trackball.

**To create a trace measurement**

1 On the control panel, press the **MEASURE** button (

).

2 Tap **Trace**.

The start-point caliper (a + mark) appears on the screen.

3 Use the trackball to move the start point, and then, to fix it, press the **SET** button (

).

4 The end-point caliper appears, superimposed on the start-point caliper.

5 Use the trackball to move the end point.

A line tracing the movements of the trackball appears on the screen.

6 To fix the end point of the trace and the trace, press the **SET** button.

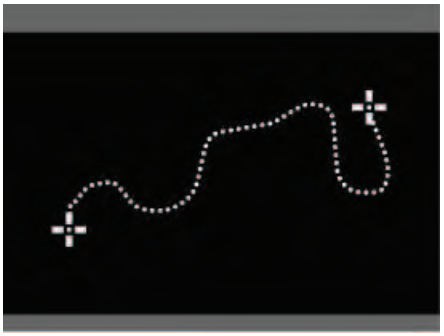


Figure 5-23: A trace measurement

The trace line is also fixed, and the distance between the two points is evaluated.

The distance following the trace is measured and appears in the lower left of the main monitor. The distance is measured from the first point to the second, so it is assigned to the first point.

## Area

With the factory setting, Ellipse is the default Measure tool.

**To measure an area with Ellipse**

1 Tap **Area** to display the start-point caliper (the + mark).

2 Use the trackball to move the start point, and then fix it by pressing the **SET** button (

).

3 The end-point caliper appears, superimposed on the start point.

4 Moving the end point with the trackball, adjust the diameter of the circle, and then fix it by pressing the **SET** button.

**5** To make the circle an ellipse, do one of the following:

- To narrow the circle's width, rotate the trackball upward.
- To widen the width of the circle, rotate the trackball downward.

**6** When the width of the circle or ellipse is fixed, the area of the circle is evaluated.

**To measure an area with Trace**

- For the procedure, see "Trace" on page 223.

The measurement display looks like the following:

**Table 5-23: Trace measurement item**

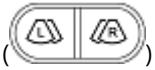
| Area | | | Measurement item |
|---|---|---|---|
| Area(1) | __._ | cm | Measurement result |
| Circ(1) | __._ | cm | Measurement result |

## Volume

The volume is calculated by measuring the diameter in three different directions on two orthogonal cross-sections.

We recommend that you create two orthogonal cross-sections (long and short axes) on the Dual screen before measuring.

**To calculate volume with two orthogonal cross-sections on two screens**

**1** Use the **L/R** buttons (  ) for the Dual screen to display a long-axis cross-section on one screen and a short-axis cross-section on the other screen.

**2** Press the **MEASURE** button (

).

**3** To display the start-point caliper, tap **Volume**.

**4** To draw the first line (the X axis), use the trackball to move the start point, and then fix it by pressing the **SET** button (

).
The end-point caliper appears, superimposed on the start point.

5 Move the end point with the trackball, and then fix it by pressing the **SET** button.

6 To draw the second line (the Y axis), repeat steps 4 through 5.

7 On the short-axis cross-section, measure the length of the first and second lines (the X and Y axes).

For the procedure to do so, see "Trace" on page 223.

8 On the long-axis cross-section, measure the length of the third line (the Z axis) in the same way.

9 When you have measured the length of the first, second, and third lines, the volume is evaluated.

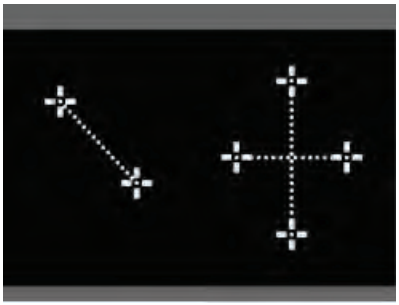


Figure 5-24: Measurement of three axes

**To calculate volume with two orthogonal cross-sections on a single screen**

1 Press the **MEASURE** button (

).

2 To display the start-point caliper, tap **Volume**.

3 On the short-axis cross-section, measure the length of the first and second lines (the X and Y axes).

For the procedure to do so, see "Distance" on page 246.

4 Unfreeze the image.

5 On the long-axis cross-section, measure the length of the third line (the Z axis) in the same way.

6 When you have measured the length of the first, second, and third lines, the volume is evaluated.

The measurement display looks like the following:

**Table 5-24: Volume measurement items**

| Volume | | | Measurement item |
|---|---|---|---|
| x(1) | __._ | cm | Longest diameter of short-axis cross-section |
| y(1) | __._ | cm | Shortest diameter of short-axis cross-section |
| z(1) | __._ | cm | Longest diameter of long-axis cross-section |
| vol(1) | __._ | $cm^3$ | Volume |

## Ratio

You can calculate the ratio between two measured values (distance or area).

### Ratio distance

**To calculate the ratio between two distance values**

**1** Press the **MEASURE** button (

).

**2** To display the start-point caliper, tap **Ratio Dist.**

**3** To measure the distance between the first two points, use the procedure in "Distance" on page 246.

**4** Measure the distance between the second two points in the same way.

**5** When you have measured the distance between the first two points and that between the second two points, the ratio is evaluated.

**Table 5-25: Ratio measurement items**

| Ratio dist | | | Measurement item |
|---|---|---|---|
| A(1) | __._ | cm | Distance between the first two points |
| B(1) | __._ | cm | Distance between the second two points |
| A/B(1) | __._ | | Ratio (Dist1)/(Dist2) |

## Ratio area

### To calculate the ratio between two area values

**1** Press the **MEASURE** button ( ).

**2** Tap **Ratio Area** to display the start-point caliper.

**3** Press the switch menu button 2 (the rocker button under **Measure tool**) to switch to **Ellipse/Trace**.

With the factory setting, **Ellipse/Trace** is the default initial setting for the tool.

Figure 5-25: Example of two areas

Or, to measure the area ratio between two ellipses, press the switch menu button 2 to switch **Measure tool** to **2 Ellipses**.

**4** Measure the first area by following the procedure described in "Area-length" on page 228.

**5** Measure the second area by following the procedure described in"Trace" on page 223.

Or, if you are measuring the areas of two ellipses, repeat step 4.

**6** When you have measured the two areas, the ratio is evaluated.

The measurement display looks like the following:

### Table 5-26: Ratio area measurement items

| Ratio Area | | | Measurement item |
|---|---|---|---|
| A(1) | —·— | $cm^2$ | First area |
| B(1) | —·— | $cm^2$ | Second area |

**Table 5-26: Ratio area measurement items**

| Ratio Area | | | Measurement item |
|---|---|---|---|
| A/B(1) | __._ | | Ratio (Area1)/(Area2) |

## %Stenosis (Stenosis ratio)

The following two types of methods are available for evaluating the stenosis ratio:

- Calculation based on diameter: %Steno Dist
- Calculation based on cross-sectional area: %Steno Area

### %Stenosis distance

**To obtain the ratio between two stenosis distance measurements**

**1** Press the **MEASURE** button (

).

**2** Tap **%Steno Dist** to display the start-point caliper for the original vessel lumen diameter.

**3** Use the trackball to move the start point, and then fix it by pressing the **SET** button (

).

**4** The end-point caliper appears, superimposed on the start point.

**5** Use the trackball to move the end point, and then fix it by pressing the **SET** button.

The original vessel lumen diameter is measured.

**6** Measure the residual lumen diameter at the stenosis site in the same way.

**7** When you have measured both diameters, the stenosis ratio is evaluated.

The measurement display looks like the following:

**Table 5-27: Stenosis distance measurement items**

| %Steno dist | | | Measurement item |
|---|---|---|---|
| V(1) | __._ | cm | Original vessel lumen diameter |
| R(1) | __._ | cm | Residual lumen diameter at stenosis site |

**Table 5-27: Stenosis distance measurement items**

| %Steno dist | | | Measurement item |
|---|---|---|---|
| Steno(1) | __._ | % | Stenosis ratio<br>(V - R)/V x 100 |

## %Stenosis area

**To obtain the ratio between two stenosis distance measurements**

**1** Press the **MEASURE** button ( ).

**2** Tap **%Steno Area** to display the start-point caliper.

With the factory setting, the Measurement tool is by default set to **Ellipse/Trace**

To evaluate the stenosis ratio between two ellipses, switch the measure tool to **2 Ellipses** by pressing the switch menu button 2 (the rocker button under **Measure tool**).

**3** Measure the original vessel lumen area by following the procedure described in "Trace area" on page 224.

**4** Measure the residual lumen area at the stenosis site by following the procedure described in "Trace" on page 223.

**5** When you have measured the original vessel lumen area and the residual lumen area, the stenosis ratio is evaluated.

Figure 5-26: Measuring the percent stenosis area

The measurement display looks like the following:

**Table 5-28: Stenosis area measurement items**

| %Steno dist | | | Measurement item |
|---|---|---|---|
| V(1) | __._ | $cm^2$ | Original vessel lumen area |
| R(1) | __._ | $cm^2$ | Residual lumen area at stenosis site |
| Steno(1) | __._ | % | Stenosis ratio<br>(V - R)/V x 100 |

## Angle

The following three methods are available for angle measurement.

- Three line (3 Line)

  Use three lines to calculate two angles. You can use this method for measuring hip dislocation.

- Two line (2 Line)

  Use two lines to calculate two angles.

- Three point (3 Point)

  Specify three points to calculate an angle.

With the factory setting, **3 Line** is the default method.

### 3 Line

**To calculate two angles with three lines**

1 Press the **MEASURE** button (

).

2 Tap **Angle**.

3 Make sure that under **Measure tool**, **3 Line** shows.

If **3 Line** is not on-screen, press the switch menu button 2 (the rocker button under **Measure tool**) until **3 Line** appears.

Three lines appear.

**4** Use the trackball to adjust the position of the first line.

**5** Rotate the multi dial ( ) to adjust the angle of the first line.

**6** Press the **SET** button ( ) to fix the first line.

**7** Repeat steps 4 through 6 to adjust the second line and then the third line.

The angle between the first and second lines and the angle between the first and third lines are measured.

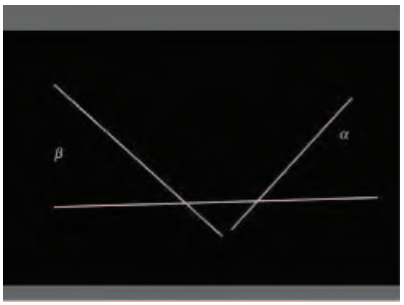



Figure 5-27: Three lines, defining two angles

**Note** The normal values (α=60°, β=55°) are set as the initial angles for this measurement.

The measurement display looks like the following:

**Table 5-29: Table. 3-line angle measurement items**

| Angle | | | Measurement item |
|---|---|---|---|
| α(1) | ____ | ° | Angle between the first and second lines (Bony roof angle) |
| β(1) | ____ | ° | Angle between the first and third lines (Cartilage roof angle) |

## 2 Line

### To calculate two angles with two lines

**1** Press the **MEASURE** button (

).

**2** Tap **Angle**.

**3** Three lines appear.

**4** To switch the measure tool to **2 Line**, press the switch menu button 2 (the rocker button under **Measure tool**).

**5** Use the trackball to adjust the position of the first line.

**6** Rotate the multi dial (
) to adjust the angle of the first line.

**7** Press the **SET** button (

) to fix the first line.

**8** Repeat Steps 5 through 7 to fix the second line.

**9** The angle between the first and second lines is measured.

The measurement display looks like the following:

### Table 5-30: 2-line angle measurement items

| Angle | | | Measurement item |
|---|---|---|---|
| α(1) | _____ | ° | Angle between the first and second lines |
| β(1) | _____ | ° | 180 - α |

## 3 Point

### To calculate an angle with three points

**1** Press the **MEASURE** button (

).

**2** Tap **Angle**.

Three lines appear.

3 To switch the measure tool to **3 Point**, press the switch menu button 2 (the rocker button under **Measure tool**).

4 Use the trackball to move the start-point caliper (the + mark), and then press the **SET** button (

) to fix it.

The second point appears, superimposed on the start point.

5 Use the trackball to move the second point, and then fix it by pressing the **SET** button.

The end point appears, superimposed on the second point.

Use the trackball to move the end point, and then fix it by pressing the **SET** button.

When you have fixed all three points, the angle between the line connecting the start and middle points and the one connecting the middle and end points is measured.

The measurement display looks like the following:

**Table 5-31: 3-point angle measurement item**

| Angle | | | Measurement item |
|---|---|---|---|
| α(1) | ____ | ° | Angle made by three points |

# CD mode

The CD mode measurement screen has two measurement tools:

- Point Vel, for measuring velocity at a point
- Area Vel, for measuring velocity over an area

**Caution** You can use the Point Vel and Area Vel measurement tools only when the displayed image is frozen.

## Point velocity

**To measure flow velocity at a specified point**

1 Press the **MEASURE** button (

).

2 Tap **Point Vel**.

The point caliper (the + mark) appears.

3 Use the trackball to move the point caliper, and then press the **SET** button (

) to fix it.

The flow velocity at the specified point is measured.

The measurement display looks like the following:

**Table 5-32: Point velocity measurement item**

| Point Vel | | | Measurement item |
|---|---|---|---|
| 1 | __._ | cm/s | Point velocity |

## Area velocity

**To measure flow velocity for an area**

1 Make sure that the image is frozen.

2 Press the **MEASURE** button (

).

3 Tap **Area Vel**.

The point caliper (the + mark) appears.

4 To specify the area, use the procedure in "Ellipse" on page 228.

After you have specified the area, the maximum and average values of the color-flow or power Doppler within the area are measured.

The measurement display looks like the following:

**Table 5-33: Area velocity measurement item**

| Area Vel | | | Measurement item |
|---|---|---|---|
| maxV | __._ | cm/s | Maximum flow velocity |
| ave V | __._ | cm/s | Average flow velocity |

# M mode

The CF mode measurement screen has the following measurement tools:

- Distance
- Time
- Slope
- HR

## Distance

This tool measures the distance between two points on the same time phase of the M-mode image.

**To measure distance between two points**

1 Press the **MEASURE** button (

).

2 Tap **Distance**.

The start-point caliper appears.

3 Use the trackball to move the start point, and then press the **SET** button (

) to fix it.

The end-point caliper appears, superimposed on the start point.

4 Use the trackball to move the end point, and then fix it by pressing the **SET** button.

The distance between the two points is measured.

When a single measurement is performed, the measurement display looks like the following:

**Table 5-34: Distance measurement item**

| Distance | | | Measurement item |
|---|---|---|---|
| Dist(1) | __._ | cm | Measurement result |

## Time

This tool measures the time between two points on the M-mode image.

**To measure time between two points**

1 Press the **MEASURE** button (

).

2 Tap **Time**.

The start-point caliper appears on a vertical line.

3 Use the trackball to move the start point and line, and then press the **SET** button (

) to fix them.

The end-point caliper and line appear, superimposed on the start point and line.

4 Use the trackball to move the end point and line, and then fix them by pressing the **SET** button.

The time between the first and second lines is measured.

When you perform a single measurement, the measurement display looks like the following

**Table 5-35: Time measurement item**

| Time | | | Measurement item |
|---|---|---|---|
| ⊿ t(1) | _ | ms | Time between two points |

## HR (heart rate)

This tool measures the heart rate based on the time between two points on the M-mode image.

**To measure time between two points**

1 Press the **MEASURE** button (

).

2 Tap **HR**.

The start-point caliper appears on a vertical line.

3 To change the number heartbeats used for calculating the passage of time, press switch menu 3 (the rocker button under **Beat**).

The possible number of beats is 1, 2, or 3.

To change the default **Beat** setting, see "Configuring measurements for all modes" on page 56.

4 Use the trackball to move the start point and line, and then press the **SET** button (

) to fix them.

The end-point caliper and line appear, superimposed on the start point and line.

5 Use the trackball to move the end point and line, and then fix them by pressing the **SET** button.

The heart rate is evaluated based on the time between the first and second lines.

When you perform a single measurement, the measurement display looks like the following:

**Table 5-36: Heart rate measurement items**

| HR | | | Measurement item |
|---|---|---|---|
| ⊿ t(1) | _ | ms | Time between two points (corresponding to heartbeat(s)) |
| HR | _ | bpm | Heart rate |
| (1) | _ | beat | Number of heartbeats |

## Slope (velocity measurement)

This tool measures the time and velocity between two points on the M-mode image.

**To measure time between two points**

1 Press the **MEASURE** button (

).

2 Tap **Slope**.

The start-point caliper appears on a vertical line.

3 Use the trackball to move the start point and line, and then press the **SET** button (

) to fix them.

The end-point caliper and line appear, superimposed on the start point and line.

4 Use the trackball to move the end point and line, and then fix them by pressing the **SET** button.

The two points are joined by a dotted line.

The velocity, amplitude, and time are evaluated based on the gradient of the line between the two points.

When a single measurement is performed, the measurement display looks like the following:

**Table 5-37: Slope measurement items**

| Slope | | | Measurement item |
|---|---|---|---|
| dist(1) | _._ | ms | Distance between two points |
| ⊿ t(1) | __ | ms | Time difference between two points |
| V(1) | _._ | cm/s | Velocity<br>(Distance between two points)/( ⊿ t) |

# D mode

The D-mode measurement screen includes the following measurement tools:

- Velocity
- Trace
- PI
- Time
- Accel
- Decel
- RI
- Volume Flow (MnV)
- Velocity Trace
- Vessel Diam
- HR

## Velocity

When you specify two points, this tool calculates the blood velocity difference and velocity ratio.

**To measure blood velocity difference and ratio**

1 Press the **MEASURE** button ( ).

2 Tap **Velocity**.

The start-point caliper appears on a horizontal line.

3 Use the trackball to move the start point and line, and then press the **SET** button ( ) to fix them.

The end-point caliper and line appear, superimposed on the start point and line.

4 Use the trackball to move the end point and line, and then fix them by pressing the **SET** button.

The two points are joined by a dotted line.

Figure 5-28: Start and end points for measuring blood-flow velocities and their ratio

The tool measures the blood velocity at the two points and calculates the flow-velocity difference and the flow-velocity ratio between the two points.

When a single measurement is performed, the measurement display looks like the following:

**Table 5-38: Velocity measurement items**

| Velocity | | | Measurement item |
|---|---|---|---|
| V(1) | __._ | cm/s | Blood velocity at start point |
| V(2) | __._ | cm/s | Blood velocity at end point |
| ⊿V(1) | __._ | cm/s | Velocity difference |
| PPG(1) | __._ | mmHg | Pressure gap of maximum blood velocity |

**Table 5-38: Velocity measurement items**

| Velocity | | | Measurement item |
|---|---|---|---|
| Ratio(1) | __._ | | Blood velocity ratio |

## PI (Pulsatility index)

The PI measurement tool calculates blood-flow information such as PI, RI (resistance index), and S/D (systolic-to-diastolic ratio) by tracing the Doppler waveform.

The following two types of tracing methods are available.

- Auto

  Each value is calculated by automatically tracing the Doppler waveform between two lines.

  With the factory setting, **Auto** is the default.

- Free

  Each value is calculated with free tracing.

**To calculate blood-flow information**

**1** Press the **MEASURE** button (

).

**2** Tap **PI**.

**3** To select a measure tool:

Press the switch menu button 2 (the rocker button under **Measure tool**) to switch between **Auto** and **Free**.

- When using **Auto**, specify a range equivalent to one heartbeat period.
- When using **Free**, you can adjust PSV (peak systolic flow velocity) and EDV (end diastolic velocity).

  For details, see "RI (resistance index)" on page 268.

**4** Use the trackball to move the first line and fix it by pressing the **SET** button (

).

The second line appears.

**5** Use the trackball to move the second line and fix it by pressing the **SET** button.

6 When the second line is fixed, the waveform between the first and second lines is traced, and each value is evaluated.

The measurement display looks like the following:

**Table 5-39: Pulsatility index measurement items**

| PI | | | Measurement item |
|---|---|---|---|
| MnV(1) | __._ | cm/s | Mean velocity |
| MnPG(1) | __._ | mmHg | Mean pressure gap |
| PSV(1) | __._ | cm/s | Peak systolic flow velocity |
| EDV(1) | __._ | cm/s | End diastolic velocity |
| PI(1) | __._ | | Pulsatility Index |
| RI(1) | __._ | | Resistance Index |

## Time

**To measure the time between two points on the Doppler waveform**

1 Press the **MEASURE** button (

).

2 Tap **Time**.

The start-point caliper appears on a vertical line.

3 Use the trackball to move the start point and line, and then press the **SET** button (

) to fix them.

The end-point caliper and line appear, superimposed on the start point and line.

4 Use the trackball to move the end point and line, and then fix them by pressing the **SET** button.

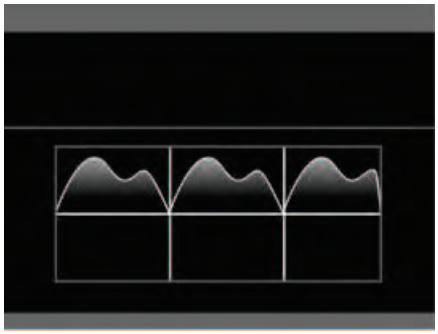


Figure 5-29: Doppler waveform with the start and end points set

**5** The tool measures the time between the first and second lines.

When a single measurement is performed, the measurement display looks like the following:

**Table 5-40: Time measurement item**

| Time | | | Measurement item |
|---|---|---|---|
| ⊿ t(1) | _ | ms | Time between two points |

## Acceleration or deceleration

The tool calculates acceleration or deceleration when you specify two points.

**To calculate acceleration or deceleration**

**1** Press the **MEASURE** button (

).

**2** Tap **Accel** or **Decel**.

The start-point caliper appears on a vertical line.

**3** Use the trackball to move the start point and line, and then press the **SET** button (

) to fix them.

The end-point caliper and line appear, superimposed on the start point and line.

**4** Use the trackball to move the end point and line, and then fix them by pressing the **SET** button.

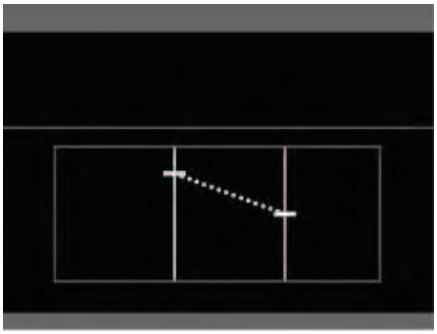


Figure 5-30: Start and end points for evaluating acceleration or deceleration

**5** The tool evaluates the acceleration or deceleration between the first and second lines.

The measurement display for acceleration looks like the following:

**Table 5-41: Velocity acceleration measurement items**

| Velocity | | | Measurement item |
|---|---|---|---|
| ⊿ t(1) | __.__ | ms | Time between two points |
| ⊿ V(1) | __.__ | m/s | Velocity difference between two points |
| ACC(1) | __.__ | $m/s^2$ | Acceleration |

The measurement display for deceleration looks like the following:

**Table 5-42: Velocity deceleration measurement items**

| Velocity | | | Measurement item |
|---|---|---|---|
| ⊿ t(1) | __.__ | ms | Time between two points |
| ⊿ V(1) | __.__ | m/s | Velocity difference between two points |
| DEC(1) | __.__ | $m/s^2$ | Deceleration |

## RI (resistance index)

The tool calculates the resistance index by specifying two points, PSV (peak systolic flow velocity) and EDV (end diastolic velocity).

**To calculate the resistance index**

1 Press the **MEASURE** button (

).

2 Tap **RI**.

The start-point caliper appears on a vertical line.

3 Use the trackball to move the start point and line, and then press the **SET** button (

) to fix them.

The end-point caliper and line appear, superimposed on the start point and line.

4 Use the trackball to move the end point and line, and then fix them by pressing the **SET** button.

5 The RI measurement tool evaluates the resistance index between the first and second points.

The measurement display looks like the following:

**Table 5-43: Resistance index measurement items**

| RI | | | Measurement item |
|---|---|---|---|
| PSV(1) | __._ | cm/s | Peak systolic flow velocity |
| EDV(1) | __._ | cm/s | End diastolic velocity |
| RI(1) | __._ | | Resistance index |
| S/D(1) | __._ | | Systolic / Diastolic velocity ratio |

## Velocity trace

This tool traces the Doppler waveform, to calculate information on blood flow, such as:

- VTI
- Mean velocity
- Mean pressure gap

The following two types of tracing methods are available:

- Auto

  Each value is calculated by automatically tracing the Doppler waveform between two lines.

In the factory setting, **Auto** is the default.

- Free

  Each value is calculated with free tracing.

### To calculate blood-flow information

1 Press the **MEASURE** button ( ).

2 Tap **Vessel Diam**.

3 In the screen's upper image, draw the blood vessel's diameter, using the technique for drawing the diameter that is described in Figure 5-9, "Examples of figures to create" on page 227.

4 Tap **Trace**.

5 Press the switch menu button 2 (the rocker button under **Measure tool**) to select **Auto** or **Free**.

**Note** | When you use **Auto**, specify a range equivalent to one heartbeat period.

- If you use **Auto**:

**a** Use the trackball to move the first line, and then press the **SET** button ( ) to fix it.

The second line appears, superimposed on the first.

**b** Use the trackball to move the second line, and then fix it by pressing the **SET** button.

Figure 5-31: Doppler waveform with two lines set

- If you use **Free**:

**c** Use the trackball to trace the waveform.

To trace the waveform, use the technique described in "Trace" on page 247.

**d** Press the **SET** button to fix the trace line.

A caliper is displayed on the maximum and minimum flow velocity values within the specified range.

**e** Use the trackball to move the caliper to the maximum flow velocity value, and then fix it by pressing the **SET** button.

When you rotate the trackball to the left, the caliper moves toward the start point of the trace line.

When you rotate the trackball to the right, the caliper moves toward the end point.

**f** Move the caliper to the minimum flow velocity value by repeating step c, and then fix it by pressing the **SET** button.

When the maximum and minimum flow velocities are fixed, each value is evaluated.

The measurement display looks like the following:

**Table 5-44: Velocity trace measurement items**

| Velocity trace | | | Measurement item |
|---|---|---|---|
| VTI(1) | __._ | m | Velocity time integral |
| MnV(1) | __._ | cm/s | Mean velocity |
| MnPG | __._ | mmHg | Mean pressure gap |
| PSV(1) | __._ | cm/s | Peak systolic flow velocity |
| EDV(1) | __._ | cm/s | End diastolic velocity |
| PI(1) | __._ | | Pulsatility index |
| RI(1) | __._ | | Resistance index |
| S/D(1) | __._ | | Systolic / diastolic velocity ratio |

## Volume flow

This tool calculates flow volume based on the mean velocity measured on the Doppler waveform and the cross-sectional area (CSA) measured on the B-mode image.

| | |
|---|---|
| **Caution** | Select the Doppler mode before measurement. |
| **Note** | You can also measure blood-flow volume by measuring Vessel Diam and then Velocity Trace. |

**To calculate blood-flow volume**

**1** Press the **MEASURE** button (

 ).

**2** Tap **Velocity Trace** in the Vol Flow (MnV) group to specify the tracing range with two lines.

**Auto** and **Free** are available for **Velocity Trace**. With the factory setting, **Auto** is the default.

**3** To measure the cross-sectional diameter, tap **Vessel Diam**.

The **Circle** and **Distance** measurement tools are available for **Vessel Diam**. In the factory setting, **Distance** is the default.

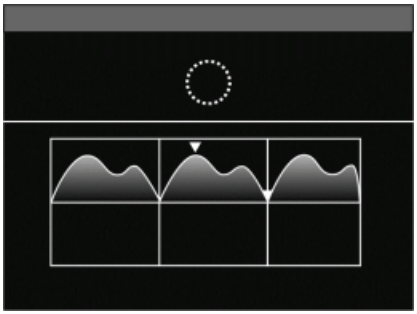


Figure 5-32: Measurement tools for flow volume

When you have measured velocity (with **Velocity Trace**) and vessel diameter, the flow volume is calculated.

The measurement display looks like the following:

**Table 5-45: Flow volume measurement items for velocity trace**

| Velocity trace | | | Measurement item |
|---|---|---|---|
| TAP(1) | __._ | m/s | Time averaged peak (Only when Trace type is 'Both') |
| PI(1) | __._ | | Pulsatility index (with TAP or MnV) |
| RI(1) | __._ | | Resistance index |
| MnV(1) | __._ | m/s | Mean velocity |

| Volume Flow | | | Measurement item |
|---|---|---|---|
| CSA(2) | __._ | $cm^2$ | Cross-sectional area |
| CSD(2) | __._ | cm | Cross-sectional diameter |
| VF(2) | __._ | ml/min | Volume Flow (with MnV) |

**Note**

Volume flow is calculated using the MnV value. To set the MnV value with Auto Trace, change Trace Type on the touch panel. To set the default calculation method, change Trace Measure Type on page 57.

When Trace type is 'Both', PI and RI are always calculated from peak trace.

## HR (heart rate)

**To evaluate the heart rate on the Doppler waveform**

1 Press the **MEASURE** button (

).

2 Tap **HR** to display the first line.

3 To change the number of heartbeats used for calculating the passage of time, press switch menu 3 (the rocker button under **Beat**).

The possible number of beats is 1, 2, or 3.

To change the default **Beat** setting, see "Configuring measurements for all modes" on page 56.

4 Use the trackball to move the first line, and then press the **SET** button (

) to fix it.

The second line appears, superimposed on the first.

**5** Use the trackball to move the second line, and then fix it by pressing the **SET** button.

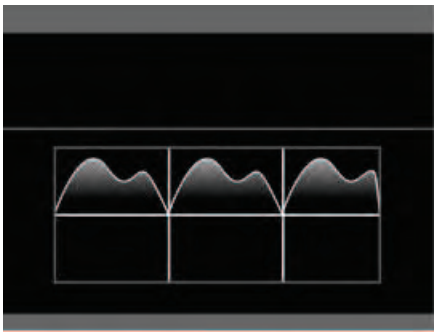


Figure 5-33: Doppler waveform with two lines set

The measurement tool evaluates the time between the first and second lines and the heart rate.

When a single measurement is performed, the measurement display looks like the following:

**Table 5-46: Time measurement items**

| Time | | | Measurement item |
|---|---|---|---|
| ⊿ t(1) | _ | ms | Time between two points |
| HR(1) | _ | bpm | Heart rate |
| (1) | _ | beat | Number of heartbeats |

# Settings

For details on configuring the measurement settings, see "Managing measurement functions" on page 56.

# Calculation formula

## 2D mode

**Table 5-47: Formula for 2D mode calculations**

| Name | Formula |
|---|---|
| Distance | =√{(X2-X1)^2+(Y2-Y1)^2} |

**Table 5-47: Formula for 2D mode calculations**

| Name | Formula |
|---|---|
| Area | =π×(LA)×(SA)/4 |
| | LA,SA[cm,mm] (Circle: LA=SA) |
| Stenosis | =\|(V)-(R)\|/(V)*100 |
| | Distance: V,R[cm,mm] |
| | Area: V,R[$cm^2$,$mm^2$] |
| Ratio | =(Dist1)/(Dist2) |
| | Dist1,Dist2[cm,mm] |
| | =(Area1)/(Area2) |
| | Area1,Area2[$cm^2$,$mm^2$] |
| Volume | =(π/6)×(x-ax)×(y-ax)×(z-ax) |
| | x-ax,y-ax,z-ax[cm,mm] |

## M mode

**Table 5-48: Formula for M mode calculations**

| Name | Formula |
|---|---|
| M-Distance | =(Y2)-(Y1) |
| M-Time | =(T2)-(T1) |
| | T2,T1[ms] |
| M-HR | =(60*@)/ ⊿t<br>@(Input value)[beat,cycle] |
| | ⊿t[s] |
| Slope | =(dist)/( ⊿t) |
| | dist[cm,mm], ⊿t[ms] |

## D mode

**Table 5-49: Formula for D mode calculations**

| Name | Formula |
|---|---|
| D-Time | =(T2)-(T1) |
| | T2,T1[ms] |
| D-HR | =(60*@)/ ⊿t<br>@(Input value)[beat,cycle] |
| | ⊿t[s] |
| Velocity | |
| PG | =4((V1)^2) |
| | V1[m/s] |
| ⊿V | =\|(V1)-(V2)\| |
| V1/V2 | =\|(V1)/(V2)\| |
| | V1,V2[cm/s,m/s] |
| VelocityTrace | |
| VTI | =∫Vel(t)dt |
| MnV | =(VTI)/ ⊿t |
| MnPG | =(4/ ⊿t)∫Vel^2(t)dt<br>( ⊿t = Flow duration) |
| PI | =\|((PSV)-(EDV))/(MnV)\|<br>\|PSV\|≥\|EDV\| |
| RI | =\|((PSV)-(EDV))/(PSV)\|<br>\|PSV\|≥\|EDV\| |
| S/D | =\|(PSV)/(EDV)\| |
| Acceleration,Deceleration | |
| ACC or DEC | =\|( ⊿V)/( ⊿t)\| |

## B/D mode

**Table 5-50: Formula for B/D mode calculations**

| Name | Formula |
|---|---|
| VolumeFlow | |
| VelocityTrace: | |
| MnV | =(VTI)/ ⊿ t |
| VesselDiam: | |
| CSA | =(π/4)×(CSD)^2 |
| CSD | :diameter |
| FV | =(MnV)×(CSA)×(60sec)×(Coef)<br>Coef=1.0 |

# Abbreviations

**Table 5-51: Abbreviations used**

| Abbreviation | Full spelling |
|---|---|
| ⊿ t | Difference in time |
| ⊿ V | Difference in velocity |
| ACC | Acceleration |
| Ave | Average |
| Coef | Coefficient |
| CSA | Cross-sectional area |
| CSD | Cross-sectional diameter |
| DEC | Deceleration |
| Diam | Diameter |
| Dist | Distance |
| EDV | End diastolic velocity |
| HR | Heart rate |
| Len | Length |
| MnPG | Mean pressure gradient |
| MnV | Mean velocity |
| PG | Pressure gradient |
| PI | Pulsatility index |
| PSV | Peak systolic flow velocity |
| R | Residual |
| RI | Resistance index |
| S/D | Systolic diastolic ratio, SD ratio |
| Steno | Stenosis |
| V | Velocity |
| Vel | Velocity |

**Table 5-51: Abbreviations used**

| Abbreviation | Full spelling |
|---|---|
| VF | Volume Flow |
| Vol | Volume |
| VTI | Velocity time integral |

# Cardiac measurement

## Functional overview

For terms and abbreviations used in the measuring tools, see "Terms and abbreviations" on page 367.

### 2D (B) mode

**Table 5-52: Descriptions of cardiac 2D-mode measurements**

| Measurement item | Description | Remarks |
|---|---|---|
| Distance/Area measurement | Aortic diameter, Aortic annulus diameter, Valsalva diameter, Sinotubular junction diameter, Valve area, Left atrial diameter, Left ventricular outflow tract diameter, Mitral annular distance, Left ventricular dimension, Wall thickness, Wall fractional thickening, Factional shortening, Ejection fraction, Left ventricular volume, Stroke volume, Cardiac output, Myocardial mass, Right / Left atrial longitudinal / transverse dimension, Right ventricular dimension, Right ventricular wall thickness, and Right ventricular fractional area change | Teichholz method<br>Pombo method<br>Gibson method<br>ASE method<br>Penn-Cube method |
| LV volume measurement | Left ventricular volume, Left ventricular length, Ejection fraction, Stroke volume, Cardiac output, and Left ventricular length difference | AL method<br>MOD method |
| LA volume measurement | Left atrial volume, Left atrial length, Ejection fraction, and Left atrial length difference | AL method<br>MOD method |

**Table 5-52: Descriptions of cardiac 2D-mode measurements**

| Measurement item | Description | Remarks |
|---|---|---|
| LV mass measurement | Left ventricular mass | ASE method<br>Penn-Cube method<br>AL method<br>TE method |

## M-mode

**Table 5-53: Summary of cardiac M-mode measurements**

| Measurement item | Description | Remarks |
|---|---|---|
| AO measurement | Right ventricular outflow tract diameter, Aortic diameter, Left atrial diameter, Left ventricular pre-ejection period and Left ventricular ejection time | |
| MV measurement | Mitral valve C-E amplitude, C-A amplitude, E-F slope, etc. and E point to septal separation | |
| LV measurement | Left ventricular dimension, Wall thickness, Wall fractional thickening, Factional shortening, Ejection fraction, Stroke volume, Cardiac output and Myocardial mass | Teichholz method<br>Pombo method<br>Gibson method<br>ASE method<br>Penn-Cube method |

## D mode

**Table 5-54: Summary of cardiac D-mode measurements**

| Measurement item | Description | Remarks |
|---|---|---|
| Aortic valve flow | Peak velocity, Mean velocity, Pressure gradient, and VTI | |
| Left ventricular outflow tract flow | Peak velocity, Mean velocity, Pressure gradient, VTI, Left ventricular pre-ejection period, Ejection time, and Acceleration time | |
| Aortic regurgitation | Peak velocity, VTI, End diastolic pressure gradient, and PHT | |

**Table 5-54: Summary of cardiac D-mode measurements**

| Measurement item | Description | Remarks |
|---|---|---|
| Mitral valve flow | E wave peak velocity, A wave peak velocity, E wave DcT, A wave duration, Peak velocity, Mean velocity, Pressure gradient, VTI, and PHT | |
| Mitral annulus flow | Peak velocity, Mean velocity, Pressure gradient, and VTI | |
| Mitral regurgitation | Peak velocity, Mean velocity, Pressure gradient, VTI, and dP/dt | |
| Pulmonary vein flow | Systolic wave peak velocity, Diastolic wave peak velocity, VTI, A wave velocity, and A wave duration | Time interval difference of A duration (PV-MV) |
| Pulmonary artery flow | Peak velocity, Pressure gradient, Right ventricular pre ejection period, Ejection time, and Acceleration time | |
| Pulmonic regurgitation | Peak velocity, Mean velocity, End diastolic pressure gradient, and VTI | Estimation of pulmonary artery pressure at end diastole |
| Tricuspid valve flow | E wave peak velocity, A wave peak velocity, E wave DcT, A wave duration, Peak velocity, Mean velocity, Pressure gradient, VTI, and PHT | |
| Tricuspid regurgitation | Peak velocity and Pressure gradient | Estimation of pulmonary artery pressure at systole |
| MPI | Myocardial Performance Index of right and left ventricles | (=Tei Index) |

**Table 5-55: Table. Summary of cardiac measurements for disease assessment**

| Purpose of measurement | Description | Remarks |
|---|---|---|
| Aortic stenosis<br>Aortic valve area calculation | Assessment of severity: calculate the aortic valve area and the pressure gradient between the left ventricle and the aorta. | Planimetry method<br>Continuity equation |

**Table 5-55: Table. Summary of cardiac measurements for disease assessment**

| Purpose of measurement | Description | Remarks |
|---|---|---|
| Aortic regurgitation<br>Regurgitant volume calculation | With the qualitative assessment, LVEDP is estimated and the regurgitant volume is assessed based on the regurgitation waveform.<br>With the quantitative assessment, the regurgitant volume, effective regurgitant orifice area, regurgitant fraction, etc. are calculated. | PHT method<br>PISA method<br>PW Doppler method<br>(=Volumetric method) |
| Mitral stenosis<br>Mitral valve area calculation | The severity is assessed by calculating the mitral valve area and the pressure gradient between the left ventricle and the left atrium. | Planimetry method<br>PISA method |
| Mitral regurgitation<br>Regurgitant volume calculation | With the quantitative assessment, the regurgitant volume, effective regurgitant orifice area, regurgitant fraction, etc. are calculated. | PISA method<br>PW Doppler method<br>(=Volumetric method) |
| Left ventricular systolic function and volume assessment | The left ventricular fractional shortening and the ejection fraction are calculated based on the left ventricular dimension.<br><br>With the left ventricular volume measurement, the left ventricular volume and the ejection fraction are assessed.<br>The dP/dt value is calculated based on the mitral regurgitation waveform.<br>The LV PEP/ET value (pre-ejection period divided by ejection time) decreases based on systolic failure. | Teichholz method<br>Pombo method<br>Gibson method<br>AL method<br>MOD method |
| Right/Left atrium assessment | Atrial enlargement is assessed by measuring the longitudinal and transverse dimension.<br>With the left atrial volume measurement, the left atrial volume and the ejection fraction are assessed. | AL method<br>MOD method |
| Left ventricular diastolic function assessment | Mitral valve flow measurement<br>Mitral annular velocity measurment<br>Pulmonary vein flow measurement | TDI method |

**Table 5-55: Table. Summary of cardiac measurements for disease assessment**

| Purpose of measurement | Description | Remarks |
|---|---|---|
| Right ventricle assessment | The right ventricular overload is assessed based on the measurement of right ventricular wall thickness and/or right ventricular dimension.<br>The systolic function is assessed based on the right ventricle fractional area change and RV PEP/ET measurements. | |
| Estimation of pulmonary artery pressures | The mean pulmonary artery pressure is estimated based on the PR maximum velocity.<br>The pulmonary artery diastolic pressure is estimated by adding the right atrial pressure to the end diastolic pressure gradient.<br>The pressure gradient between the right ventricle and the right atrium and other items are measured for evaluation after the tricuspid annuloplasty or prosthetic valve replacement.<br>The pulmonary artery systolic pressure is estimated by adding the right atrial pressure to the peak pressure gradient of the tricuspid regurgitation. | Manually input the right atrial pressure by observing the IVC. |
| Qp/Qs | Shunt diseases such as atrial septal defect and ventricular septal defect are assessed by calculating the pulmonic to systemic flow ratio based on the pulmonic circulation volume and the systemic circulation volume. | |
| MPI | The systolic and diastolic functions can be assessed with MPI (=Tei Index). | |

# Cross-sectional views for measurement

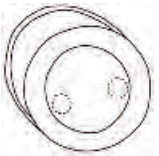
## 2D (B) mode

**Table 5-56: Left sternal border approach**

Left ventricular long axis view

Short axis view at aortic valve level (Right ventricular outflow tract)

Short axis view at mitral valve level

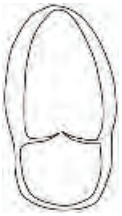


Short axis view at papillary muscle level

**Table 5-57: Apical approach**

Apical four-chamber view

Apical two-chamber view



Apical long axis view

## M mode

**Table 5-58: M-mode trace examples**

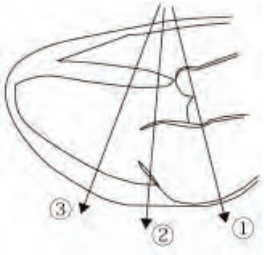
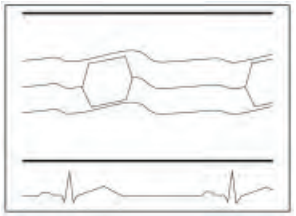
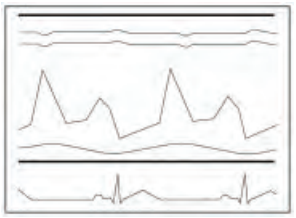


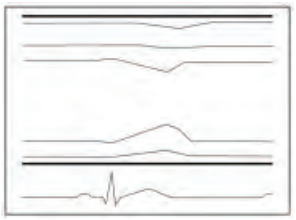
**Table 5-58: M-mode trace examples**



**1** M-mode image of aortic valve



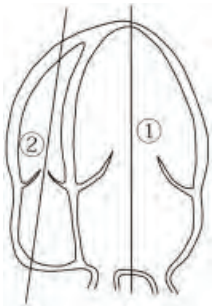
**2** M-mode image of mitral valve



**3** M-mode image of left ventricle

## D mode

**Table 5-59: Examples of cross-sectional views for recording blood-flow waveforms**




① Mitral valve waveform

Mitral annulus waveform

Mitral regurgitation waveform

② Tricuspid valve waveform

Tricuspid regurgitation waveform

**Table 5-59: Examples of cross-sectional views for recording blood-flow waveforms**

③ Pulmonary vein waveform

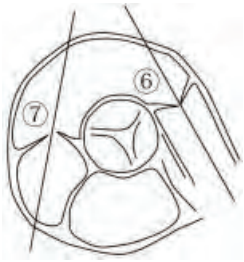
④ Left ventricular outflow tract waveform

Aortic valve waveform

Aortic regurgitation waveform

⑤ Mitral valve waveform

Mitral regurgitation waveform




⑥ Right ventricular outflow tract waveform

Pulmonary artery flow waveform

Pulmonic regurgitation waveform

⑦ Tricuspid valve waveform

Tricuspid regurgitation waveform

# Built-in measurement functions

## 2D (B) mode

### AO tab

**Table 5-60: Measurements on the AO tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| AV ann | AV ann | cm, mm | |
| AoD Val | AoD Val | cm, mm | |
| STJ | STJ | cm, mm | |
| LAD | LAD | cm, mm | |
| LVOT | LVOT | cm, mm | Used for calculating LVOT SV, |
| RVOT | RVOT | cm, m | |
| AVA trace | AVA (planimetry) | $cm^2$ | |
| | AVAI (planimetry) | $cm^2/ m^2$ | BSA needs to be input |
| AR radius | radius | cm | Used for AR PISA method |

### MV tab

**Table 5-61: Measurements on the MV tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| MVA trace | MVA (planimetry) | $cm^2$ | |
| MR radius | radius | cm | Used for MR PISA method |
| MS radius | radius | cm | Used for MS PISA method |
| MS angle | angle | ° | Used for MS PISA method |
| MA distA | distA | cm, mm | Used for calculating MVann SV |
| MA distB | distB | cm, mm | Used for calculating MVann SV |

## LV tab

**Table 5-62: Measurements on the LV tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| LV diastole | IVSd | cm, mm | Teichholz, Pombo, Gibson |
| | LVDd | cm, mm | |
| | LVPWd | cm, mm | |
| | EDV | ml | |
| | LVM | g | ASE, Penn-Cube |
| | LVMI | $g/m^2$ | BSA needs to be input |
| LV systole | IVSs | cm, mm | Teichholz, Pombo, Gibson |
| | LVDs | cm, mm | |
| | LVPWs | cm, mm | |
| | ESV | ml | |
| | FS | % | Displayed when LV diastole and systole are measured |
| | EF | % | |
| | SV | ml | |
| | CO | l/min | HR needs to be input |
| | SI | $ml/m^2$ | BSA needs to be input |
| | CI | $l/min/m^2$ | |
| | IVSFT | % | Displayed when IVSd and IVSs are measured |
| | LVPWFT | % | Displayed when LVPWd and LVPWs are measured |
| RVWd | RVWd | cm, mm | |
| RVDd | RVDd | cm, mm | |
| RVWs | RVWs | cm, mm | |
| RVDs | RVDs | cm, mm | |

### LV Vol tab

**Table 5-63: Measurements on the LV Vol tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| LV4 diast | EDV4 | ml | MOD, AL |
| | area, 4d | $cm^2$ | |
| | L4d | cm, mm | |
| LV4 sys | ESV4 | ml | MOD, AL |
| | area, 4s | $cm^2$ | |
| | L4s | cm, mm | |
| | EF4 | % | |
| LV2 diast | EDV2 | ml | MOD, AL |
| | area, 2d | $cm^2$ | |
| | L2d | cm, mm | |
| LV2 sys | ESV2 | ml | MOD, AL |
| | area, 2s | $cm^2$ | |
| | L2s | cm, mm | |
| | EF2 | % | |

**Table 5-63: Measurements on the LV Vol tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| Biplane | EDV | ml | Displayed when LV4 diast, LV4 sys, LV2 diast, and LV2 sys are measured MOD, AL |
| | ESV | ml | |
| | EF | % | |
| | SV | ml | |
| | CO | l/min | HR needs to be input |
| | EDVI | $ml/m^2$ | BSA needs to be input |
| | ESVI | $ml/m^2$ | |
| | SI | $ml/m^2$ | |
| | CI | $l/min/m^2$ | |
| | Ld diff | % | Length difference between 4ch and 2ch |
| | Ls diff | % | |

### LA Vol tab

**Table 5-64: Measurements on the LA Vol tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| LA4 max | V4 max | ml | MOD, AL |
| | area, 4max | $cm^2$ | |
| | L4 max | cm, mm | |
| LA4 min | V4 min | ml | MOD, AL |
| | area, 4min | $cm^2$ | |
| | L4 min | cm, mm | |
| | EF4 | % | |
| LA2 max | V2 max | ml | MOD, AL |
| | area, 2max | $cm^2$ | |
| | L2 max | cm, mm | |
| LA2 min | V2 min | ml | MOD, AL |
| | area, 2min | $cm^2$ | |
| | L2 min | cm, mm | |
| | EF2 | % | |
| Biplane | V max | ml | Displayed when LA4 max, LA4 min, LA2 max, and LA2 min are measured MOD, AL |
| | V min | ml | |
| | EF | % | |
| | VI max | $ml/m^2$ | BSA needs to be input |
| | VI min | $ml/m^2$ | |
| | L max diff | % | Length difference between 4ch and 2ch |
| | L min diff | % | |

### LV mass tab

**Table 5-65: Measurements on the LV mass tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| LV Mass (AL) | A epi | $cm^2$ | |
| | A end | $cm^2$ | |
| | LVL | cm, mm | |
| | t | cm, mm | Calculated based on A epi, A end, and LVL |
| | LVM (AL) | g | |
| | LVMI (AL) | $g/m^2$ | BSA needs to be input |
| LV Mass (TE) | A epi | $cm^2$ | |
| | A end | $cm^2$ | |
| | a | cm, mm | |
| | d | cm, mm | |
| | t | cm, mm | Calculated based on A epi, A end, a and d |
| | LVM (TE) | g | |
| | LVMI (TE) | $g/m^2$ | BSA needs to be input |

### Atrial tab

**Table 5-66: Measurements on the Atrial tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| Atrial dimension | LAL | cm, mm | |
| | LAT | cm, mm | |
| | RAL | cm, mm | |
| | RAT | cm, mm | |

### RV tab

**Table 5-67: Measurements on the RV tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| RVD (4ch) | RVD (4ch) | cm, mm | |
| RV FAC | RVd area | $cm^2$ | |
| | RVs area | $cm^2$ | |
| | RV FAC | % | Calculated based on RVd area and RVs area |

### Shunt tab

**Table 5-68: Measurements on the Shunt tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| Systemic diam | Sys diam | cm, mm | Used for calculating Qp/Qs |
| Pulmonic diam | Pulmo diam | cm, mm | |

## M mode

### AO tab

**Table 5-69: Measurements on the AO tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| RVOT | RVOT | cm, mm | |
| LA/AO | AoD | cm, mm | |
| | LAD | cm, mm | |
| | LA/AO | | Calculated based on AoD and LAD |
| LVPEP/ET | PEP | ms | |
| | ET | ms | |
| | PEP/ET | | Calculated based on LV PEP and LVET |

## LV tab

**Table 5-70: Measurements on the LV tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| LV diastole | IVSd | cm, mm | Teichholz, Pombo, Gibson |
| | LVDd | cm, mm | |
| | LVPWd | cm, mm | |
| | EDV | ml | |
| | LVM | g | ASE, Penn-Cube |
| | LVMI | $g/m^2$ | BSA needs to be input |
| LV systole | IVSs | cm, mm | Teichholz, Pombo, Gibson |
| | LVDs | cm, mm | |
| | LVPWs | cm, mm | |
| | ESV | ml | |
| | FS | % | Displayed when LVDd and LVDs are measured |
| | EF | % | |
| | SV | ml | |
| | CO | l/min | HR needs to be input |
| | SI | $ml/m^2$ | BSA needs to be input |
| | CI | $l/min/m^2$ | |
| | IVSFT | % | Displayed when IVSd and IVSs are measured |
| | LVPWFT | % | Displayed when LVPWd and LVPWs are measured |
| RVWd | RVWd | cm, mm | |
| RVDd | RVDd | cm, mm | |
| RVWs | RVWs | cm, mm | |
| RVDs | RVDs | cm, mm | |
| HR | HR | bpm | |

### MV tab

**Table 5-71: Table. Measurements on the MV tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| CE amp | CE amp | cm, mm | |
| CA amp | CA amp | cm, mm | |
| | E/A | | Calculated based on CE amp and CA amp |
| | A/E | | |
| EF slope | EF slope | cm/s | |
| EPSS | EPSS | cm, mm | |

## D mode

### AO tab

**Table 5-72: Table. Measurements on the AO tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| AoV vel | Vel | m/s, cm/s | |
| | PG | mmHg | |
| AoV trace | VTI | cm | Used for calculating AVA by continuity equation |
| | PV | m/s, cm/s | |
| | PPG | mmHg | |
| | MnV | m/s, cm/s | |
| | MnPG | mmHg | |
| LVOT vel | Vel | m/s, cm/s | |
| | PG | mmHg | |

**Table 5-72: Table. Measurements on the AO tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| LVOT trace | VTI | cm | Used for calculating:<br>LVOT SV and CO<br>AVA by continuity equation<br>LVOT/AoV (VTI)<br>Regurgitant volume of AR (PISA), AR (PW Doppler), and MR (PW Doppler) |
| | PV | m/s, cm/s | |
| | PPG | mmHg | |
| | MnV | m/s, cm/s | |
| | MnPG | mmHg | |
| | HR | bpm | |
| | Ratio (VTI) | | LVOT VTI to AoV VTI ratio |
| LVPEP | PEP | ms | |
| LVET | ET | ms | |
| LV AcT | AcT | ms | |
| LV PEP/ET | PEP/ET | | Based on LVPEP and LVET |
| LV AcT/ET | AcT/ET | | Based on LV AcT and LVET |
| AR trace | VTI | cm | Used for calculating regurgitant volume of AR (PISA) and AR (PED) |
| | PV | m/s, cm/s | |
| | PPG | mmHg | |
| | MnV | m/s, cm/s | |
| | MnPG | mmHg | |
| ARed V | V | m/s, cm/s | |
| | PG | mmHg | |
| AR PHT | PHT | ms | |
| | DcT | ms | |
| | Vmax | m/s | |
| | Slope | $cm/s^2$ | |

## MV tab

**Table 5-73: Measurements on the MV tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| MV flow | E vel | m/s, cm/s | |
| | E PG | mmHg | |
| | A vel | m/s, cm/s | |
| | A PG | mmHg | |
| | E/A | | Calculated based on MV E vel and MV A vel |
| | A/E | | |
| | DcT | ms | |
| | A dur | ms | Used for calculating Diff A dur |
| MV trace | VTI | cm | |
| | PV | m/s, cm/s | |
| | PPG | mmHg | |
| | MnV | m/s, cm/s | |
| | MnPG | mmHg | |
| MVA (PHT) | PHT | ms | |
| | MVA (PHT) | $cm^2$ | |
| | DcT | ms | |
| | Vmax | m/s | |
| MVann trace | VTI | cm | Used for calculating regurgitant volume of AR (PW Doppler), MR (PISA), and MR (PW Doppler) |
| | PV | m/s, cm/s | |
| | PPG | mmHg | |
| | MnV | m/s, cm/s | |
| | MnPG | mmHg | |
| MS Vmax (MVA PISA) | Vmax | m/s, cm/s | Used for calculating MVA (PISA) |
| | PGmax | mmHg | |

**Table 5-73: Measurements on the MV tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| MR trace | VTI | cm | |
| | PV | m/s, cm/s | |
| | PPG | mmHg | |
| | MnV | m/s, cm/s | |
| | MnPG | mmHg | |
| MR Vmax | Vmax | m/s, cm/s | |
| | PGmax | mmHg | |
| MR dP/dt | dt | ms | |
| | Vel 1 | m/s, cm/s | |
| | Vel 2 | m/s, cm/s | |
| | dP/dt | mmHg | |

## PV tab

### Table 5-74: Measurements on the PV tab

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| PV flow (vel) | PVS vel | m/s, cm/s | |
| | PVD vel | m/s, cm/s | |
| | DcT | ms | |
| | PVA vel | m/s, cm/s | |
| | PVA dur | ms | |
| | S/D | | Calculated based on PVS vel and PVD vel |
| | A dur (PV-MV) | ms | Calculated based on PVA dur and MV A dur |
| PV flow (VTI) | PVS VTI | cm | |
| | PVS PV | m/s, cm/s | |
| | PVD VTI | cm | |
| | PVD PV | m/s, cm/s | |
| | PV Sys. Frac. | % | Calculated based on PVS VTI and PVD VTI |

## Pulmo tab

### Table 5-75: Measurements on the Pulmo tab

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| PA vel | Vmax | m/s, cm/s | |
| | PGmax | mmHg | |
| RVPEP | PEP | ms | |
| RVET | ET | ms | |
| RV AcT | AcT | ms | |
| RV PEP/ET | PEP/ET | | Calculated based on RVPEP and RVET |

**Table 5-75: Measurements on the Pulmo tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| RV AcT/ET | AcT/ET | | Calculated based on RV AcT and RVET |
| PR Vmax | Vmax | m/s, cm/s | |
| | PGmax | mmHg | |
| PRed vel | vel | m/s, cm/s | |
| | PG | mmHg | |
| | PAP ed | mmHg | RA press needs to be input |
| RA press | RA press | mmHg | Estimated right atrial pressure is input manually |

### TV tab

**Table 5-76: Measurements on the TV tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| TV flow | E vel | m/s, cm/s | |
| | E PG | mmHg | |
| | A vel | m/s, cm/s | |
| | A PG | mmHg | |
| | E/A | | Calculated based on MV E vel and MV A vel |
| | A/E | | |
| | DcT | mmHg | |
| | A dur | ms | |
| TV trace | VTI | cm | |
| | PV | m/s, cm/s | |
| | PPG | mmHg | |
| | MnV | m/s, cm/s | |
| | MnPG | mmHg | |
| TR Vmax | Vmax | m/s, cm/s | |
| | PGmax | mmHg | |
| | PAP sys | mmHg | RA press needs to be input |
| RA press | RA press | mmHg | Estimated right atrial pressure is input manually |

### Shunt tab

**Table 5-77: Measurements on the Shunt tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| Systemic VTI | Sys VTI | cm | Used for calculating Qp/Qs |
| Pulmonic VTI | Pulmo VTI | cm | |

### MPI tab

**Table 5-78: Measurements on the MPI tab**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| MV c-o time | c-o time | ms | Used for calculating LV MPI |
| LVET | ET | ms | Linked with ET on AO tab |
| | LV MPI | | Calculated based on above two items |
| TV c-o time | c-o time | ms | Used for calculating RV MPI |
| RVET | ET | ms | Linked with ET on Pulmo tab |
| | RV MPI | | Calculated based on above two items |

**Table 5-79: TDI**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| e' (Sep) | e' (Sep) | cm/s | Measure by TDI-PW mode |
| a' (Sep) | a' (Sep) | cm/s | |
| e' (Lat) | e' (Lat) | cm/s | |
| a' (Lat) | a' (Lat) | cm/s | |
| e' (Inf) | e' (Inf) | cm/s | |
| a' (Inf) | a' (Inf) | cm/s | |
| e' (Ant) | e' (Ant) | cm/s | |
| a' (Ant) | a' (Ant) | cm/s | |

## Specifying the measures that are visible on CALCS tabs

**To specify the measurement items for the Cardiac preset**

**1** Display a report, and then switch to the Worksheet.

For information on how to do so, see "Worksheet/Report" on page 365.

**2** Tap the button whose visible measurement items you want to change.

The buttons represent groups of measurement items for the current preset.

3 In the **Check** column, make sure that a check mark is present for the measurement items that you want to be visible.

If the check mark is not present, tap in the column.

There may be more than one page of measurement items to select.

4 If there is more than one page of measurement items, then to see other pages, press switch menu button 4 (the rocker button under **Worksheet Page**).

5 When you have finished, tap **Close**.

# All modes: Accessing the cardiac measurement tabs

The procedures in the following sections tell you to select a tab, such as the **AO** tab, **LV** tab, etc. To make these tabs appear, use the following procedure.

**Note** When you switch modes, such as switching to CW mode when you are in 2D (B) mode, you may have to perform this step again.

**To access measurement tabs**

- In an examination, press the **FREEZE** button ( ) to freeze the image, and then press the **CALCS** button ( ).

# All modes: Deleting measurements

**To delete measurements on the examination display**

- Press the **DELETE** button (

).

# 2D (B) mode

## Aorta

You can measure AV ann, AoD val, STJ, or LAD with the following procedure.

**To measure AV ann, AoD val, STJ, or LAD**

1 Press the **2D** button, and display the left ventricular long-axis view.

2 Press the **CALCS** button, and then the **AO** tab.

3 On the touch panel, tap the desired measurement (**AV ann**, **AoD val**, **STJ**, or **LAD**).

4 Use the trackball to move the caliper to the start point and press the **SET** button (

).

5 Use the trackball to move the next caliper to the end point, and then press the **SET** button to finalize the measurement.

**Note**

With regard to LAD, measure the maximum end systolic diameter by selecting an appropriate image in the cine memory.

The measurement display looks like the following:

**Table 5-80: AV ann measurement item**

| AV ann | | | Measurement item |
|---|---|---|---|
| AV ann | _._ | cm | Aortic annulus diameter |

**Table 5-81: AoD val measurement item**

| AoD val | | | Measurement item |
|---|---|---|---|
| AoD val | _._ | cm | Valsalva diameter |

**Table 5-82: STJ measurement item**

| STJ | | | Measurement item |
|---|---|---|---|
| STJ | _._ | cm | Sinotubular junction diameter |

**Table 5-83: LAD measurement item**

| LAD | | | Measurement item |
|---|---|---|---|
| LAD | _._ | cm | Left atrial diameter |
| When you measure AoV and LAD, the following result appears: | | | |
| LA/AO | __._ | | LAD to AoV ratio |

## Left ventricular

When you measure IVS, LVD, and LVPW in this order, use the following procedure to select LV diastole and LV systole.

**Note** | To display SI and CI, you must input BSA.

When you select one of the items, only the selected item is measured.

**To measure IVS, LVD, and LVPW**

1 Display the left ventricular end diastolic or systolic view within the same cardiac cycle.

2 Press the **CALCS** button, and then the **LV** tab.

3 Select the **LV** tab on the touch panel, and tap **LV diastole** or **LV systole**.

4 Move the caliper to the start point of IVS measurement and press the **SET** button (

).

5 Move the displayed calipers to the end point of IVS, left ventricular posterior wall, and the ending point of LVPW, and fix them by pressing the **SET** button.

The measurement display looks like the following:

**Table 5-84: LV diastole and systole measurement items**

| LV diastole | | | Measurement item |
|---|---|---|---|
| IVSd | __._ | cm | Interventricular septum thickness, end diastole |
| LVDd | __._ | cm | LV dimension, end diastole |
| LVPWd | __._ | cm | LV posterior wall thickness, end diastole |
| EDV | __._ | ml | LV end diastolic volume |
| LVM (ASE) | __._ | g | LV mass |

| LV systole | | | Measurement item |
|---|---|---|---|
| IVSs | __._ | cm | Interventricular septum thickness, end systole |
| LVDs | __._ | cm | LV dimension, end systole |
| LVPWs | __._ | cm | LV posterior wall thickness, end systole |
| ESV | __._ | ml | LV end systolic volume |
| When you measure LV diastole and LV systole, the following measurements appear: | | | |
| FS | _._ | % | Fractional shortening |
| EF | _._ | % | LV ejection fraction |

**Note**

The measurements including LVMI, IVSFT, LVPWT, SV, SI, CO, and/or CI are displayed on the Report screen.

The formula used is set beforehand.

For CO and/or CI, you must input HR.

For LVMI, SI, and/or CI, you must input BSA.

## LV volume

**To complete the procedure**

**1** Press the **2D** button, and display the end diastolic apical four-chamber view.

**2** Press the **FREEZE** button and the **CALCS** button.

**3** Select the **LV vol (AL)** tab on the touch panel, and tap **LV4 vol (AL)**.

**4** Place the caliper on the mitral annulus on one side and press the **SET** button (

).

Use the trackball to trace the left ventricular endocardium up to the mitral annulus on the other side (end point) and press the **SET** button.

The tool measures the LV area.

**5** A line indicating the left ventricular length is automatically drawn from the midpoint of the line between the two mitral annuluses.

**6** Use the trackball to correct the axis and the position of cardiac peak when necessary and press the **SET** button.

The tool measures LVL.

**7** Display the end systolic view within the same cardiac cycle.

**8** Press the function button and repeat Steps 4 through 6.

**9** Display the end diastolic apical two-chamber view. Select **LV2 vol** using the touch panel.

**10** Repeat Steps 4 through 8.

**Note** Exclude papillary muscle or trabeculae carneae from cardiac muscle. Trace the outside of them.

The measurement display looks like the followingg:

**Table 5-85: LV4 measurement items**

| LV4 vol | | | Measurement item |
|---|---|---|---|
| area, 4d | --.-- | $cm^2$ | LV area, end diastole, 4ch |
| L4d | --.-- | cm | LV length, end diastole, 4ch |
| EDV4 | --.-- | ml | LV end diastolic volume, 4ch |
| area, 4s | --.-- | $cm^2$ | LV area, end systole, 4ch |
| L4s | --.-- | cm | LV length, end systole, 4ch |
| ESV4 | --.-- | ml | LV end systolic volume, 4ch |
| When LV4 volume is measured, the following item displays: | | | |
| EF4 | --.-- | % | LV ejection fraction, 4ch |

| LV2 vol | | | Measurement item |
|---|---|---|---|
| area, 2d | --.-- | $cm^2$ | LV area, end diastole, 2ch |
| L2d | --.-- | cm | LV length, end diastole, 2ch |
| EDV2 | --.-- | ml | LV end diastolic volume, 2ch |
| area, 2s | --.-- | $cm^2$ | LV area, end systole, 2ch |
| L2s | --.-- | cm | LV length, end systole, 2ch |
| ESV2 | --.-- | ml | LV end systolic volume, 2ch |

| LV2 vol | | | Measurement item |
|---|---|---|---|
| When LV2 volume is measured, the following item displays: | | | |
| EF2 | --.-- | % | LV ejection fraction, 2ch |

When LV4 volume and LV2 volume are measured, the following items are calculated using the Biplane method:

**Table 5-86: LV measurement items**

| Vol | | | Measurement item |
|---|---|---|---|
| EDV | --.-- | ml | LV end diastolic volume |
| ESV | --.-- | ml | LV end systolic volume |
| EF | --.-- | % | LV ejection fraction |

**Note**

You must input BSA in order to display EDVI, ESVI, SI and CI.

The measurements including SV, SI, CO, CI, EDVI, ESVI, LVLd diff, and/or LVLs diff are displayed on the Report screen.

The formula used is set beforehand.

For CO and/or CI, you must input HR.

## LA volume

**To complete the procedure**

1 Press the **2D** button, and display a maximum size of left atrium in four-chamber view within the cardiac cycle.

2 Press the **FREEZE** button and the **CALCS** button.

3 Select **LA Vol (AL)** tab on the touch panel, and tap **LA4 vol (AL)**.

4 Place the caliper on the mitral annulus on one side, and then press the **SET** button (

).

5 Use the trackball to trace the left atrial cavity up to the mitral annulus on the other side (end point) and press the **SET** button.

The LA area is measured.

A line indicating the left atrial length is automatically drawn from the midpoint of the line between the two mitral annuluses.

6 If necessary, use the trackball to correct the axis and the distance to the superior wall of the left atrial, and then press the **SET** button.

LAL is measured.

7 Press the function button to switch the trackball function to cine search, and display a minimum size of the left atrium within the same cardiac cycle.

8 Press the function button again, and repeat Steps 4 to 6.

9 Display two-chamber view. On the touch panel, select **LA2 vol (AL)**.

10 Repeat Steps 4 through 8.

**Note** When tracing, exclude the pulmonary vein from the left atrial lumen.

**Table 5-87: LA4 vol measurement items**

| LA4 vol | | | Measurement item |
|---|---|---|---|
| area, 4max | __._ | $cm^2$ | LA maximum area, 4ch |
| L4 max | __._ | cm | LA maximum length, 4ch |
| V4 max | __._ | ml | LA maximum volume, 4ch |
| area, 4min | | $cm^2$ | LA minimum area, 4ch |
| L4 min | | cm | LA minimum length, 4ch |
| V4 min | | ml | LA minimum volume, 4ch |
| When LA4 volume is measured, the following item appears: | | | |
| EF4 | __. | % | LV ejection fraction, 4ch |

| LA2 vol | | | Measurement item |
|---|---|---|---|
| area, 2max | __._ | $cm^2$ | LA maximum area, 2ch |
| L2 max | __._ | cm | LA maximum length, 2ch |
| V2 max | __._ | ml | LA maximum volume, 2ch |
| area, 2min | | $cm^2$ | LA minimum area, 2ch |
| L2 min | | cm | LA minimum length, 2ch |

| LA2 vol | | | Measurement item |
|---|---|---|---|
| V2 min | | ml | LA minimum volume, 2ch |
| When LA2 volume is measured, the following item appears. | | | |
| EF2 | __. | % | LV ejection fraction, 2ch |

When LA4 volume and LA2 volume are measured, the following items are calculated using the method shown in the table.

To display LAVI max and LAVI min, you must input BSA.

**Table 5-88: Volume measurement items**

| LA2 vol | | | Measurement item |
|---|---|---|---|
| V max | __._ | ml | LA maximum volume |
| V min | __._ | ml | LA minimum volume |
| EF | __._ | % | LA ejection fraction |

**Note**

LAVI max, LAVI min, L max diff and/or LAL min diff are displayed on the Report screen.

To display LAVI, you must input BSA.

## LV mass

**To complete the procedure using the Area-length (AL) method**

1 Press the **2D** button, and display the end diastolic left ventricular short-axis view at the papillary muscle level.

2 Press the **FREEZE** button and the **CALCS** button.

3 Select the **LV Mass** tab on the touch panel, and tap **LV Mass (AL)**.

The **A epi** measuring tool, a trace-area free trace tool, is automatically selected.

4 Place the caliper on the epicardial surface and press the **SET** button (

).

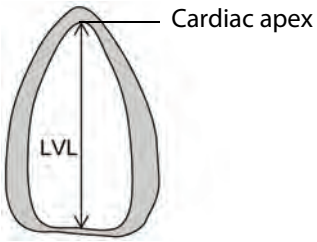
5 Trace the epicardial surface up to the end point and press the **SET** button.

The measuring tool selection automatically changes to **A endo**, which is also a trace-area free trace tool.

**6** Trace the endocardial surface by following the procedure described in Steps 4 and 5.

**7** Display the end diastolic four-chamber or two-chamber view.

**8** Measure the distance between the mitral annulus level and the cardiac peak using the trackball and press the **SET** button.




**To complete the procedure using the Truncated ellipsoid (TE) method**

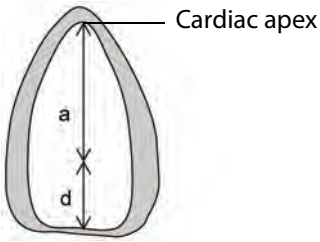
**1** Display the end diastolic left ventricular short-axis view at the papillary muscle level.

**2** On the touch panel, tap **LV Mass (TE)**.

**3** Carry out steps 4 through 7 of the area-length (AL) method.

**4** Measure the long-axis distance between the papillary muscle and the cardiac apex (a).

**5** Measure the long-axis distance between the papillary muscle and the mitral annulus level (d).




**WARNING** When tracing the epicardial and endocardial surfaces, exclude trabeculae carneae or papillary muscle.

**Note**

Select each button to perform each measurement again.

When measuring A epi or A endo, you can select **Free** or **Ellipse** by using the switch menu button 2 (the rocker button under **Measure tool**) to switch the measure tool.

When measuring the long-axis distance, select the view (four-chamber or two-chamber) that displays the long axis longer.

The measurement display looks like the following:

**Table 5-89: LV mass measurement items**

| LV mass (AL) | | | Measurement item |
|---|---|---|---|
| A epi | __._ | $cm^2$ | Epicardial area |
| A endo | __._ | $cm^2$ | Endocardial area |
| LVL | __._ | cm | LV length |
| When you measure A epi, A endo, and LVL, the following measurements appear: | | | |
| t | __._ | cm | Mean LV myocardial thickness |
| LVM | __._ | g | LV mass |

| LV mass (TE) | | | Measurement item |
|---|---|---|---|
| A epi | __._ | $cm^2$ | Epicardial area |
| A endo | __._ | $cm^2$ | Endocardial area |
| a | __._ | cm | Left ventricular length (Cardiac apex - Papillary muscle level) |
| d | __._ | cm | Left ventricular length (Papillary muscle - Mitral annulus level) |
| When you measure A epi, A endo, a, and d, the following measurements appear: | | | |
| t | __._ | cm | Mean LV myocardial thickness |
| LVM | __._ | g | LV mass |

To display LVMI, you must input BSA.

LVMI is displayed on the Report screen.

## Atrial

**To complete the procedure**

1 Press the **2D** button, display the apical four-chamber view and select the time phase in which the atria are fully expanded.

2 Press the **FREEZE** button and the **CALCS** button.

3 Select the **Atrial** tab on the touch panel, and tap **Atrial dimension**.

By default, the **LAL** tool is selected.

4 Measure the following distances:

- From the mitral annulus level to the superior wall
- From the left atrial cavity to the interatrial septum on the left atrial side
- From the tricuspid annulus level to the superior wall of the right atrium
- From the right atrial cavity to the interatrial septum on the right atrial side

The measurement display looks like the following:

**Table 5-90: Atrial dimension measurement items**

| Atrial dimension | | | Measurement item |
|---|---|---|---|
| LAL | __._ | cm | LA longitudinal dimension |
| LAT | __._ | cm | LA transverse dimension |
| RAL | __._ | cm | RA longitudinal dimension |
| RAT | __._ | cm | RA transverse dimension |

## Right ventricular

**To complete the RVD (4ch) procedure**

1 Press the **2D** button, and display the end-diastolic apical four-chamber view.

2 Press the **FREEZE** button and the **CALCS** button.

3 Select the **RV** tab on the touch panel, and tap **RVD (4ch)**.

4 Place the caliper on the right ventricular endocardium and press the **SET** button (

).

5 Measure the distance to the IVS on the right ventricular side and press the **SET** button.

**To complete the RV FAC procedure**

1 Press the **2D** button, and display the end diastolic apical four-chamber view.

2 Press the **FREEZE** button and the **CALCS** button.

3 On the touch panel, tap **RV FAC**.

4 Place the caliper on the tricuspid annulus on one side and press the **SET** button (

).

5 Trace the right ventricular endocardial surface up to the tricuspid annulus on the other side (end point) and press the **SET** button.

6 Press the function button to switch the trackball function to cine search, and display the end systolic image.

7 To return to measurement, press the function button again.

8 Measure the area in the same way as in steps 4 and 5.

The measurement display looks like the following:

**Table 5-91: RVD measurement items**

| RVD (4ch) | | | Measurement item |
|---|---|---|---|
| RVD (4ch) | __._ | cm | RV transverse dimension, diastole (4ch) |

| RV FAC | | | Measurement item |
|---|---|---|---|
| RVd area | __._ | $cm^2$ | RV area, diastole |
| RVs area | __._ | $cm^2$ | RV area, systole |
| When you measure the RVd area and RVs area, the following measurement appears: | | | |
| RV FAC | __._ | % | RV fractional area change |

# M mode

## Aorta

When you select **LA/AO** or **LV PEP/ET**, two measurements are performed continuously. When you select one of the other items (**RVOT**, **AoD**, **LAD**, **LVPEP**, or **LVET**), only the measurement that you select is performed.

**To measure the RVOT**

1 Press the **M** button and record the M-mode image of the aortic valve.

2 Press the **FREEZE** button and the **CALCS** button.

3 Select the **AO** tab on the touch panel, and tap **RVOT**.

4 Place the caliper on the end-diastolic right ventricular endocardium and press the **SET** button (

).

5 Place the caliper on the aortic anterior wall and press the **SET** button.

**To measure the LA/AO**

1 Select the **AO** tab.

2 On the touch panel, tap **LA/AO**.

3 Measure AoD, and then LAD.

4 Place the caliper on the end-diastolic and aortic anterior wall and press the **SET** button (

).

5 5Place the caliper on the aortic posterior wall and press the **SET** button.

6 Move the caliper to the time phase where the left atrium is fully expanded, place it on the left atrial anterior wall, and press the **SET** button.

7 Place the caliper on the left atrial posterior wall and press the **SET** button.

**To measure the LV PEP/ET**

1 Select the **AO** tab.

2 On the touch panel, tap **LV PEP/ET**.

**3** Measure LVPEP, and then LVET.

**4** Place the caliper on the onset of the ECG Q wave and then press the **SET** button (

).

**5** Place the caliper on the opening point of aortic valve and press the **SET** button.

**6** Place the caliper on the closing point of aortic valve and press the **SET** button.

The measurement display looks like the following

**Table 5-92: RVOT measurement items**

| RVOT | | | Measurement item |
|---|---|---|---|
| RVOT | __._ | cm | Right ventricular outflow tract diameter |

| LA/AO | | | Measurement item |
|---|---|---|---|
| AoD | _._ | cm | Aortic diameter |
| LAD | _._ | cm | Left atrial diameter |
| When you measure AoV and LAD, the following measurement appears: | | | |
| LA/AO | __._ | | LAD to AoV ratio |

| LV PEP/ET | | | Measurement item |
|---|---|---|---|
| PEP | _ | ms | LV pre ejection period |
| ET | _ | ms | LV ejection time |
| When you measure PEP and ET, the following measurement appears: | | | |
| PEP/ET | __._ | | PEP to ET ratio |

## Left ventricular

In the following procedures, when you select one of the items, only the item that you selected is measured.

When you measure IVS, LVD, and LVPW in this order, select LV diastole and LV systole and follow the procedure below.

**To complete the RVW/RVD procedure**

1 Press the **M** button and record the M-mode image of the left ventricle.

2 Press the **FREEZE** button and the **CALCS** button.

3 On the touch panel, still in M mode, tap the **LV** tab and select the item from **RVWd**, **RVDd**, **RVWs** and **RVDs**.

4 Measure the distance which you selected.

**To complete the LV diastole, LV systole procedure**

1 Select the **LV** tab.

2 On the touch panel, tap **LV diastole**.

3 Place the caliper on the start point of IVS measurement and press the **SET** button (

).

4 Place the displayed calipers on the end point of IVS, left ventricular posterior wall, and the end point of LVPW, and fix them by pressing the **SET** button.

5 On the touch panel, tap **LV systole**.

6 Use the trackball and the **SET** button to measure as you did for LV diastole.

The measurement display looks like the following.

**Table 5-93: Left ventricular measurement items**

| RVWd | | | Measurement item |
|---|---|---|---|
| RVWd | __._ | cm | RV wall thickness, diastole |

| RVDd | | | Measurement item |
|---|---|---|---|
| RVDd | __._ | cm | RV diameter, diastole |

| LV diastole | | | Measurement item |
|---|---|---|---|
| IVSd | __._ | cm | Interventricular septum thickness, end diastole |
| LVDd | __._ | cm | LV dimension, end diastole |
| LVPWd | __._ | cm | LV posterior wall thickness, end diastole |

| LV diastole | | | Measurement item |
|---|---|---|---|
| When you measure IVSd, LVDd and LVPWd, the following measurements appear: | | | |
| EDV | __._ | ml | LV end-diastolic volume |
| LVM | __._ | g | LV mass |

| RVWs | | | Measurement item |
|---|---|---|---|
| RVWs | __._ | cm | RV wall thickness, systole |

| RVDs | | | Measurement item |
|---|---|---|---|
| RVDs | __._ | cm | RV diameter, systole |

| LV systole | | | Measurement item |
|---|---|---|---|
| IVSs | __._ | cm | Interventricular septum thickness, end systole |
| LVDs | __._ | cm | LV dimension, end systole |
| LVPWs | __._ | cm | LV posterior wall thickness, end systole |
| When you measure LVDs, the following item appears: | | | |
| ESV | __._ | ml | LV end-systolic volume |
| When you measure LV diastole and LV systole, the following measurements appear: | | | |
| FS | _._ | % | Fractional shortening |
| EF | _._ | % | LV ejection fraction |

**Note**

The measurements including LVMI, IVSFT, LVPWT, SV, SI, CO, and/or CI are displayed on the Report screen.

The formula used is set beforehand.

For CO and/or CI, you must input HR.

For LVIM, SI, and/or CI, you must input BSA.

## Mitral valve

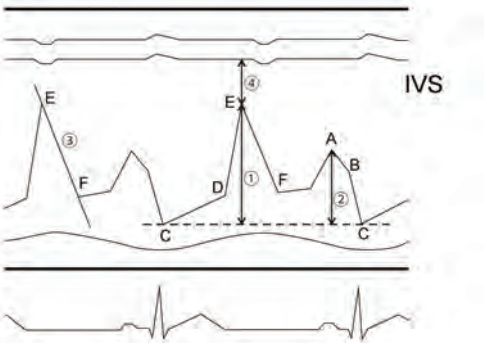



Figure 5-34: Reference for CE amp and CA amp

**To complete the CE amp, CA amp procedure**

**1** Record the M-mode image of the mitral valve.

**2** Press the **FREEZE** button and the **CALCS** button.

**3** On the touch panel, select the MV tab, then tap **CE amp**.

In Figure 5-34: ① indicates the measurement point.

**4** Place the caliper on Point E, and press the **SET** button (

).

**5** Place the caliper level with Point C and press the **SET** button to measure the C-E amplitude.

**6** On the touch panel, tap CA **amp** and repeat steps as above to measure the C-A amplitude ②.

**To measure the E-F slope** ③

**1** On the touch panel, select the **MV** tab.

**2** On the touch panel, tap **EF slope**.

**3** Place the caliper on Point E in Figure 5-34, and press the **SET** button (

).

**4** Use the trackball to align the displayed line with the E-F slope, and press the **SET** button.

**To measure the distance between the IVS and Point E ④**

**1** On the touch panel, select the **MV** tab.

**2** On the touch panel, tap **EPSS**.

**3** Place the caliper on the IVS on the left ventricular side and press the **SET** button (

).

**4** Place the caliper on Point E, and press the **SET** button.

For these procedures, the measurement display looks like the following:

**Table 5-94: Mitral valve measurement items**

| CE amp | | | Measurement item |
|---|---|---|---|
| CE amp | __._ | cm | C-E amplitude |

| CA amp | | | Measurement item |
|---|---|---|---|
| CA amp | __._ | cm | C-A amplitude |
| When you measure C-E amp and C-A amp, the following measurements appear: | | | |
| E/A | __._ | | CE amp to CA amp ratio |
| A/E | __._ | | CA amp to CE amp ratio |

| EF slope | | | Measurement item |
|---|---|---|---|
| EF slope | __._ | cm/s | Mitral valve E-F slope |

| EPSS | | | Measurement item |
|---|---|---|---|
| EPSS | __._ | cm | E point to septal separation |

# D mode

## Aortic valve

**To measure flow velocity with a caliper: AoV vel and LVOT vel**

**1** Press the **2D** button and display the apical left ventricular long-axis view.

2 Record each waveform in PW or CW mode, and press the **FREEZE** button and the **CALCS** button.

3 Select the **AO** tab on the touch panel, and tap either **AoV vel** or **LVOT vel**.

4 Place the caliper on the peak velocity, and then press the **SET** button (

).

The measurement display looks like the following:

**Table 5-95: Aortic valve measurement items**

| AoV vel | | | Measurement item |
|---|---|---|---|
| vel | __._ | m/s | Aortic valve velocity |
| PG | __._ | mmHg | Aortic valve pressure gradient |

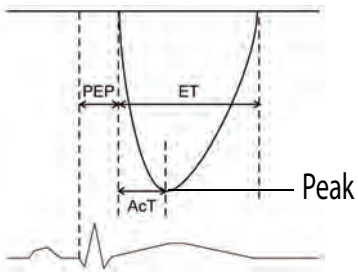
| LVOT vel | | | Measurement item |
|---|---|---|---|
| vel | __._ | m/s | Left ventricular outflow tract velocity |
| PG | __._ | mmHg | Left ventricular outflow tract pressure gradient |

**To complete the LV PEP/ET and LV AcT/ET procedure**

1 Select the **AO** tab on the touch panel.

2 On the touch panel, tap either **LV PEP**, **LVET**, or **LV AcT** and use the calipers to measure the time referring to the figure below.

- For LVPEP, measure the time between the start point of the ECG Q wave and the start point of the waveform.
- For LVET, measure the time between the start and end points of the waveform.
- For LV AcT, measure the time between the start point and the peak of the waveform.



The measurement display looks like the following:

**Table 5-96: LV PEP/ET measurement items**

| LVPEP | | | Measurement item |
|---|---|---|---|
| PEP | _ | ms | LV pre ejection period |

| LVET | | | Measurement item |
|---|---|---|---|
| ET | _ | ms | LV ejection time |
| When you measure LVPEP and LVET, the following measurement appears: | | | |
| PEP/ET | __._ | | LV PEP to ET ratio |

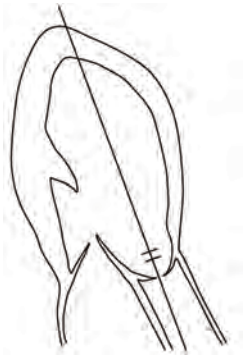
| LVAcT | | | Measurement item |
|---|---|---|---|
| AcT | _ | ms | LV acceleration time |
| When you measure LVET and LV AcT, the following measurement appears. | | | |
| AcT/ET | __._ | | LV AcT to ET ratio |

Perform the following two procedures.

**To measure cardiac output with LVOT trace**

**1** Press the **2D** button and display the apical long axis view.

**2** Record the left ventricular outflow tract waveform, and press the **FREEZE** button and the **CALCS** button.



**3** Select the **AO** tab on the touch panel, and tap **LVOT trace**.

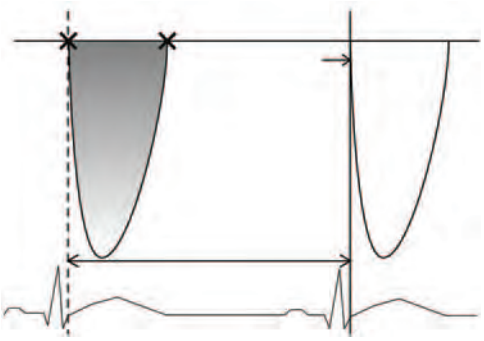
4 Press the **SET** button (

) at the starting point of the left ventricular outflow tract flow.

5 Use the trackball to trace the outline of the waveform and press the **SET** button at the end point.

6 On the touch panel, tap the HR.

7 Place the caliper on the start point of the waveform, press the **SET** button, and then press the **SET** button again at the start point of the next waveform.



**Note** | For HR, any number can be entered on the worksheet.

**To complete the LVOT procedure**

1 Press the **2D** button.

2 Display the systolic left ventricular outflow tract in the left ventricular long-axis view.

- To enlarge the image, press the **DEPTH/ZOOM** button (
), and then press the up-arrow side of the rocker button below.

3 Press the **FREEZE** button and the **CALCS** button.

4 Select the **AO** tab on the touch panel, and tap **LVOT**.

5 Measure the left ventricular outflow tract diameter with calipers, and press the **SET** button (

).

Measure either of these two items first, as necessary.

The measurement display looks like the following:

**Table 5-97: LVOT trace measurement items**

| LVOT trace | | | Measurement item |
|---|---|---|---|
| VTI | __._ | cm | Left ventricular outflow tract flow VTI |
| PV | __._ | m/s | LVOT peak velocity |
| PPG | __._ | mmHg | LVOT peak pressure gradient |
| MnV | __._ | m/s | LVOT mean velocity |
| MnPG | __._ | mmHg | LVOT mean pressure gradient |

| HR | | | Measurement item |
|---|---|---|---|
| HR | __ | bpm | Heart rate |

| LVOT | | | Measurement item |
|---|---|---|---|
| LVOT | __._ | cm | Left ventricular outflow tract diameter |
| area | __._ | $m^2$ | LVOT cross-sectional area |
| When you measure LVOT VTI, HR, and LVOT, the following items appear | | | |
| LVOT SV | __._ | ml | Stroke volume |

**Note**

The measurements including SI, CO, and/or CI are displayed on the Report screen.

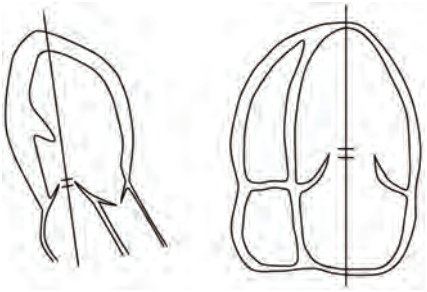
To display SI and CI, you must input BSA.

## Mitral valve

**To complete the MV flow procedure**

1 Press the **D** button, in the apical long-axis view or apical four-chamber view, and record the blood flow at the mitral valve leaflet tips level in the PW mode.

**2** Press the **FREEZE** button and the **CALCS** button.



**3** Select the **MV1** tab on the touch panel, and tap **MV flow**.

By default, the **MV E vel** tool is selected.

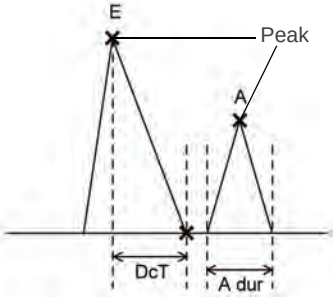
**4** Place the caliper on the peak of the E wave and press the **SET** button (

).

**5** Use the trackball to align the line that appears with the deceleration slope of the E wave, and press the **SET** button.

**6** Place the caliper on the peak of the A wave, and press the **SET** button.

**7** To measure the A wave duration:




**a** Place the caliper on the start point of the A wave, and press the **SET** button.

**b** Place the caliper on the end point of the A wave, and press the **SET** button.

The measurement display looks like the following:

**Table 5-98: MV flow measurement items**

| MV flow | | | Measurement item |
|---|---|---|---|
| E vel | __._ | m/s | MV E velocity |
| E PG | __._ | mmHg | MV E vel pressure gradient |
| DcT | __ | ms | MV E wave deceleration time |
| A vel | __._ | m/s | MV A velocity |
| A PG | __._ | mmHg | MV A vel pressure gradient |
| A dur | __ | ms | MV A wave duration |
| When you measure MV E vel and MV A vel, the following item appears: | | | |
| E/A | __._ | | MV E vel to A vel ratio |

## Mitral Annulus Velocity (TDI-PW mode)

**To calculate the mitral annulus velocity**

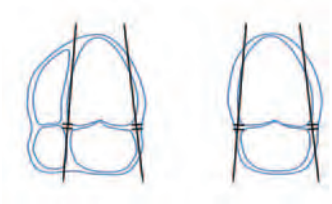
The operation procedure applies to the following calculation:

e' (Sep), a' (Sep), e' (Lat), a' (Lat), e' (Inf), a' (Inf), e' (Ant), a' (Ant)

**1** Press the **D** button and select the **TDI** tab on the touch panel.

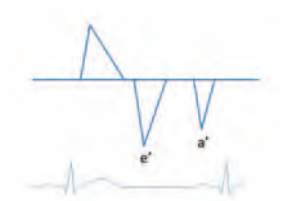
**2** Display the apical four-chamber (4ch) or two-chamber (2ch) view, and select the TDI mode on the touch panel. And then record the PW wave form.

**3** Press the **FREEZE** button and the **CALCS** button.



**4** Select the **TDI** tab and then **e' (Sep)** on the touch panel.

**5** Move caliper to top of the e' wave and press **SET**.




The measurement display looks like the following:

**Table 5-99: Mitral annulus velocity measurement items**

| e'(Sep) | | | Measurement Part |
|---|---|---|---|
| e'(Sep) | ___._ | cm /s | e' velocity (Sep) |
| When you measure MV E vel, the display looks like the following: | | | |
| E/e'(Sep) | ___._ | | E vel / e'(Sep) ratio |

| a'(Sep) | | | Measurement Part |
|---|---|---|---|
| a'(Sep) | ___._ | cm /s | a' velocity (Sep) |

| e'(Lat) | | | Measurement item |
|---|---|---|---|
| e'(Lat) | ___._ | cm /s | e' velocity (Lat) |
| When you measure MV E vel, the display looks like following: | | | |
| E/e'(Lat) | ___._ | | E vel / e'(Lat) ratio |

| a'(Lat) | | | Measurement item |
|---|---|---|---|
| a'(Lat) | ___._ | cm /s | a' velocity (Lat) |

| e'(Inf) | | | Measurement item |
|---|---|---|---|
| e'(Inf) | ___._ | cm /s | e' velocity (Inf) |
| When you measure MV E vel, the display looks like the following: | | | |
| E/e'(Inf) | ___._ | | E vel / e'(Inf) ratio |

| a'(Inf) | | | Mearsurement item |
|---|---|---|---|
| a'(Inf) | __._ | cm /s | a' velocity (Inf) |

| e'(Ant) | | | Measurement item |
|---|---|---|---|
| e'(Ant) | __._ | cm /s | e' velocity (Ant) |
| When you measure MV E vel, the display looks like the following: | | | |
| E/e'(Ant) | __._ | | E vel / e'(Ant) ratio |

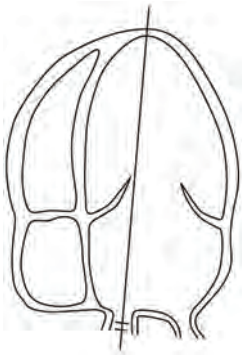
| a'(Ant) | | | Measurement item |
|---|---|---|---|
| a'(Ant) | __._ | cm /s | a' velocity (Ant) |

## Pulmonary vein

**To complete the PV flow (vel) procedure**

**1** Press the **D** button, display the apical four-chamber view, and record the pulmonary vein flow that flows into the left atrium in the PW-mode.

**2** Press the **FREEZE** button and the **CALCS** button.



**3** Select the **PV** tab on the touch panel, and tap **PV flow (vel)**.

By default, the **PVS vel** tool is selected.

**4** Place the caliper on the peak of the PVS wave, and press the **SET** button (

).

**5** Place the caliper on the peak of the PVD wave and press the **SET** button.

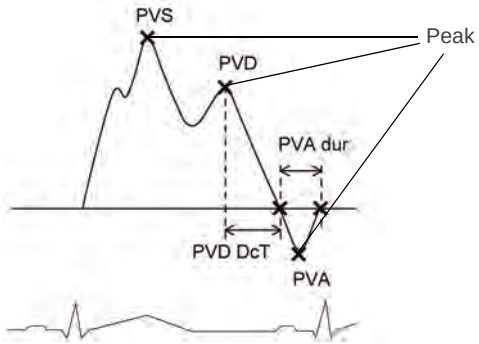
6 Use the trackball to align the line that appears with the deceleration slope of the PVD wave and press the **SET** button.

7 Place the caliper on the peak of the PVA wave and press the **SET** button.

8 To measure the PVA wave duration:

**a** Place the caliper on the start point of the PVA wave, and then press the **SET** button.

**b** Place the caliper on the end point of the PVA wave, and then press the **SET** button.




The measurement display looks like the following:

**Table 5-100: Pulmonary flow measurement items**

| PV flow (vel) | | | Measurement item |
|---|---|---|---|
| PVS vel | __._ | m/s | PV systolic wave peak velocity |
| PVD vel | __._ | m/s | PV diastolic wave peak velocity |
| PVD DcT | __ | ms | PV diastolic wave deceleration time |
| PVA vel | __._ | m/s | PV A wave peak velocity |
| PVA dur | __ | ms | PV A wave duration |
| When you measure PVS vel and PVD vel, the following measurement appears: | | | |
| S/D | __._ | | PVS velocity to PVD velocity ratio |
| When you measure MV A dur and PVA dur, the following measurement appears: | | | |
| A dur (PV-MV) | __._ | ms | Time interval difference of A duration (PVA - MV A) |

**To complete the PV flow (VTI) procedure**

1 Press the **D** button.

2 Display the apical four-chamber view and record the pulmonary vein flow that flows into the left atrium in the PW-mode.

3 Select the **PV** tab on the touch panel, and tap **PV flow (VTI)**.

4 Place the caliper on the starting point of the PVS wave, and press the **SET** button (

).

5 Trace the outline of the PVS wave and press the **SET** button at the ending point.

- You can trace with either Free Trace or Auto Trace.
- To switch to either Free Trace or Auto Trace, press the switch menu button 2 (the rocker button under **Measure tool**).

6 Place the caliper on the starting point of the PVD wave, and press the **SET** button.

Trace the outline of the PVD wave and press the **SET** button at the end point.

The measurement display looks like the following:

**Table 5-101: PV flow (VTI) measurement items**

| PV flow (VTI) | | | Measurement item |
|---|---|---|---|
| PVS VTI | __._ | cm | PV systolic wave VTI |
| PVS PV | __._ | m/s | PV systolic wave peak velocity |
| PVD VTI | __._ | cm | PV diastolic wave VTI |
| PVD PV | __._ | m/s | PV diastolic wave peak velocity |
| When PVS VTI and PVD VTI are measured, the following measurement shows: | | | |
| PV Sys.Frac. | __._ | % | PV systolic filling fraction |

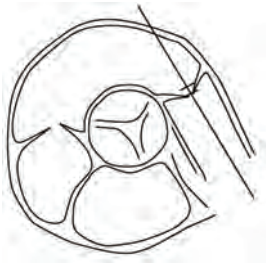
# Pulmonic artery

## Measuring flow velocity with a caliper

**To complete the PA vel procedure**

1 Press the **D** button, display the right ventricular outflow tract view and record the waveform in the PW or CW mode.

**2** Press the **FREEZE** button and the **CALCS** button.



**3** Select the **Pulmo** tab on the touch panel, and tap **PA vel**.

**4** Place the caliper on the peak velocity, and press the **SET** button (

).

The measurement display looks like the following:

**Table 5-102: PA vel measurement items**

| PA vel | | | Measurement item |
|---|---|---|---|
| Vmax | __._ | m/s | PA velocity |
| PGmax | __._ | mmHg | PA pressure gradient |

## RV PEP/ET and RV AcT/ET

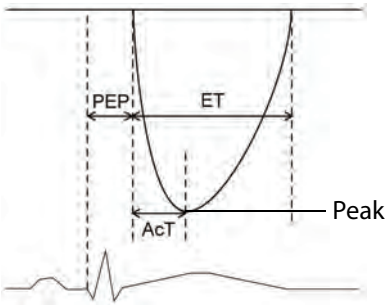
### To complete an RVPEP, RVET, or RV AcT measurement

**1** Press the **D** button.

**2** On the touch panel, tap the item that you want to measure (**RVPEP**, **RVET**, or **RV AcT**), and use the calipers to measure the times labeled in the figure below:

- For RVPEP, measure the time between the starting point of the ECG Q wave and the start point of the waveform.

- For RVET, measure the time between the start and end points of the waveform.
- For RV AcT, measure the time between the start point and the peak of the waveform.




The measurement display looks like the following:

**Table 5-103: RVPEP, RVET, and R AcT measurement items**

| RVPEP | | | Measurement item |
|---|---|---|---|
| PEP | __ | ms | RV pre ejection period |

| RVET | | | Measurement item |
|---|---|---|---|
| ET | __ | ms | RV ejection time |
| When you measure RVPEP and RVET, the following measurement appears: | | | |
| PEP/ET | _.__ | | RV PEP to ET ratio |

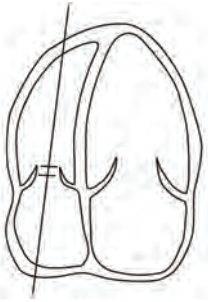
| RVAcT | | | Measurement item |
|---|---|---|---|
| AcT | __ | ms | RV acceleration time |
| When you measure RVET and RV AcT, the following measurement appears: | | | |
| AcT/ET | _.__ | | RV AcT to ET ratio |

## Tricuspid valve

**To complete the TV flow procedure**

1 Press the **D** button, display the apical four-chamber view, and record the blood flow at the tricuspid valve leaflet tips level in the PW-mode.

**2** Press the **FREEZE** button and the **CALCS** button.



**3** Select the **TV** tab on the touch panel, and tap **TV flow.**

By default, the **TV E vel** tool is selected.

**4** Place the caliper on the peak of the E wave, and press the **SET** button (

).

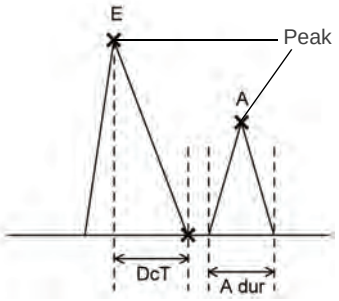
**5** Use the trackball to align the displayed line with the deceleration slope of the E wave and press the **SET** button.

**6** Place the caliper on the peak of the A wave, and press the **SET** button.

**7** To measure the A wave duration:

**a** Place the caliper on the start point of the A wave, and then press the **SET** button.

**b** Place the caliper on the end point of the A wave, and press the **SET** button.



The measurement display looks like the following:

**Table 5-104: TV flow measurement items**

| TV flow | | | Measurement item |
|---|---|---|---|
| E vel | __._ | m/s | TV E wave peak velocity |
| E PG | __._ | mmHg | TV E vel pressure gradient |
| DcT | __ | ms | TV E wave deceleration time |
| A vel | __._ | m/s | TV A wave peak velocity |
| A PG | __._ | mmHg | TV A vel pressure gradient |
| TA dur | __ | ms | TV A wave duration |
| When TV E vel and TV A vel are measured, the following measurements show: | | | |
| E/A | __._ | | TV E vel to A vel ratio |
| A/E | __._ | | TV A vel to E vel ratio |

# Aortic stenosis

## Aortic valve area: Planimetry method

Display the stenotic valve orifice and trace it to measure the aortic valve area.

**To measure the aortic valve area by planimetry**

**1** Press the **2D** button.

**2** Display the aortic valve level short axis view.

**3** To enlarge the image of the most widely opened valve orifice at systole, press the **DEPTH/ZOOM** button ( ), and then press the up-arrow side of the rocker button below.

4 Press the **FREEZE** button and the **CALCS** button, select the **AO** tab **O**n the touch panel, and tap **AVA trace**.

5 Place the caliper on the inner side of the valve orifice, and then press the **SET** button (

).

6 Trace the lumen, place the caliper on the end point, and then press the **SET** button.

The measurement display looks like the following:

**Table 5-105: AVA trace measurement items**

| AVA trace | | | Measurement item |
|---|---|---|---|
| AVA | ___._ | $cm^2$ | Aortic valve area (Planimetry method) |

To display AVAI, you must input BSA. AVAI is displayed on the Report screen.

## Continuity equation

The aortic valve stenosis area is calculated based on the principle of conservation of flow (the amount of blood flowing into a lumen is equal to that flowing out of the lumen).

To calculate the aortic valve area (AVA), measure the following items.

- AoV trace

  For information on measuring the AoV trace, see the following procedure.

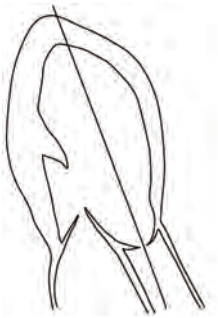
- LVOT SV

  For information on LVOT procedures, see "To measure cardiac output with LVOT trace" on page 322.

**To calculate the AVA**

1 Press the **D** button, display the apical long axis view, etc., and record the trans aortic valve flow in the CW-mode.

2 Press the **FREEZE** button and the **CALCS** button.



3 Select the **AO** tab on the touch panel, and tap **AoV trace**.

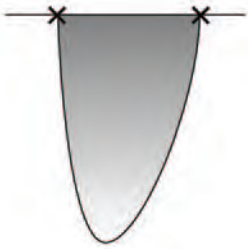
4 Place the caliper on the start point of the waveform, and press the **SET** button (

).

5 Use the trackball to trace the outline of the waveform.

- You can trace with either the Free Trace or the Auto Trace measure tool.
- To switch to either Free Trace or Auto Trace, press the switch menu button 2 (the rocker button under **Measure tool**).

6 Place the caliper on the end point of the blood flow waveform, and press the **SET** button.



The measurement display looks like the following:

**Table 5-106: AoV trace measurement items**

| AoV trace | | | Measurement item |
|---|---|---|---|
| VTI | __._ | cm | Aortic valve flow VTI |
| PV | __._ | m/s | AoV peak velocity |

**Table 5-106: AoV trace measurement items**

| AoV trace | | | Measurement item |
|---|---|---|---|
| PPG | __._ | mmHg | AoV peak pressure gradient |
| MnV | __._ | m/s | AoV mean velocity |
| MnPG | __._ | mmHg | AoV mean pressure gradient |

When you measure AoV VTI, AoV PV, LVOT VTI, LVOT PV, and LVOT, the following measurements appear:

**Table 5-107: AA (continuity) measurement item**

| AVA (continuity) | | | Measurement item |
|---|---|---|---|
| AVA VTI | __._ | $cm^2$ | AVA by continuity equation by VTI |
| AVA PV | __._ | $cm^2$ | AVA by continuity equation by peak velocity |
| AVAI VTI | __._ | $cm^2/m^2$ | AVA index by continuity equation by VTI |
| AVAI PV | __._ | $cm^2/m^2$ | AVA index by continuity equation by peak velocity |
| Ratio (VTI) | __._ | | LVOT VTI to AoV VTI ratio |

**Note** To check items that are not displayed on the main monitor, place a check on the worksheet to check it on a report.

# Aortic regurgitation

## Aortic regurgitation waveform measurement

### Aortic regurgitation waveform

Trace the waveform to measure each item. The regurgitant volume is calculated.

**To measure the aortic-regurgitation waveform with AR trace**

1 Press the **D** button, display the apical long axis view, etc., and record the aortic regurgitation waveform in the CW-mode.

**2** Press the **FREEZE** button and the **CALCS** button.

**3** Select the **AO** tab on the touch panel, and tap **AR trace**.

**4** Place the caliper on the start point of the waveform and press the **SET** button (

).

**5** Use the trackball to trace the outline of the waveform.

**6** Place the caliper on the end point of the blood flow waveform and press the **SET** button.

The measurement display looks like the following:

**Table 5-108: AR trace measurement items**

| AR trace | | | Measurement item |
|---|---|---|---|
| VTI | __._ | cm | Aortic regurgitation VTI |
| PV | __._ | m/s | AR peak velocity |
| PPG | __._ | mmHg | AR peak pressure gradient |
| MnV | __._ | m/s | AR mean velocity |
| MnPG | __._ | mmHg | AR mean pressure gradient |

## AR PHT (Pressure Half Time)

Measure the time interval for the peak pressure gradient of the aortic regurgitation decreases by half.

### To measure the aortic-regurgitation waveform with AR PHT

1 Press the **CALCS** button.

2 Select the **AO** tab on the touch panel, and tap **AR PHT**.

3 Place the caliper on the peak of the waveform, and press the **SET** button (

).

4 Use the trackball to align the displayed line with the deceleration slope of the waveform, and press the **SET** button.

The measurement display looks like the following:

**Table 5-109: AR PHT measurement items**

| AR PHT | | | Measurement item |
|---|---|---|---|
| PHT | ___ | ms | AR pressure half time |
| DcT | ___ | ms | AR deceleration time |
| Vmax | _._ | m/s | AR maximum velocity |
| Slope | _._ | $cm/s^2$ | AR slope |

## End-diastolic pressure gradient between left ventricle and aorta

Measure the pressure gradient between the left ventricle and the aorta based on the aortic regurgitation waveform.

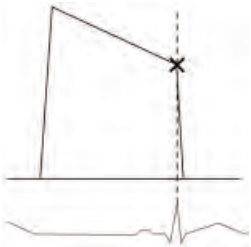
### To measure the aortic-regurgitation waveform with ARed V

1 Press the **CALCS** button.

2 Select the **AO** tab on the touch panel, and tap **ARed V**.

**3** Place the caliper on the end diastole (peak of the ECG R wave), and press the **SET** button (

).



The measurement display looks like the following:

**Table 5-110: ARed V measurement items**

| ARed V | | | Measurement item |
|---|---|---|---|
| V | __._ | m/s | AR end-diastolic velocity |
| PG | __._ | mmHg | AR end-diastolic pressure gradient |

## Aortic regurgitant volume: PISA method

At the upstream side of the regurgitant orifice, hemispherical suction flow is formed with accelerated blood flow. Proximal isovelocity surface area (PISA) is the surface area of the hemisphere. The effective regurgitant orifice area and the regurgitant volume are calculated by measuring the color aliasing radius and the regurgitant blood flow.

Measure the following two items and manually input Alias vel.

- AR trace

  For information on measuring the AR trace, see "Aortic regurgitation waveform measurement" on page 337.

- AR radius (PISA)

**To measure the aortic-regurgitant volume with AR radius (PISA)**

**1** Press the **2D** button and **C** button

**2** Display AR in the apical long axis view, etc.

**3** Decrease the color scale to around 40cm/s to make the display PISA larger.

**4** To enlarge PISA further, press the **DEPTH/ZOOM** button ( ), and then press the up-arrow side of the rocker button below.

**5** Press the **CALCS** button, select the **AO** tab on the touch panel, and tap **AR radius**.

**6** Place the caliper on the center of PISA (the coaptation point of valve cusps) and press the **SET** button (

).

**7** Use the trackball to measure the PISA radius, and press the **SET** button.

**8** Manually input the velocity value of the color bar in **Alias vel.** on the worksheet. See "Worksheet/Report" on page 365.

The measurement display looks like the following:

**Table 5-111: AR volume measurement items**

| AR (PISA) | | | Measurement item |
|---|---|---|---|
| radius | __._ | cm | AR PISA radius |
| When you have measured AR trace, the following items appear: | | | |
| RV | __._ | ml | AR regurgitant volume flow |
| ERO | __._ | $cm^2$ | AR effective regurgitant orifice area |
| FR | __._ | ml/s | AR flow rate |
| When you have measured LVOT SV, the following item appears: | | | |
| RF | __._ | % | AR regurgitant fraction |

**Note** Depending on the measurement order, results may not be displayed on the main monitor; you can verify them on the Report screen.

## Aortic regurgitant volume: PW Doppler method

The ejection flow volume at LVOT is the sum of the aortic regurgitant volume (AR RV) and the original stroke volume. Accordingly, the aortic regurgitant volume is measured by subtracting MVann SV from LVOT SV.

Measure the following items in the desired order to calculate the aortic regurgitant volume.

- LVOT SV, in D mode

  For information on completing the procedure, see "To measure cardiac output with LVOT trace" on page 322.

- MVann trace, in D mode, on the **MV 2** tab

  For information, see the following procedure.

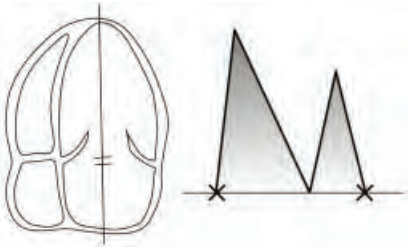
- MA distA and MA distB, in 2D (**B**) mode, on the **MV** tab

  For information, see the following procedure.

**To perform the MVann trace**

1 For the MVann SV measurement, press the **D** button.

2 Display the apical four-chamber or two-chamber view, and record the inflow waveform at the mitral annulus level in the PW-mode.



3 Press the **CALCS** button, select the **MV 2** tab on the touch panel, and tap **MVann trace**.

4 Place the caliper on the start point of the waveform, and press the **SET** button (

).

- You can trace with either the Free Trace or the Auto Trace measure tool.

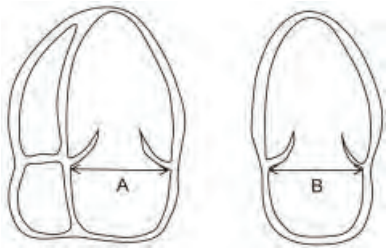
- To switch to either Free Trace or Auto Trace, press the switch menu button 2 (the rocker button under **Measure tool**).

**5** Use the trackball to trace the outline of the waveform, place the end point at the end of the waveform, and press the **SET** button.

**To perform the MA distA and MA distB measurement**

**1** Press the **2D** button, and then display the apical four-chamber or two-chamber view.

**2** Press the **CALCS** button, select the **MV** tab, and then **MA distA** or **MA distB** on the touch panel and measure the annulus diameter.




You can measure A and B in the desired order.

The measurement display looks like the following:

**Table 5-112: MA distA and MA distB measurement items**

| MV ann trace | | | Measurement item |
|---|---|---|---|
| VTI | __._ | cm | Mitral annulus flow VTI |
| PV | __._ | m/s | MVann peak velocity |
| PPG | __._ | mmHg | MVann peak pressure gradient |
| MnV | __._ | m/s | MVann mean velocity |
| MnPG | __._ | mmHg | MVann mean pressure gradient |

| MA distA | | | Measurement item |
|---|---|---|---|
| distA | __._ | cm | Mitral annular distance A |

| MA distB | | | Measurement item |
|---|---|---|---|
| distB | __._ | cm | Mitral annular distance B |

When you have measured MVann VTI, MA distA and MA distB, MVann SV is calculated. When you have measured LVOT SV, the following items show.

| AR (PWD) | | | Measurement item |
|---|---|---|---|
| RV | __._ | ml | Aortic regurgitant volume |
| RF | __._ | ml | Aortic regurgitant fraction |

# Mitral stenosis

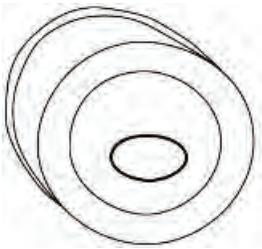
## Mitral valve area: Planimetry method

Display the stenotic valve orifice and trace it to measure the mitral valve area.

**To measure the mitral-valve area by planimetry**

**1** Press the **2D** button.

**2** Display the mitral valve level short axis view.



To enlarge the image of the most widely opened valve orifice at diastole, press the **DEPTH/ZOOM** button ( ), and then press the up-arrow side of the rocker button below.

**Note**

The distance between the anterior and posterior leaflets of the opened mitral valve should be the same on both the left ventricular long axis view and the left ventricular short axis view. If the short axis view is positioned closer to the left atrium, it may result in overestimation of the valve area.

**3** Press the **CALCS** button, select the **MV** tab on the touch panel, and tap **MVA trace.**

**4** Place the caliper on the inner side of the valve orifice, and then press the **SET** button (

).

- You can trace with either the Free Trace or the Ellipse measure tool.
- To switch to Free Trace or Ellipse, press the switch menu button 2 (the rocker button under **Measure tool**).

**5** Trace the lumen, place the caliper on the end point, and then press the **SET** button.

The measurement display looks like the following:

**Table 5-113: MVA trace measurement item**

| MVA trace | | | Measurement item |
|---|---|---|---|
| MVA | __._ | $cm^2$ | Mitral valve area (Planimetry method) |

## Mitral stenosis waveform measurement

The waveform of accelerated stenotic blood flow is recorded to calculate the items for stenotic severity assessment. Select the proper view including apical four-chamber view or apical long axis view on which the blood flow can be recorded at an appropriate angle.

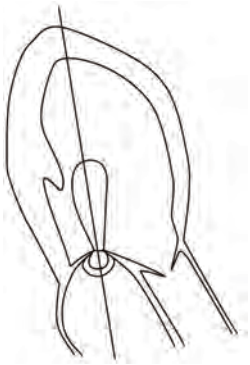
### Mitral stenosis waveform

Trace the waveform to calculate each item.

**To complete the mitral stenosis waveform MV trace procedure**

**1** Press the **D** button, display the apical four-chamber view or long axis view, and record the trans mitral valve flow in the CW-mode.

2 Press the **FREEZE** button and the **CALCS** button.



3 Select the **MV 2** tab, and then **MV trace** on the touch panel.

4 Place the caliper on the start point of the waveform, and then press the **SET** button (

).

5 Use the trackball to trace the outline of the waveform.

- You can trace with either the Free or the Auto measure tool.
- To switch to either Free Trace or Auto Trace, press the switch menu button 2 (the rocker button under **Measure tool**).

6 Place the caliper on the end point of the blood flow waveform, and then press the **SET** button.

The measurement display looks like the following:

**Table 5-114: MV trace measurement items**

| MV trace | | | Measurement item |
|---|---|---|---|
| VTI | __._ | cm | Mitral valve flow VTI |
| PV | __._ | m/s | MV peak velocity |

**Table 5-114: MV trace measurement items**

| MV trace | | | Measurement item |
|---|---|---|---|
| PPG | __._ | mmHg | MV peak pressure gradient |
| MnV | __._ | m/s | MV mean velocity |
| MnPG | __._ | mmHg | MV mean pressure gradient |

## Mitral valve area: PHT

Measure the time interval for the peak pressure gradient of the mitral stenosis flow decreases by half. Based on the measured value, MVA is estimated.

**To complete the MVA PHT procedure**

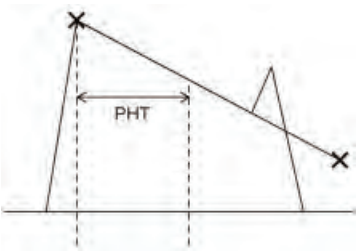
1 Press the **D** button and the **CALCS** button.

2 Select the **MV 2** tab on the touch panel, and tap **MVA (PHT)**.

3 Place the caliper on the peak of the waveform, and press the **SET** button (

).

4 Use the trackball to align the displayed line with the deceleration slope, and then press the **SET** button.




The measurement display looks like the following:

**Table 5-115: MVA (PHT) measurement items**

| MVA (PHT) | | | Measurement item |
|---|---|---|---|
| PHT | __ | ms | Mitral valve pressure half time |
| MVA (PHT) | __._ | $cm^2$ | Mitral valve area (PHT) |
| DcT | __ | ms | Mitral valve E wave deceleration time |
| Vmax | __._ | m/s | Mitral valve peak velocity |

## Mitral valve area: PISA method

At the upstream side of the regurgitant orifice, hemispherical suction flow is formed with accelerated blood flow. Proximal isovelocity surface area (PISA) is the surface area of the hemisphere. The valve area is calculated by measuring the color aliasing radius and measuring the blood flow waveforms in stenotic, etc.

Measure the following three items in the desired order and manually input Alias vel.

- MS radius and MS angle

  2D (**B**) mode, on the **MV** tab

- MS Vmax

  D mode, on the **MV2** tab

**To measure the mitral valve area, using the PISA method**

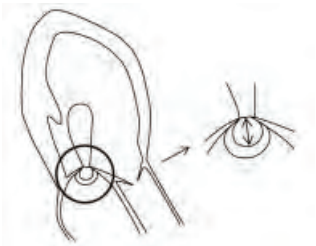
**1** To measure MS radius and MS angle:

**a** Press the C button.

**b** Display the MS flow in the Color Doppler mode.

**c** To enlarge the display of PISA, decrease the color scale to about 40cm/s.

**d** To enlarge PISA further, press the **DEPTH/ZOOM** button ( ), and then press the up-arrow side of the rocker button below.



**e** Select the **MV** tab on the touch panel, and tap **MS radius**.

**f** Place the caliper on the center of PISA (the coaptation point of valve cusps), and press the **SET** button (

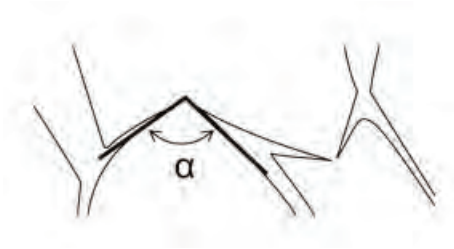
).

**g** Use the trackball to measure the PISA radius, and press the **SET** button.

**h** Manually input the velocity value of the color bar in Arias vel. See "Worksheet/Report" on page 365.

**i** Turn off the color to change to (2D) B mode, and then tap **MS angle**.

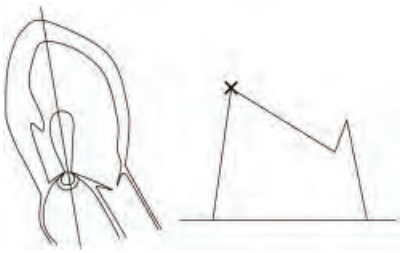
**j** Measure the angle $\alpha$ between the anterior and posterior leaflets of the mitral valve.




**2** To measure MS Vmax:

**a** Change to CW mode, record the MS flow, and press the **FREEZE** button and the **CALCS** button.

**b** On the touch panel, tap **MS Vmax**, and measure the peak velocity with the caliper.



The measurement display looks like the following:

**Table 5-116: MV measurement items**

| MS radius | | | Measurement item |
|---|---|---|---|
| radius | __._ | cm | Mitral stenosis flow PISA radius |

| PMS angle | | | Measurement item |
|---|---|---|---|
| angle | _ | ° | Mitral leaflet opening angle |

| MS Vmax (PISA) | | | Measurement item |
|---|---|---|---|
| Vmax | __._ | m/s | Mitral stenosis maximum velocity |

| MS Vmax (PISA) | | | Measurement item |
|---|---|---|---|
| PGmax | __._ | mmHg | Mitral stenosis maximum pressure gradient |

When you measure the above four measurements, the following result shows.

| MS PISA | | | Measurement item |
|---|---|---|---|
| MVA | __._ | $cm^2$ | Mitral valve area |

**Note** To check result that is not displayed on the main monitor, check it on a report.

# Mitral regurgitation

## Measuring the mitral regurgitation waveform

**To complete the MR Vmax procedure**

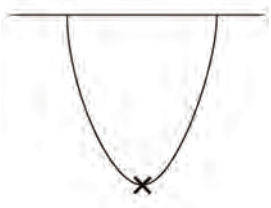
**1** Press the **D** button.

**2** Record the mitral regurgitation waveform in the CW mode, and press the **FREEZE** button and the **CALCS** button.

**3** On the touch panel, tap the **MV 2** tab, and then tap **MR Vmax**.

**4** Place the caliper on the peak of the waveform, and press the **SET** button (

).



The measurement display looks like the following:

**Table 5-117: MR Vmax measurement items**

| MR Vmax | | | Measurement item |
|---|---|---|---|
| Vmax | __._ | m/s | MR maximum velocity |
| PGmax | __._ | mmHg | MR maximum pressure gradient |

## Mitral regurgitant volume: PISA method

At the upstream side of the regurgitant orifice, hemispherical suction flow is formed with accelerated blood flow. Proximal isovelocity surface area (PISA) is the surface area of the hemisphere. The effective regurgitant orifice area and the regurgitant volume are calculated by measuring the color aliasing radius and tracing the regurgitant blood flow.

Measure the following two items in the desired order, and then manually input Alias vel.

- MR radius

  In 2D (**B**) mode, use the **MV** tab.

- MR trace

  In D mode, use the **MV 2** tab.

For information on measuring MVann SV, see "Aortic regurgitant volume: PW Doppler method" on page 342.

**To measure MR radius**

**1** Press the **2D** button.

**2** Display the MR in the Color Doppler mode.

**3** Decrease the color scale to around 40cm/s to expand the PISA in view.

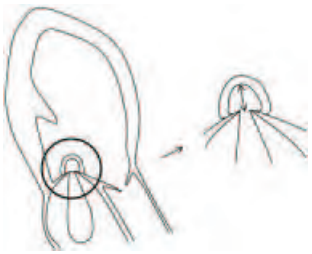
4 To enlarge PISA further, press the **DEPTH/ZOOM** button ( ), and then press the up-arrow side of the rocker button below.

5 Select the **MV** tab on the touch panel, and tap **MR radius**.

6 Place the caliper on the center of the PISA (the coaptation point of the valve cusps) and press the **SET** button (

).

7 Use the trackball to measure the PISA radius, and then press the **SET** button.



8 Manually input the velocity value of the color bar in Arias vel. See "Worksheet and report" on page 413.

**To measure using an MR trace**

1 Select CW mode, record the mitral regurgitation waveform, and press the **FREEZE** button and the **CALCS** button.

2 On the touch panel, tap the **MV 2** tab, and then tap **MR trace**.

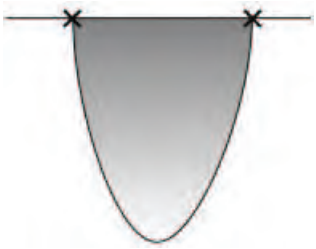
3 Place the caliper on the start point of the waveform and press the **SET** button (

).

4 Use the trackball to trace the outline of the waveform.

- You can trace with either the **Free** or the **Auto** measure tool.
- To switch to either Free Trace or Auto Trace, press the switch menu button 2 (the rocker button under **Measure tool**).

5 Place the caliper on the end point of the blood flow waveform and press the **SET** button.



The measurement display looks like the following:

**Table 5-118: MR measurement items**

| MR radius | | | Measurement item |
|---|---|---|---|
| radius | __._ | cm | MR PISA radius |

| MR trace | | | Measurement item |
|---|---|---|---|
| VTI | __._ | cm | Mitral regurgitation VTI |
| PV | __._ | m/s | MR peak velocity |
| PPG | __._ | mmHg | MR peak pressure gradient |
| MnV | __._ | m/s | MR mean velocity |
| MnPG | __._ | mmHg | MR mean pressure gradient |

| MR PISA | | | Measurement item |
|---|---|---|---|
| RV | __._ | ml | MR regurgitant volume |
| ERO | __._ | $cm^2$ | MR effective regurgitant orifice area |
| FR | __._ | ml/s | MR flow rate |
| When you have measured MVann SV, the following measurement shows. For measuring MVann SV, see the next section. | | | |
| RF | __._ | % | MR regurgitant fraction |

**Note**

Depending on the measurement order, results may not be displayed on the main monitor; you can verify them on the Report screen.

## Mitral regurgitant volume: PW Doppler method

The ejection flow volume at the mitral valve is the sum of the MR regurgitant volume (MR RV) and the original stroke volume. Accordingly, the MR regurgitant volume is measured by subtracting LVOT SV from MVann SV.

Measure the following items in the desired order to calculate the MR regurgitant volume.

- LVOT SV

  For the procedure, see "To measure cardiac output with LVOT trace" on page 322.

- MVann SV

For the procedure, see "Aortic regurgitant volume: PW Doppler method" on page 342.

The measurement display looks like the following:

**Table 5-119: MR (PWD) measurement items**

| MR (PWD) | | | Measurement item |
|---|---|---|---|
| RV | __._ | ml | MR regurgitant volume |
| RF | __._ | % | MR regurgitant fraction |

## MR dP/dt

The mitral regurgitation waveform reflects the pressure gradient between the left ventricle and the left atrium. If the left ventricular systolic function deteriorates, the left ventricular pressure increases gradually and this value decreases.

**To measure the MR dP/dt**

1 In the **CW mode**, and record the mitral regurgitation waveform.

  It is recommended that you set the scale of the waveform to around 4m/s and extend Sweep Speed to the maximum.

2 On the touch panel, tap the MV 2 tab, and then tap **MR dP/dt**.

3 Place the caliper at about 1m/s (Vel 1) on the outline of the MR flow, and press the **SET** button (

).

**4** Place the caliper at about 3m/s (Vel 2) on the outline of the MR flow, and press the **SET** button.

The measurement display looks like the following:

**Table 5-120: MR dP/dt measurement items**

| MR d/dt | | | Measurement item |
|---|---|---|---|
| dt | __._ | ms | Time between Vel 1 and Vel 2 |
| Vel 1 | __._ | m/s | Velocity at the first point |
| Vel 2 | __._ | m/s | Velocity at the second point |
| dP/dt | __._ | mmHg | Left ventricular pressure increase rate |

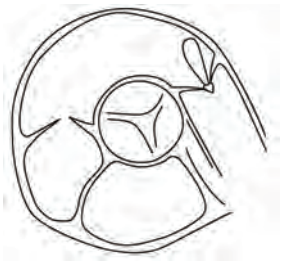
# Pulmonic regurgitation

## Estimating pulmonary artery mean pressure

It is reported that there is a good correlation between the maximum pressure gradient of the pulmonic regurgitation and the pulmonary artery mean pressure.

**To obtain PR Vmax**

**1** Press the **D** button and then switch to CW mode.

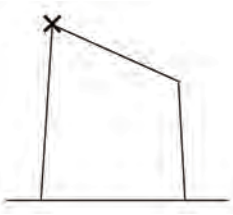


**2** Record the pulmonic regurgitation waveform in the CW mode, and press the **FREEZE** button and the **CALCS** button.

**3** On the touch panel, tap the **Pulmo** tab, and then tap **PR Vmax**.

4 Place the caliper on the peak of PR flow, and press the **SET** button (

).



The measurement display looks like the following:

**Table 5-121: PR Vmax measurement items**

| PR Vmax | | | Measurement item |
|---|---|---|---|
| Vmax | _._ | m/s | Pulmonic regurgitation maximum velocity |
| PGmax | _._ | mmHg | Pulmonic regurgitation maximum pressure gradient |

## Estimating pulmonary artery pressure at end diastole

It is reported that there is a good correlation between the pulmonary artery pressure at end diastole (calculated by adding the right atrial pressure to the end diastolic pressure gradient of the pulmonic regurgitation) and the pulmonary artery wedge pressure. Enter the estimated right atrial pressure manually onto the Worksheet (see "Worksheet/Report" on page 365).

**To complete the procedure**

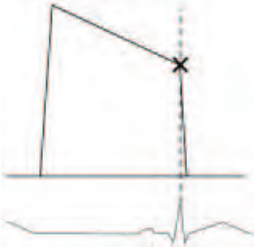
1 Select **D mode**, and then switch to CW mode.

2 Record the pulmonic regurgitation waveform in the CW mode, and press the **FREEZE** button and the **CALCS** button.

3 On the touch panel, tap the **Pulmo** tab, and then tap **PRed vel**.

**4** Place the caliper on the end diastole of the PR flow, and press the **SET** button (

).



**5** On the Worksheet, in the **RA Press** column, manually input the estimated right atrial pressure.

The measurement display looks like the following:

**Table 5-122: Pulmonary artery pressure measurement items**

| PRed vel | | | Measurement item |
|---|---|---|---|
| vel | __._ | m/s | PR end diastolic velocity |
| PG | __._ | mmHg | PR end diastolic pressure gradient |

When you have entered PRed PG and RA press, the following measurement appears.

| PAP ed | | | Measurement item |
|---|---|---|---|
| PAP ed | __._ | mmHg | Estimated PA pressure at end diastole |

**Note** If results are not displayed on the main monitor, you can verify them on the Report screen.

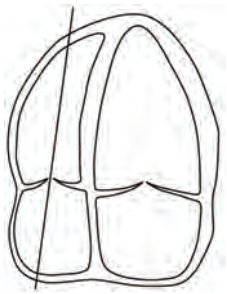
# Tricuspid valve flow

## Measuring tricuspid valve flow velocity

Measure the high-velocity blood flow after tricuspid annuloplasty or due to tricuspid stenosis, a prosthetic valve, etc.

**To measure tricuspid valve flow**

1 Record the trans tricuspid valve flow in the CW-mode, and press the **FREEZE** button and the **CALCS** button.



2 On the touch panel, tap the **TV** tab, and then **TV trace**.

You can trace with either the Free or the Auto measure tool.

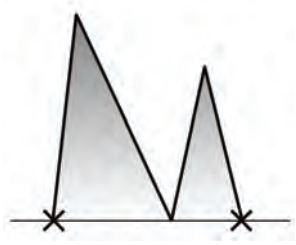
To switch to either Free Trace or Auto Trace, press the switch menu button 2 (the rocker button under **Measure tool**).

3 Place the caliper on the start point of the waveform and press the **SET** button (

).

4 Use the trackball to trace the outline of the waveform.

5 Place the caliper on the end point of the waveform and press the **SET** button.



The measurement display looks like the following:

**Table 5-123: TV trace measurement items**

| TV trace | | | Measurement item |
|---|---|---|---|
| VTI | __._ | cm | Tricuspid valve flow VTI |
| PV | __._ | m/s | TV peak velocity |

**Table 5-123: TV trace measurement items**

| TV trace | | | Measurement item |
|---|---|---|---|
| PPG | __._ | mmHg | TV peak pressure gradient |
| MnV | __._ | m/s | TV mean velocity |
| MnPG | __._ | mmHg | TV mean pressure gradient |

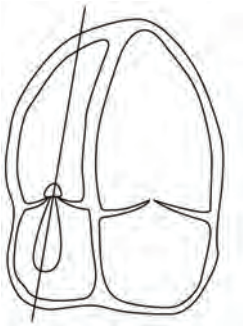
# Tricuspid regurgitation

## Estimating pulmonary artery pressure at systole

The pulmonary artery pressure at systole is estimated by adding the estimated right atrial pressure to the maximum pressure gradient between the right ventricle and the right atrium, measured with the waveform of tricuspid regurgitation. You manually enter the estimated right atrial pressure onto the Worksheet (see "Worksheet/Report" on page 365).

**To measure tricuspid valve flow**

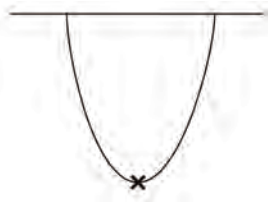
1 Record the tricuspid regurgitation waveform in the CW-mode, and press the **FREEZE** button and the **CALCS** button.



2 On the touch panel, tap the **TV** tab, and then **TR Vmax**.

3 Place the caliper on the peak of the TR flow and press the **SET** button (

).



4 Press **RA press**, and manually input the estimated right atrial pressure in the **RA Press** column on the Worksheet.

The measurement display looks like the following:

**Table 5-124: TR Vmax and PAP sys measurement items**

| TR Vmax | | | Measurement item |
|---|---|---|---|
| Vmax | __._ | m/s | TR maximum velocity |
| PGmax | __._ | mmHg | TR maximum pressure gradient |

When you have entered TR PGmax and RA press, the following measurement appears.

| PAP sys | | | Measurement item |
|---|---|---|---|
| PAP sys | __._ | mmHg | Estimated PA pressure at systole |

**Note** If results are not displayed on the main monitor, you can verify them on the Report screen.

## Qp/Qs

The ratio between the pulmonic flow and the systemic flow is calculated in the case of shunt diseases such as atrial septal defect and ventricular septal defect. Measure the following items in order:

1 Systemic flow

**a** Systemic diam

**b** Systemic VTI

**2** Pulmonic flow

**a** Pulmonic diam

**b** Pulmo VTI

**To measure systemic flow**

**1** Press the **2D** button, display the left ventricular long axis view and enlarge the systolic left ventricular outflow tract.

**2** Press the **FREEZE** button and the **CALCS** button.

**3** On the touch panel, tap the **Shunt** tab, and then **Systemic Diam**.

**4** Use the calipers to measure the outflow tract diameter.

**5** Press the **D** button, display the apical long axis view and record the left ventricular outflow tract flow, in the PW mode.

**6** Press the **FREEZE** button and the **CALCS** button.

**7** On the touch panel, tap the Shunt tab, and then tap **Systemic VTI**.

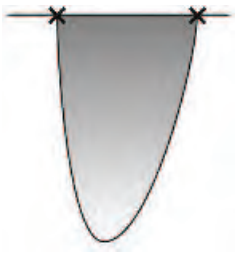
- You can trace with either the Free or the Auto measure tool.
- To switch to either Free Trace or Auto Trace, press the switch menu button 2 (the rocker button under **Measure tool**).

**8** Place the caliper on the start point of the waveform and press the **SET** button (

).

**9** Use the trackball to trace the outline of the waveform.

**10** Place the caliper on the end point of the waveform and press the **SET** button.



**To measure pulmonic flow**

**1** Press the **2D** button.

**2** Display the right ventricular outflow tract and enlarge the systolic right ventricular outflow tract.

**3** On the touch panel, tap the Shunt tab, and then **Pulmonic diam**.

**4** Use the calipers to measure the outflow tract diameter.

**5** Press the **D** button and record the right ventricular outflow tract flow, in the PW mode.

**6** Press the **FREEZE** button and the **CALCS** button.

**7** On the touch panel, tap the Shunt tab, and then tap **Pulmonic VTI**.

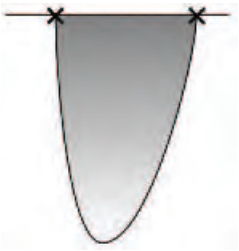
- You can trace with either the Free or the Auto measure tool.
- To switch to either Free Trace or Auto Trace, press the switch menu button 2 (the rocker button under **Measure tool**).

**8** Place the caliper on the starting point of the waveform, and press the **SET** button (

).

**9** Use the trackball to trace the outline of the waveform.

**10** Place the caliper on the ending point of the waveform, and press the **SET** button.



The measurement display looks like the following:

**Table 5-125: Systemic and pulmonic measurement items**

| Systemic diam | | | Measurement item |
|---|---|---|---|
| Sys diam | __._ | cm | Systemic diameter |

| Systemic VTI | | | Measurement item |
|---|---|---|---|
| Sys VTI | __._ | cm | Systemic flow VTI |
| Sys Vmax | __._ | m/s | Systemic flow maximum velocity |

| Pulmonic diam | | | Measurement item |
|---|---|---|---|
| Pulmo diam | __._ | cm | Pulmonic flow diameter |

| Pulmonic VTI | | | Measurement item |
|---|---|---|---|
| Pulmo VTI | __._ | cm | Pulmonic flow VTI |
| Pulmo Vmax | __._ | m/s | Pulmonicic flow maximum velocity |
| When you have measured the above items, the following results appear: | | | |
| Qp/Qs | __._ | | Pulmonic to Systemic flow ratio |

## MPI (Myocardial Performance Index)

It is said that the MPI value increases in the case of cardiac failure. To calculate the MPI of right and left heart, measure the following items.

**1** LV MPI: MV c-o time (the mitral valve closing to opening time), LVET

**2** RV MPI: TV c-o time (tricuspid valve closing to opening time), RVET

**To complete the procedure**

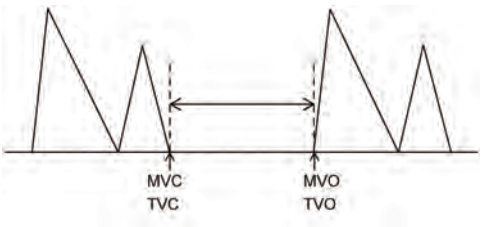
**1** Press the **D** button, and record the atrioventricular valve flow of left or right heart.

**2** Press the **FREEZE** button and the **CALCS** button.

**3** Select the **MPI** button on the touch panel, and tap **MV c-o time** or **TV c-o time.**

To see the **MPI** tab, tap the » button.

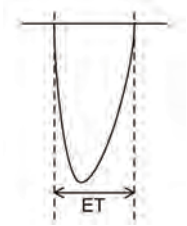
**4** Use the calipers to measure the time between MVC/TVC to MVO/TVO (the interval from closing to opening of the atrioventricular valve).




**5** Record the ejection flow of left or right heart, and press the **FREEZE** button and the **CALCS** button.

**6** On the touch panel, tap **LVET** or **RVET.**

**7** Use the calipers to measure each ejection time.




The measurement display looks like the following:

**Table 5-126: MPI measurement items**

| MV c-o time | | | Measurement item |
|---|---|---|---|
| c-o time | __ | ms | MV closing to opening time |

| LVET | | | Measurement item |
|---|---|---|---|
| ET | ___ | ms | LV ejection time |

When you measure the above two items, the following item show.

| LV MPI | | | Measurement item |
|---|---|---|---|
| LV MPI | ___._ | | LV myocardial performance index |

| TV c-o time | | | Measurement item |
|---|---|---|---|
| c-o time | ___ | ms | Tricuspid valve closing to opening time |

| RVET | | | Measurement item |
|---|---|---|---|
| ET | ___ | ms | RV ejection time |

When you measure the above two items, the following item show.

| RV MPI | | | Measurement item |
|---|---|---|---|
| RV MPI | ___._ | | RV myocardial performance index |

## Worksheet/Report

To display the Report screen of the cardiac measurement, press the **FREEZE** button to freeze the image and then operate the switch menu button.

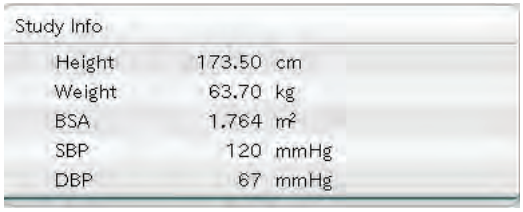



Figure 5-35: Study Information screen

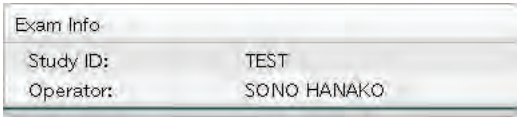



Figure 5-36: Exam Information screen

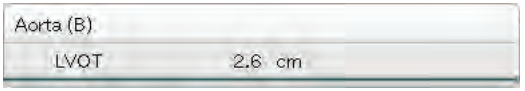



Figure 5-37: Cardiac_Report screen

### Switching the page of Report screen

If the report results cannot be displayed within one page, the number of the report pages is displayed at the lower side of the touch panel.

To switch the page, operate the paddle button under the Report Page.

### Switching to the Worksheet

Select the Worksheet button at the right side of the touch panel.

### Switching between Multiple Reports

Tap a report displayed on the touch panel.

## Editing Values on Worksheet

Tap the category you want to edit to display the Worksheet edition screen for cardiac measurement.

On the Worksheet screen, the measurement values (measurement results) of the cardiac measurement are displayed. The displayed values can also be corrected or deleted.

In addition, measurement items to be used and displayed can be specified on the Worksheet screen.

### Specifying information items on the Study / Exam Information screen

Information items to be displayed on the screens such as the Report screen can be specified by placing a check mark in the check box on the left-hand side of each information item on the worksheet.

### Specifying measurement items for the Cardiac measurement

The measurement items for the Cardiac measurement can be specified by placing a check mark in the check box on the left-hand side of each measurement item on the worksheet.

### Editing and saving the content of Worksheet

While editing, characters are indicated in red and an asterisk is displayed.

After the content is edited, tap **Update** and then operate the switch menu button 2.

When the changes are reflected, characters are indicated in white.

### Switching the page of Worksheet

If the content of the worksheet cannot be displayed within one page, the number of the worksheet pages is displayed at the lower side of the touch panel.

To switch the page, operate the paddle switch under Worksheet Page. To switch the block in the Worksheet, tap **Select Edit Block** and then operate the switch menu button 3.

### Setting the value to be displayed at the time of continuous measurement

Tap **Value** and then operate the switch menu button 2 to select the measurement value to be displayed on the Worksheet from among the following.

- Average value of the continuous measurement
- Value of the last measurement

### Switching to the Report screen

Select the Report button at the right side of the touch panel.

## Terms and abbreviations

**Table 5-127: Terms and abbreviations expanded**

| Abbreviation | Definition |
|---|---|
| 2ch | apical two-chamber view |
| 4ch | apical four-chamber view |
| a | Left Ventricular Length (Apical-Papillary Muscle) |
| A dur | A wave duration |
| A dur(PV-MV) | Time interval difference of A duration (PVA - MV A) |
| A endo | Endocardial Area |
| A epi | Epicardial Area |
| A vel | A velocity |
| A/E | A vel to E vel ratio |
| AcT | Acceleration time |

**Table 5-127: Terms and abbreviations expanded**

| Abbreviation | Definition |
|---|---|
| AcT/ET | AcT to ET ratio |
| Alias vel | Aliasing velocity |
| AoD | Aortic diameter |
| AoD val | Valsalva diameter |
| AR | Aortic regurgitation |
| AR FR | AR flow rate |
| AR radius | AR PISA radius |
| AR RF | AR regurgitant fraction |
| AR RV | AR regurgitant volume |
| ARed V | AR end-diastolic velocity |
| AV ann | Aortic annulus diameter |
| AVA (Planimetry) | Aortic valve area by planimetry |
| AVA PV | AVA by continuity equation by peak velocity |
| AVA VTI | AVA by continuity equation by VTI |
| AVAI VTI | AVA index by continuity equation by VTI |
| AVAI | Aortic valve area index |
| AVAI PV | AVA index by continuity equation by peak velocity |
| BSA | Body surface area |
| CA amp. | C-A amplitude |
| CE amp. | C-E amplitude |
| CI | Cardiac index |
| CO | Cardiac output |
| d | Left ventricular length (PM-MVA) |
| DcT | Deceleration time |
| diast | diastole |

**Table 5-127: Terms and abbreviations expanded**

| Abbreviation | Definition |
|---|---|
| E vel | E velocity |
| E/A | E vel to A vel ratio |
| EF | Ejection fraction |
| EF slope | Mitral valve E-F slope |
| EPSS | E point to septal separation |
| ERO | Effective regurgitant orifice area |
| ET | Ejection time |
| FS | Factional shortening |
| HR | Heart rate |
| IVSd | Interventricular septum thickness, end diastole |
| IVSs | Interventricular septum thickness, end systole |
| LA | Left atrial |
| LA area, max | LA area, maximum |
| LA area, min | LA area, minimum |
| LA/AO | LAD to AoD ratio |
| LAD | LA diameter |
| LAL | LA longitudinal dimension |
| LAL max | LA maximum length |
| LAL max diff | LA length difference, maximum |
| LAL min | LA minimum length |
| LAL min diff | LA length difference, minimum |
| LAT | LA transverse dimension |
| LAV max | LA maximum volume |
| LAV min | LA minimum volume |
| LAVI max | LA maximum volume index |

**Table 5-127: Terms and abbreviations expanded**

| Abbreviation | Definition |
|---|---|
| LAVI min | LA minimum volume index |
| LV | Left ventricular |
| LV area, d | LV area, end diastole |
| LV area, s | LV area, end systole |
| LVDd | LV dimension, end diastole |
| LVDs | LV dimension, end systole |
| LVEDV | LV end-diastolic volume |
| LVEDVI | LV end-diastolic volume index |
| LVESV | LV end-systolic volume |
| LVESVI | LV end-systolic volume index |
| LVLd | LV length, end diastole |
| LVLd diff | LV length difference, end diastole |
| LVLs | LV length, end systole |
| LVLs diff | LV length difference, end systole |
| LVM | LV mass |
| LVMI | LV mass index |
| LVOT | LV outflow tract |
| LVOT vel | LVOT velocity |
| LVPWd | LV posterior wall thickness, end diastole |
| LPWFT | LV posterior fractional thickening |
| LVPWs | LV posterior wall thickness, end systole |
| MA distA | Mitral annular distance A |
| MA distB | Mitral annular distance B |
| MnPG | Mean pressure gradient |
| MnV | Mean velocity |

**Table 5-127: Terms and abbreviations expanded**

| Abbreviation | Definition |
|---|---|
| MPI | Myocardial performance index |
| MR | Mitral regurgitation |
| MR FR | MR flow rate |
| MR PV | MR peak velocity |
| MR radius | MR PISA radius |
| MR RF | MR regurgitant fraction |
| MR RV | MR regurgitant volume |
| MR Vmax | MR maximum velocity |
| MS angle | Mitral leaflet opening angle |
| MS PGmax | Mitral stenosis maximum pressure gradient |
| MS radius | Mitral stenosis flow PISA radius |
| MS Vmax | Mitral stenosis maximum velocity |
| MV | Mitral valve |
| MV c-o time | MV closing to opening time |
| MVA | Mitral valve area |
| MVann | Mitral annulus |
| MVann SV | Stroke volume by MVann |
| PA | Pulmonary artery |
| PA PGmax | PA maximum pressure gradient |
| PA Vmax | PA maximum velocity |
| PAP ed | PA pressure at end diastole |
| PAP sys | PA pressure at systole |
| PEP | Pre ejection period |
| PEP/ET | PEP to ET ratio |
| PG | Pressure gradient |

**Table 5-127: Terms and abbreviations expanded**

| Abbreviation | Definition |
|---|---|
| PHT | Pressure half time |
| PPG | Peak pressure gradient |
| PR | Pulmonic regurgitation |
| PR PGmax | PR maximum pressure gradient |
| PR Vmax | PR maximum velocity |
| PRed PG | PR end-diastolic pressure gradient |
| PRed vel | PR end-diastolic velocity |
| Pulmonic diam | Pulmonic diameter |
| Pulmonic VTI | Pulmonic flow VTI |
| PV | Pulmonary vein |
| PV Sys. Frac. | PV systolic filling fraction |
| PVA | PV A wave |
| PVA dur | PVA duration |
| PVD | PV diastolic wave |
| PVS | PV systolic wave |
| Qp/Qs | Pulmonic to Systemic flow ratio |
| RA | Right atrial |
| RA press | Estimated right atrial pressure |
| RAL | RA longitudinal dimension |
| RAT | RA transverse dimension |
| RV | Right ventricular |
| RV FAC | RV fractional area change |
| RVD | RV dimension, end diastole (4ch) |
| RVd area | RV area, end diastole |
| RVDd | RV diameter, diastole |

**Table 5-127: Terms and abbreviations expanded**

| Abbreviation | Definition |
|---|---|
| RVOT | RV outflow tract |
| RVs area | RV area, end systole |
| S/D | PVS velocity to PVD velocity ratio |
| SI | Stroke index |
| SV | Stroke volume |
| sys | systole |
| Systemic diam | Systemic diameter |
| Systemic VTI | Systemic flow VTI |
| t | Mean LV myocardial thickness |
| TR | Tricuspid regurgitation |
| TR PGmax | TR maximum pressure gradient |
| TR Vmax | TR maximum velocity |
| TV | Tricuspid valve |
| TV c-o time | TV closing to opening time |
| VTI | Velocity time integral |

# Vascular measurement

Vascular measurement has several categories: Carotid Artery Measurement, Upper Extremity Arterial, Upper Extremity Venous, Lower Extremity Arterial, and Lower Extremity Venous.

Auto IMT (intima-media thickness) measurement (Optional) is included in Carotid Artery Measurement.

# Mode measurement functions

The following tables describe the measurement functions of each mode.

**Table 5-128: B mode measurement functions**

| Measurement item | Description | Remarks |
|---|---|---|
| Carotid artery measurement | Distance<br>Area<br>%Steno Dist<br>%Steno Area<br>IMT<br>Auto IMT | (Right · Left) |
| Upper and lower extremity vascular measurement | Distance<br>Area<br>%Steno Dist<br>%Steno Area | (Right · Left)<br>(prox. · mid. · dist.) |

**Table 5-129: D mode measurement functions**

| Measurement item | Description | Remarks |
|---|---|---|
| Carotid artery measurement | PSV, EDV<br>MnV<br>PI ,RI | (Right · Left) |
| | PSV, EDV<br>MnV<br>PI, RI | (Right · Left)<br>(prox. · mid. · dist.) |

# Built-in mode measurement functions

**Table 5-130: B mode, carotid artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| CCA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | CCA (Common Carotid Artery) |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| | IMT1<br>IMT2<br>IMT3<br>Max<br>Mean<br>Len | mm<br>mm<br>mm<br>mm<br>mm<br>mm | <br><br><br>(Based on IMT1 to 3)<br>(Based on IMT1 to 3)<br>Vessel diameter |
| ECA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | ECA (External Carotid Artery) |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| | IMT1<br>IMT2<br>IMT3<br>Max<br>Mean<br>Len | mm<br>mm<br>mm<br>mm<br>mm<br>mm | <br><br><br>(Based on IMT1 to 3)<br>(Based on IMT1 to 3)<br>Vessel diameter |

**Table 5-130: B mode, carotid artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| ICA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | ICA (Internal Carotid Artery) |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| | IMT1<br>IMT2<br>IMT3<br>Max<br>Mean<br>Len | mm<br>mm<br>mm<br>mm<br>mm<br>mm | <br><br><br>(Based on IMT1 to 3)<br>(Based on IMT1 to 3)<br>Vessel diameter |
| Vert A<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Vert A (Vertebral Artery) |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| | IMT1<br>IMT2<br>IMT3<br>Max<br>Mean<br>Len | mm<br>mm<br>mm<br>mm<br>mm<br>mm | <br><br><br>(Based on IMT1 to 3)<br>(Based on IMT1 to 3)<br>Vessel diameter |

**Table 5-130: B mode, carotid artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| Subclav A<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Subclav A (Subclavian Artery) |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| | IMT1<br>IMT2<br>IMT3<br>Max<br>Mean<br>Len | mm<br>mm<br>mm<br>mm<br>mm<br>mm | <br><br><br>(Based on IMT1 to 3)<br>(Based on IMT1 to 3)<br>Vessel diameter |
| Innom A<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Innom A (Innominate Artery) |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| | IMT1<br>IMT2<br>IMT3<br>Max<br>Mean<br>Len | mm<br>mm<br>mm<br>mm<br>mm<br>mm | <br><br><br>(Based on IMT1 to 3)<br>(Based on IMT1 to 3)<br>Vessel diameter |

**Table 5-130: B mode, carotid artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| BIF<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | BIF (Bifurcation) |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| Auto IMT<br>(Right · Left)<br>– Far<br>– Near | Max<br>Mean<br>Width | mm<br>mm<br>mm | |
| Plaque<br>(Right · Left) | Dist | mm | |

**Table 5-131: B mode, upper extremity artery measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| AA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Axilllary artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %mm<br>m<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-131: B mode, upper extremity artery measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| BA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Brachial artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| DBA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Brachial artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| Bas A<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Basilic artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| RA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Radial artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-131: B mode, upper extremity artery measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| UA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Ulnar artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| SPA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Superficial Palmar Arches artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| Graft<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Graft |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-132: B mode, upper extremity venous measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| IJV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Internal Jugular vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %mm<br>m<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| ScV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Subclavian vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| AV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Axillary vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| BV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Brachial vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-132: B mode, upper extremity venous measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| RV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Radial vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| UV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Ulnar vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| UCV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Upper Cephalic vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| FCV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Forearm Cephalic vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-132: B mode, upper extremity venous measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| UBasV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Upper Basilic vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| FBasV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Forearm Basilic vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-133: B mode, lower extremity artery measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| CIA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Common Iliac artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %mm<br>m<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-133: B mode, lower extremity artery measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| EIA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | External Iliac artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| CFA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Common Femoral artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| DFA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Deep Femoral artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| SFA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Superficial Femoral artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-133: B mode, lower extremity artery measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| PopA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Popliteal artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| ATA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Anterior Tibial artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| PerA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Perineal artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| PTA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Posterior Tibial artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-133: B mode, lower extremity artery measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| DPA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Dorsalis Pedis artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| IIA<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Internal Iliac artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-134: B mode, lower extremity venous measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| CIV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Common Iliac vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %mm<br>m<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-134: B mode, lower extremity venous measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| EIV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | External Iliac vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| CFV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Common Femoral vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| PopV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Popliteal vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| ATV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Anterior Tibial vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-134: B mode, lower extremity venous measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| PerV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Perineal vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| PTV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Posterior Tibial artery |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| DFV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Deep Femoris vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| IIV<br>(Right · Left) | Dist<br>Area | mm<br>$mm^2$ | Internal Iliac vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-134: B mode, lower extremity venous measurement**

| Measurement item | Result | Unit | Remarks |
|---|---|---|---|
| GSV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Great Saphenous vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| LSV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Lesser Saphenous vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |
| SFV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Dist<br>Area | mm<br>$mm^2$ | Superficial Femoral vein |
| | %Steno-Dist<br>Dist1<br>Dist2 | %<br>mm<br>mm | (Based on Dist1 and Dist2) |
| | %Steno-Area<br>Area1<br>Area2 | %<br>$mm^2$<br>$mm^2$ | (Based on Area1 and Area2) |

**Table 5-135: D mode, carotid artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| CCA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Common Carotid Artery |

**Table 5-135: D mode, carotid artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| ECA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | External Carotid Artery |
| ICA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Internal Carotid Artery |
| Vert A<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Vertebral Artery |
| Subclav A | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Subclavian Artery |
| Innom A<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Innominate Artery |
| BIF<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | BIF (Bifurcation) |

**Table 5-136: D mode, upper extremity artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| ScA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Subclavian Artery |
| AA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Axillary artery |
| BA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Brachial artery |
| DBA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Deep Brachial artery |
| Bas A<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Basilic artery |
| RA | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Radial artery |

**Table 5-136: D mode, upper extremity artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| UA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Ulnar artery |
| SPA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Superficial Palmar Arches artery |
| Graft<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist.<br>-outflow<br>-inflow | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Graft |

**Table 5-137: D mode, upper extremity venous measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| UCV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | MnV | cm/s | Upper Cephalic vein |
| FCV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | MnV | cm/s | Forearm Cephalic vein |
| UBasV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | MnV | cm/s | Upper Basilic vein |

**Table 5-137: D mode, upper extremity venous measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| FBasV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | MnV | cm/s | Forearm Basilic vein |
| IJV<br>(Right · Left) | MnV | cm/s | Internal Jugular vein |
| SCV<br>(Right · Left) | MnV | cm/s | Subclavian vein |
| AV<br>(Right · Left) | MnV | cm/s | Axillary vein |
| BV<br>(Right · Left) | MnV | cm/s | Brachial vein |
| RV<br>(Right · Left) | MnV | cm/s | Radial vein |
| UV<br>(Right · Left) | MnV | cm/s | Ulnar vein |

**Table 5-138: Lower extremity artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| CIA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Common Iliac artery |
| EIA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | External Iliac Artery |

**Table 5-138: Lower extremity artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| CFA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Common Femoral artery |
| DFA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Deep Femoral artery |
| SFA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Superficial Femoral artery |
| PopA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Popliteal artery |
| ATA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Anterior Tibial artery |
| PerA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Perineal artery |

**Table 5-138: Lower extremity artery measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| PTA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Posterial Tibial artery |
| DPA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Dorsalis Pedis artery |
| IIA<br>(Right · Left) | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- | Internal Iliac artery |

**Table 5-139: Lower extremity venous measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| CIV<br>(Right · Left) | MnV | cm/s | Common Iliac vein |
| EIV<br>(Right · Left) | MnV | cm/s | External Iliac vein |
| CFV<br>(Right · Left) | MnV | cm/s | Common Femoralcvein |
| PopV<br>(Right · Left) | MnV | cm/s | Popliteal vein |
| PTV<br>(Right · Left) | MnV | cm/s | Posterior Tibial vein |
| PerV<br>(Right · Left) | MnV | cm/s | Perineal vein |
| ATV<br>(Right · Left) | MnV | cm/s | Anterior Tibial vein |

**Table 5-139: Lower extremity venous measurement**

| Measurement item | Display item | Unit | Remarks |
|---|---|---|---|
| IIV<br>(Right · Left) | MnV | cm/s | Internal Iliac vein |
| DFV<br>(Right · Left) | MnV | cm/s | Deep Femoral vein |
| GSV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | MnV | cm/s | Great Saphenous vein |
| LSV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | MnV | cm/s | Lesser Saphenous vein |
| SFV<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | MnV | cm/s | Superficial Femoral vein |

# 2D (B) mode

## Vascular measurement on a B-mode image

This section explains how to use the measurement functions listed in "Built-in mode measurement functions" on page 375 for B mode.

In B mode, you can measure the following:

- Vessel diameter (Distance)
- Area (Area)
- Stenosis ratio (%Steno Distance and %Steno Area)

For the carotid artery, you can also measure intima-media thickness (IMT).

For each vessel, you measure regions such as right/left (Rt./Lt.), and proximal/middle/distal (prox/mid/dist). The displayed measurement menu varies, depending on the selected vessel.

## Measuring distance

This section explains the procedure for measuring distance. As an example, the procedure uses the right common carotid artery measurement (Rt.CCA). Note that you must have the Carotid preset selected to see the Rt. CCA measurement.

**To measure distance**

1 In 2D (B) mode, on the touch panel, tap the **Rt.CCA** button of CCA.

2 Display the longitudinal section of Rt.CCA.

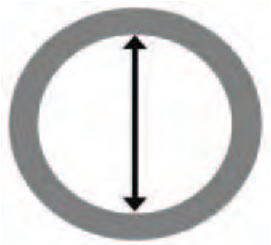
3 On the touch panel, tap **Distance**.

A caliper mark (+) appears on the monitor.

4 When the measurement regions such as **prox**, **mid**, and **dist** show on the measurement menu, tap the button for the desired region.

You do not need to measure all the regions.

5 Measure the diameter of the right common carotid artery.



6 Press the **SET** button (

).

The Rt.CCA distance measurement is finalized.

The measurement display looks like the following:

**Table 5-140: Rt.CCA distance measurement item**

| Rt.CCA | | | Measurement item |
|---|---|---|---|
| Dist | __._ | mm | |

## Measuring area

This section explains the procedure for measuring area. As an example, the procedure uses the right common carotid artery measurement (Rt.CCA). Note that you must have the Carotid preset selected to see the Rt. CCA measurement.

**To measure area**

1 On the touch panel, tap the **2D (B)** tab.

2 Select the **Rt.CCA** button of CCA.

3 Display the transverse section of Rt.CCA.

4 On the touch panel, tap the **Area** button.

A caliper mark (+) appears on the monitor.

5 When the measurement regions such as **prox**, **mid**, and **dist** show on the measurement menu, tap the button for the desired region.

You do not need to measure all the regions.

6 Trace the lumen of the right common carotid artery.

- You can trace with either the **Free** trace (manual tracing) or the **Ellipse** measure tool.
- To switch to Free or Ellipse, press the switch menu button 2 (the rocker button under **Measure tool**).

- For information on using these tools, see "Trace" on page 223 and "Ellipse" on page 228.

**7** Press the **SET** button (

).

The area measurement of Rt.CCA is finalized.

The measurement display looks like the following:

**Table 5-141: Rt.CCA area measurement item**

| Rt.CCA | | | Measurement item |
|---|---|---|---|
| Area | __._ | mm | |

## Measuring %Stenosis (stenosis ratio)

You can calculate the stenosis ratio based on either of the following:

- Diameter (**%Steno Dist**)
- Cross-sectional area (**%Steno Area**)

### Calculating stenosis ration based on %Steno Distance

The following procedure uses Rt.CCA as an example. Note that you must have the Carotid preset selected to see the Rt. CCA measurement.

**To measure the stenosis ratio based on diameter**

**1** On the touch panel, tap the **2D (B)** tab.

**2** Select the **Rt.CCA** button of CCA.

The touch panel screen switches.

**3** Display the longitudinal section of Rt.CCA.

**4** On the touch panel, tap **%Steno Distance**.

For more information on measuring distance for a stenosis ratio, see "%Stenosis (Stenosis ratio)" on page 253.

A caliper mark (+) appears on the monitor.

5 When the measurement regions such as **prox**, **mid**, and **dist** show on the measurement menu, tap the button for the desired region.

You do not need to measure all the regions.

6 Measure the diameter of the right common carotid artery.

7 Measure the diameter of the stenotic segment.

8 Press the **SET** button (

).

The %Steno Distance measurement of Rt.CCA is finalized.

The measurement display looks like the following:

**Table 5-142: Rt.CCA steno distance measurement items**

| Rt.CCA | | | Measurement item |
|---|---|---|---|
| Dist1 | __._ | mm | |
| Dist2 | __._ | mm | |
| Steno | __._ | % | |

## Calculating stenosis ratio based on %Steno Area

The following procedure uses Rt.CCA as an example. Note that you must have the Carotid preset selected to see the Rt. CCA measurement.

### To measure the stenosis ratio based on area

1 On the touch panel, tap the **2D (B)** tab.

2 Select the **Rt.CCA** button of CCA.

3 Display the transverse section of Rt.CCA.

4 On the touch panel, tap **%Steno Area**.

For more information on measuring area for a stenosis ratio, see "Calculating stenosis ratio based on %Steno Area" on page 400.

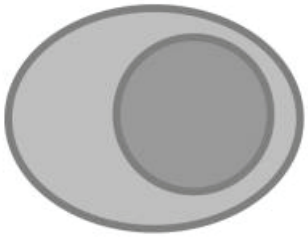
A caliper mark (+) appears on the monitor.

5 When the measurement regions such as **prox**, **mid**, and **dist** show on the measurement menu, tap the button for the desired region.

You do not need to measure all the regions.

6 Trace the lumen of the right common carotid artery.

7 Trace the area of the stenotic segment.



- You can trace with either the **Free** trace (manual tracing) or the **Ellipse** measure tool.
- To switch to **Free** or **Ellipse**, press the switch menu button 2 (the rocker button under **Measure tool**).
- For information on using these tools, see "Trace" on page 223 and "Ellipse" on page 228.

8 Press the **SET** button (

).

The %Steno Area measurement of Rt.CCA is finalized.

The measurement display looks like the following:

**Table 5-143: Rt.CCA steno area measurement items**

| Rt.CCA | | | Measurement item |
|---|---|---|---|
| Area1 | —.— | $mm^2$ | |
| Area2 | —.— | $mm^2$ | |

**Table 5-143: Rt.CCA steno area measurement items**

| Rt.CCA | | | Measurement item |
|---|---|---|---|
| Steno | __._ | % | |

## Measuring IMT

This section explains the procedure for measuring the IMT (intima-media thickness). As an example, the procedure uses the right common carotid artery measurement (Rt.CCA). Note that you must have the Carotid preset selected to see the Rt. CCA measurement.

**To measure IMT**

1 On the touch panel, tap the **B** tab.

2 Select the **Rt.CCA** button of CCA.

3 Display the longitudinal section of Rt.CCA.

4 On the touch panel, tap **IMT**.

An auxiliary line appears.

5 With the trackball, move the line, and then, with the multi dial ( ), adjust its angle.

6 Press the **Set** button

.

A caliper mark (+) appears on the monitor.

7 Measure the most-thickened part of the right common carotid artery.

This measurement is IMT1.

8 Measure the thickness of the right common carotid artery at the peripheral side.

This measurement is IMT2.

9 Measure the thickness of the right common carotid artery at the center side.

This measurement is IMT3.

10 Measure the vessel diameter.

All measurements are finalized.

**Table 5-144: Rt.CCA IMT measurement items**

| Rt.CCA | | | Measurement item |
|---|---|---|---|
| IMT1 | __._ | mm | IMT at most thickened part |
| IMT2 | __._ | mm | IMT at periphery side |
| IMT3 | __._ | mm | IMT at center side |
| Max | __._ | mm | Maximum IMT value |
| Mean | __._ | mm | Mean IMT value |
| Diam | __ | mm | Vessel diameter |
| Width | __ | mm | Width of auxiliary line |

## Auto IMT (intima-media thickness) measurement (Optional)

**WARNING**

To ensure high quality images, all patient images must be obtained by qualified and trained individuals.

To avoid patient injury, IMT results should not be used as a sole diagnostic tool. All IMT results should be interpreted in conjunction with other clinical information or risk factors.

To avoid measurement errors, all measurements must be of the common carotid artery (CCA). This tool is not intended for measuring the bulb or the internal carotid artery (ICA).

To avoid incorrect calculations, verify that the patient information, date, and time settings are accurate.

To avoid misdiagnosis or erroneously influencing the results of patient examination, start a new patient information form before starting a new patient examination and performing calculations. Starting a new patient information form clears the previous patient's data. The previous patient's data will be combined with the current patient if calculations and examinations are performed without creating a new patient information form. For the procedure to create a new patient information form, see "Entering patient information" on page 124.

The transducers and presets that can be used with Auto IMT (intima-media thickness) measurement (Optional) are as follows.

| Probe | Carotid |
|---|---|
| HFL38xp | ✓ |
| HFL50xp | ✓ |
| L25xp | ✓ |
| L38xp | ✓ |

**To automatically measure IMT**

**1** Freeze the B-mode image and press the **CALCS** button.

**Note**

In order to perform correct measurement, an image with the direction of the common carotid artery (CCA) parallel to the body surface must be obtained before freezing the image.

**2** Select the **Rt.IMT Far1** button.

**3** Use the trackball to place the IMT tool on top of the region of interest.

**4** Adjust the tool and edit it as necessary. For more information about the IMT tool, see "IMT tool menu" on page 405.

**5** Press the **SET** button (

).

**Rt.IMT Far1** measurement is confirmed.

The measurement values are as shown in the table below.

**Table 5-145: Rt.IMT Far1 measurement items**

| Rt.IMT Far1 (right intima-media thickness far 1) | | | Measurement item |
|---|---|---|---|
| Max | __._ | mm | Max. IMT value |

**Table 5-145: Rt.IMT Far1 measurement items**

| Rt.IMT Far1 (right intima-media thickness far 1) | | | Measurement item |
|---|---|---|---|
| Mean | __._ | mm | Mean IMT value |
| Width | __._ | mm | Measured width |

**Note**

Because of ultrasound characteristics, normally IMT measurement of posterior wall is more accurate than IMT measurement of anterior wall. Anterior wall IMT measures the distance between the adventitia and the posterior edge of the lumen, while posterior wall IMT measures the distance between the lumen and the anterior edge of the adventitia.

IMT Far: Measures the posterior wall IMT.

IMT Near: Measures the anterior wall IMT.

## IMT tool menu

You can select the following menu items while using the IMT tool.

**Table 5-146: Description of menu items**

| Menu item | Description |
|---|---|
| Width | Adjusts the tool width in 1 mm increments. Rotate the multi dial to the right to increase the width, or to the left to decrease the width. |
| Adven | Adjusts the adventitia-media line. Rotate the dial menu button to the right to raise the line, or to the left to lower the line. |
| Lumen | Adjusts the lumen-intima line. Rotate the dial menu button to the right to raise the line, or to the left to lower the line. |

**Note**

Adven and Lumen IMT lines can be adjusted individually.

# D mode

## Measuring blood flow

As an example of the procedure for measuring blood flow, the procedure uses the right common carotid artery measurement (Rt.CCA; note that you must have the Carotid preset selected to see the Rt. CCA measurement). You can measure other vessels and regions in the same way. With this measurement item, you can measure the blood flow of CCA, ECA, ICA, VertA, Subclav A, Rt. Innom A, etc.

The measurement regions of each vessel are as follows:

- Right (rt.) and left (lt.).
- Anterior (pre), proximal (prox), middle (mid), distal (dist), etc.

D mode displays the Doppler image of the common carotid artery.

**To measure blood flow**

**1** On the touch panel, tap the **D** tab.

**2** Select the **Rt.CCA** button of CCA.

The touch panel screen switches.

**3** Display the longitudinal section of Rt.CCA.

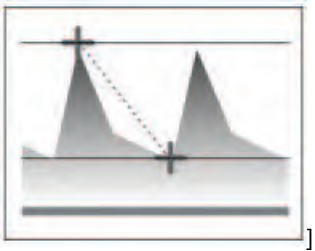
**4** To measure PSV and EDV:

**a** Tap the **PSV**, **EDV** button.

**b** Place the caliper on the PSV point, and then press the **SET** button (

).

**c** Place the next caliper on the EDV point, and then press the **SET** button to finalize the measurement.


]

**5** To measure MnV:

**a** Tap the **MnV** button.

**b** Use the caliper to trace the target waveform.

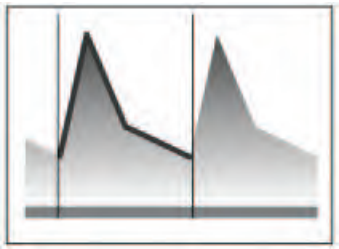
For measuring MnV, PI or RI, you can trace with either the Velocity Trace (manual tracing) or Auto Velocity Trace measure tool.

To change to either Velocity Trace or Auto Velocity Trace, press the switch menu button 2 (the rocker button under **Measure tool**).

For details on the procedure of each method, see "Velocity trace" on page 269.

**c** Press the **SET** button.

The waveform is displayed automatically, and the MnV value is calculated.



**6** To measure PI or RI:

**a** Tap the **PI** or **RI** button.

**b** Use the caliper to trace the target waveform.

**c** Press the **SET** button.

The measurement is finalized, and the MnV, PI, RI and S/D values are calculated.

The measurement display looks like the following:

**Table 5-147: Rt.CCA measurement items**

| Rt.CCA | | | Measurement item (PSV, EDV) |
|---|---|---|---|
| PSV | __._ | m/s | Peak systolic velocity |
| EDV | __._ | m/s | End-diastolic velocity |
| S/D | | | S/D |

| Rt.CCA | | | Measurement item (MnV) |
|---|---|---|---|
| ⊿t | __._ | ms | Time between two points |
| ⊿t (ET) | __._ | ms | Ejection time |
| HR | __._ | bpm | Heart rate |
| MaxV | __._ | m/s | Maximum velocity |
| MinV | __._ | m/s | Minimum velocity |
| MnV | __._ | | Mean velocity |
| S/D | | | S/D ratio |
| | | beat | Number of heartbeats |

| Rt.CCA | | | Measurement item (PI, RI) |
|---|---|---|---|
| ⊿t | __._ | ms | Time between two points |
| ⊿t (ET) | __._ | ms | Ejection time |
| HR | __._ | bpm | Heart rate |
| MaxV | __._ | m/s | Maximum velocity |
| MinV | __._ | m/s | Minimum velocity |
| MnV | __._ | | Mean velocity |
| PI | | | Pulsatility Index |
| RI | | | Resistance Index |
| S/D | | | S/D ratio |
| | | beat | Number of heartbeats |

# Measurement of upper and lower extremity artery

In this measurement, measure upper and lower extremity artery.

- Upper Extremity Artery
  - ScA , AA , BA , DBA , BasA , RA , UA , SPA , Graft
- Lower Extremity Artery
  - CIA , EIA , CFA , DFA , SFA , PopA , ATA , PreA , PTA , DPA , IIA

Each vein has the parts which are Rt/Lt, pre , prox. , mid , dist, inflow and outflow to measure the blood flow.

In this section, there is example of examination to measure Rt.Sca. However, you can use same operating procedure for each parts and veins.

**To measure Upper and lower extremity artery**

**1** Display the Doppler image of Subclavian Artery.

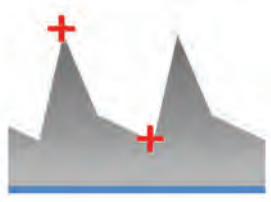
**2** Tap the **Rt. UEA** tab. If there is no **Rt. UEA** tab, tap » or « to display the tab.

**3** Tap Rt ScA. An image similar to the following appears:

**4** Select the **PSV and EDV** button.

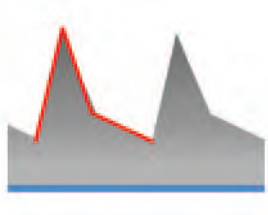
**5** Move the caliper to PSV and press **SET**.

**6** Next, move the caliper to the EDV and press **SET**.



**7** Select the **MnV** button.

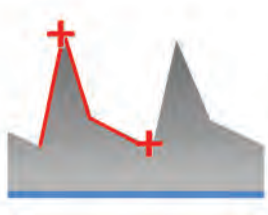
**8** Trace the waveform you want to measure by using the caliper.



**9** Press **SET** and the calculated value of MnV appears.

**10** Select **PI, RI**.

**11** Trace the waveform you want to measure by using the caliper.



**12** Press **SET** and the calculated values of MnV, PI,RI, and S/D appear.

There are two ways to trace Doppler:

- Velocity Trace which traces Doppler manually
- Auto Velocity

Each measurement has different operating procedure to trace the wave form.

## Measurement of upper and lower extremity venous

In this measurement item, measure the upper extremery venous and lower extremity venous.

- Upper Extremity Artery/VENOUS
  - UCV , FCV , UBaV , FBaV , IJV , ScV , AV , BV , RV , UV
- Lower Extremity Artery/VENOUS

- GSV , LSV , CIV , SFV , PopV , PTV , PreV , ATV , IIV , DFV

Each vein has the parts which are Rt/Lt, pre, prox , mid, and dist to measure the blood flow.

In this section, there is example of examination to measure Lt.ScV. However, you can use same operating procedure for each veins and parts.

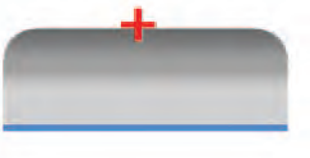
**1** Display the Doppler image of subclavian vein.

**2** Select the **Lt. UEV2** tab on the touch panel. If there is no **Lt. UEV2** tab, tap >> or << to display the tab.

**3** Tap **Lt. ScV**. An image similar to the following appears:

**4** Select the **Peak V** button

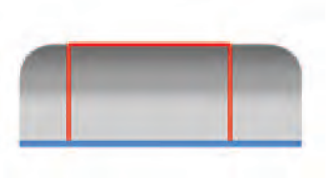
**5** Move caliper to Peak V point and Press the **SET**.



**6** Select **MnV** button.

**7** Trace the wave form which you want to measure by using caliper

**8** Press **SET** and the caluculated value of MnV appears.



There are two ways to trace Doppler:

- Velocity Trace which traces Doppler manually
- Auto Velocity

Each measurement has different operating procedure to trace the wave form.

## Vascular worksheet and report

In addition to **Study Information** and **Exam Information**, the Vascular report screen has these categories: Carotid Artery, IMT, Upper Extremity Arterial, Upper Extremity Venous, Lower Extremity Arterial, and Lower Extremity Venous.

For more information on working with the report and worksheet, see the following:


- "Vascular worksheet and report" on page 412
- "Displaying a report" on page 413
- "Editing values on a worksheet" on page 414
- "Saving changes on a worksheet" on page 415
- "Specifying the worksheet's continuous-measurement calculation" on page 415


**Table 5-148: Terms and abbreviations, carotid artery**

| Name | Formal nomenclature |
|---|---|
| CCA | Common carotid artery |
| BIF | Bifurcation |
| ECA | External carotid artery |
| ICA | Internal carotid artery |
| IMT | Intimal medial thickness |
| Vert. A | Vertebral artery |

**Table 5-148: Terms and abbreviations, carotid artery**

| Name | Formal nomenclature |
|---|---|
| Subclav A | Subclavian artery |

## Worksheet and report

### Displaying a report

**To display application-specific measurement data for a current examination**

1 Press the **FREEZE** button ( ) to freeze the image, and then press the **CALCS** button ( ).

2 Press either arrow on the switch menu button 1(the rocker button beneath **Report**).

Report screens appear.

**To display application-specific measurement data for an archived examination:**

1 Press the **SYSTEM** button

The **User Setting** screen appears.

2 On page 1/1, tap **UI**. The **UI** screen appears.

3 Tap **F-Key Config**. Assign the report function to any function button.

4 Tap **Archive** screen.

5 Tap an examination and press the function button to which the report function has been assigned.

### Changing pages on the Report screen or worksheet

If the report results cannot be displayed within one page, the number of the report pages is displayed at the lower side of the touch panel.

**To switch the page**

- Press switch menu button 4 (the rocker button under **Page**).

### Switching between the report and the worksheet

**To switch between the Report and the Worksheet**

- At the right side of the touch panel, tap **Report** or **Worksheet**, as appropriate.

## Editing values on a worksheet

The **Worksheet** screen displays the measurement values (measurement results) of the cardiac or vascular measurement.

You can also specify the measurement items to be used and displayed on the **Worksheet** screen.

**To correct or delete the displayed values**

- Place the cursor in the value's text box and either correct or delete the value.

## Making information items visible on the Study or Exam Information screen

**To specify the information items to be displayed on screens such as the Report screen**

1. Tap the **Study Info** or **Exam Info** button, depending on whose visible items you want to change.
2. In the **Check** column, make sure a check mark is present for the measurement items that you want to be visible.

   If the check mark is not present, tap in the column.

   There may be more than one page of measurement items to select.
3. If there is more than one page of measurement items, then to see other pages, press switch menu button 4 (the rocker button under **Worksheet Page**).
4. When you have finished, tap **Close**.
5. Place a check mark in the check box on the left-hand side of each information item on the worksheet.

## Specifying measurement items for the Cardiac measurement

**To specify the measurement items for the Cardiac measurement**

1. Tap the button whose visible measurement items you want to change.

   The buttons represent groups of measurement items for the current preset.
2. In the **Check** column, make sure that a check mark is present for the measurement items that you want to be visible.

   If the check mark is not present, tap in the column.

   There may be more than one page of measurement items to select.
3. If there is more than one page of measurement items, then to see other pages, press switch menu button 4 (the rocker button under **Worksheet Page**).

**4** When you have finished, tap **Close**.

## Saving changes on a worksheet

As you edit, content that you change turns red, and an asterisk appears.

### To save the content

- After you have edited the content, tap **Update**, and then operate the switch menu button 2.

  Saved changes turn white.

## Specifying the worksheet's continuous-measurement calculation

### To specify calculation of the Worksheet value during continuous measurement

**1** On the touch panel, tap **Value**.

**2** Press the switch menu button to select the measurement value to be displayed on the Worksheet.

The possible values are:

- Average value of the continuous measurement
- Value of the last measurement

# Abdominal Measurement

## Functional Overview

**Table 5-149: 2D mode**

| Measurement item | Description |
|---|---|
| Liver/Spleen Measurement | Distance<br>Area<br>SI<br>(Spleen Index) |
| Bile duct/Shunt measurement | Distance |
| Gall bladder measurement | Distance<br>Wall Thickness |
| Pancreas measurement | Distance |
| Aorta measurement | Distance |
| Bowel measurement | Distance<br>Wall Thickness |
| Liver measurement | Distance<br>Volume |
| Hip dislocation measurement | Angle |

**Table 5-150: D-mode**

| Measurement item | Description |
|---|---|
| Liver/Spleen Measurement | Peak Velocity<br>Mean<br>Velocity |
| Bile duct/Shunt measurement | Peak Velocity<br>Mean<br>Velocity |
| Aorta measurement<br>(prox · mid · dist) | Peak Velocity<br>PSV , EDV<br>Mean<br>Velocity<br>PI, RI, S/D |

**Table 5-150: D-mode**

| Measurement item | Description |
|---|---|
| Renal artery measurement<br>(Right · Left) | PSV, EDV<br>Mean<br>Velocity<br>PI, RI, S/D |

# Built-in Measurement Functions

**Table 5-151: 2D mode**

| Measurement item | Display item | Unit |
|---|---|---|
| Liver (Right · Left) | L1<br>L2 | cm<br>cm |
| Spleen<br>SI=a x b | a<br>b<br>SI | cm<br>cm<br>-- |
| Hepatic Vein | Dist | mm |
| SMV (Superior mesenteric vein) | Dist | mm |
| Splenic Vein | Dist | mm |
| PS Confince (Confluence) | Dist | mm |
| Main PV | Dist | mm |
| PV (Right · Left) | Dist<br>Dist | mm<br>mm |
| Shunt | Shunt | mm |
| GB | GB L<br>GB W<br>GB Wall | cm<br>cm<br>cm |
| CBD | prox.<br>mid.<br>dist. | mm<br>mm<br>mm |
| Pancreas | head<br>body<br>tail<br>P-Duct | cm<br>cm<br>cm<br>cm |
| Renal (Right · Left) | L<br>W<br>A-P<br>Vol. | cm<br>cm<br>cm<br>$cm^3$ |
| Renal Artery (Right · Left) | Renal A | cm |

**Table 5-151: 2D mode**

| Measurement item | Display item | Unit |
|---|---|---|
| Adrenal (Right · Left) | L<br>W<br>A-P | cm<br>cm<br>cm |
| Aorta (AP · Trans)<br>AP and Trans for each item | prox.<br>mid.<br>dist. | cm<br>cm<br>cm |
| CIA (Right · Left)<br>Right and Left for each item | prox.<br>mid.<br>dist. | cm<br>cm<br>cm |
| Appendix | Appendix<br>Appendix<br>Wall | cm<br>mm |
| Pylorus | Pylorus<br>Pylorus Wall | cm<br>mm |

**Table 5-152: 2D Mode (Hip Angle)**

| Measurement item | Display item | Unit |
|---|---|---|
| Hip Angle (Right · Left) | α<br>β | °(degree)<br>°(degree) |

**Table 5-153: D-Mode**

| Measurement item | Display item | Unit |
|---|---|---|
| Aorta<br>-prox.<br>-mid.<br>-dist. | Peak V<br>PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- |

**Table 5-153: D-Mode**

| Measurement item | Display item | Unit |
|---|---|---|
| CIA<br>(Right · Left)<br>-prox.<br>-mid.<br>-dist. | Peak V<br>PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- |
| Celiac Art.<br>-1<br>-2 | Peak V<br><br><br>PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br><br><br>cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- |
| SMA<br>-1<br>-2<br>-3 | Peak V<br><br>PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br><br>cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- |
| Hepatic A<br>-Common<br>-Rt.<br>-Lt. | Peak V<br>PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- |
| Splenic A | Peak V<br>PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- |

**Table 5-153: D-Mode**

| Measurement item | Display item | Unit |
|---|---|---|
| IMA | Peak V<br>PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | cm/s<br>cm/s<br>cm/s<br>cm/s<br>--<br>--<br>-- |
| Hepatic Vein | Peak V<br>MnV | cm/s<br>cm/s |
| SMV | Peak V<br>MnV | cm/s<br>cm/s |
| Splenic Vein | Peak V<br>MnV | cm/s<br>cm/s |
| PS Conflnce<br>(Confluence) | Peak V<br>MnV | cm/s<br>cm/s |
| PV<br>-Main PV<br>-Rt.<br>-Lt. | Peak V<br><br><br>MnV | cm/s<br><br><br>cm/s |
| Shunt<br>-pre.<br>-prox.<br>-mid.<br>-dist. | Peak V<br>MnV | cm/s<br>cm/s |

# 2D mode

## Liver Size Measurement

This section explains the procedure for measuring the size of the right or left lobe of liver.

Both the right and left lobes are measured with the same procedure.

**To measure liver size**

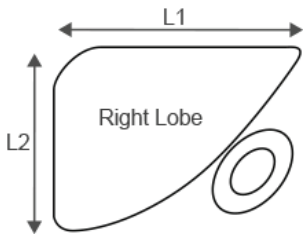
**1** On a frozen 2D image of the right or left lobe of a liver, select the **Liver/Spleen** tab on the touch panel.

**2** Select the **LiverSize** button. The touch panel is switched to the sequence screen.

**3** To measure the right lobe:

**a** The **Rt.L1** button is lit. Measure the L1 diameter on the right lobe image.

**b** The **Rt.L2** button is lit. Measure the L2 diameter on the right lobe image.

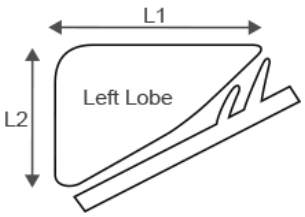



**4** To measure the left lobe:

**a** The **Lt.L1** button is lit. Measure the L1 diameter on the left lobe image.

**b** The **Lt.L2** button is lit. Measure the L2 diameter of the left lobe image.

**5** Press the **SET** button. The Liver Size measurement is finalized.




When measuring the left lobe first, start measurement by selecting the Lt.L1 button directly.

**Table 5-154: Liver size measurement items**

| Liver Size | | | Measurement item |
|---|---|---|---|
| Rt.L1 | __._ | cm | Right lobe diameter (L1) |
| Rt.L2 | __._ | cm | Right lobe diameter (L2) |
| Lt.L1 | __._ | cm | Left lobe diameter (L1) |
| Lt.L2 | __._ | cm | Left lobe diameter (L2) |

## Spleen Size Measurement

The section explains the procedure for measuring the size of the spleen to calculate Spleen Index.

**To measure spleen size**

1 On a frozen 2D image of the spleen, select the **Liver/Spleen** tab on the touch panel.

2 Select the **SpleenSize** button. The touch panel is switched to the sequence screen.

3 The **a** button is lit. Measure the length of the spleen (a).

4 The **b** button is lit. Measure the thickness of the spleen (b).

5 Press the **SET** button. The Spleen Size measurement is finalized and Spleen Index (SI = a x b) is calculated.

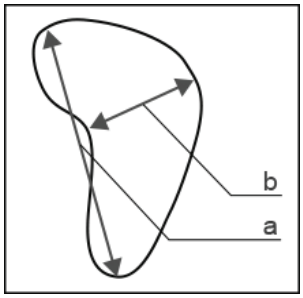



**Table 5-155: Spleen size measurement items**

| Spleen Size | | | Measurement item |
|---|---|---|---|
| a | __._ | cm | Spleen length (a) |
| b | __._ | cm | Spleen thickness (b) |
| SI(axb) | __._ | $cm^3$ | Spleen Index (SI = a x b) |

## Hepatic Vein Measurement

The diameter of the vessels such as Hepatic Vein, SMV, Splenic Vein, PS Confluence, Main PV, PV, etc. is measured.

This section explains the procedure for measuring Hepatic Vein as an example. Other vessels can also be measured in the same way.

**To measure the hepatic vein**

1 On a frozen 2D image of the hepatic vein, select the **Liver/Spleen** tab on the touch panel.

2 Select the **HepaticVein** button.

3 The touch panel screen is switched and a caliper mark (+) is displayed.

4 Measure the diameter of the hepatic vein and press the **SET** button. The Hepatic Vein measurement is finalized.

**Table 5-156: Hepatic vein measurement items**

| Hepatic Vein | | | Measurement item |
|---|---|---|---|
| Dist | __._ | cm | Hepatic vein diameter |

## GB (Gall Bladder) Size Measurement

The section explains the procedure for measuring the size of the gall bladder and the thickness of the gallbladder wall.

**To measure gall bladder size**

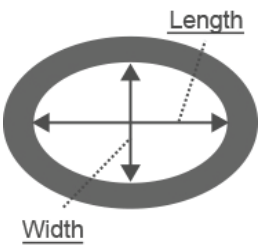
1 On a frozen 2d cross-sectional image of the gall bladder, press the **GB** tab on the touch panel.

2 Select the **GB Size** button. The touch panel is switched to the sequence screen.

3 The **GB L** button is lit. Measure the length of the gall bladder.

4 The **GB W** button is lit. Measure the width of the gall bladder.

5 Press the **SET** button. The GB Size measurement is finalized.




**To measure gall bladder wall thickness**

1 On a frozen 2D cross-sectional image of the gall bladder, select the **GB Wall** button.

2 The touch panel is switched and a caliper mark (+) is displayed.

3 Measure the thickness of the gallbladder wall and press the **SET** button. The GB Wall measurement is finalized.

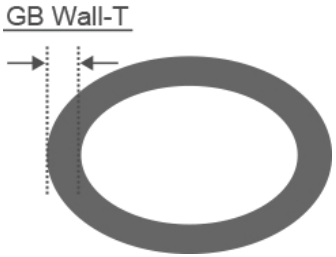



**Table 5-157: GB wall thickness measurement items**

| GB | | | Measurement item |
|---|---|---|---|
| GB L | __._ | cm | Length |
| GB W | __._ | cm | Width |
| GB Wall | __._ | cm | Gallbladder wall thickness |

## Pancreas Size Measurement

This section explains the procedure for measuring the size of the pancreas and the diameter of the pancreas duct.

Not all the measurement regions are displayed on the same screen. Switch to an appropriate sectional view as necessary.

**To measure pancreas size**

1 On a frozen 2D, cross-sectional image of the pancreas, select the **Pancreas** tab on the touch panel.

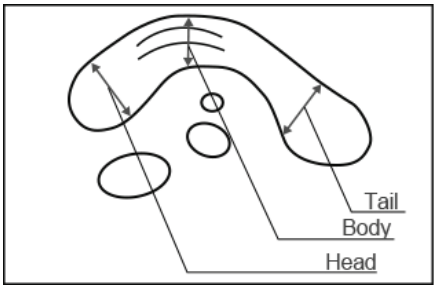
2 Select the **Pancreas Size** button. The touch panel is switched to the sequence screen.

3 The **head** button is lit. Measure the pancreas head.

4 The **body** button is lit. Measure the pancreas body.

5 The **tail** button is lit. Measure the pancreas tail.

6 Press the **SET** button. The Pancreas Size measurement is finalized.




**To measure pancreas duct diameter**

1 On a frozen 2D, cross-sectional image of the pancreas, select the **Panc Duct** button.

2 A caliper mark (+) is displayed on the monitor.

3 Measure the diameter of the pancreas duct and press the **SET** button. The Panc Duct measurement is finalized.

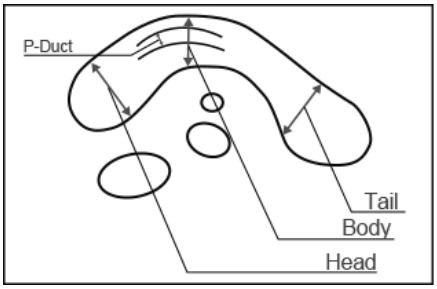



**Table 5-158: Pancreas measurement items**

| Pancreas | | | Measurement item |
|---|---|---|---|
| Head | __._ | cm | Pancreas head diameter |
| Body | __._ | cm | Pancreas body diameter |
| Tail | __._ | cm | Pancreas tail diameter |
| P-Duct | __._ | cm | Pancreas duct diameter |

## Renal Measurement

The size of the liver and the diameter of the renal artery are measured.

This section explains the procedure for measuring the right liver as an example.

Both the right and left livers are measured with the same procedure.

**To measure liver size**

1 On a frozen 2D image of the liver (longitudinal or transverse), select the **Renal** tab on the touch panel.

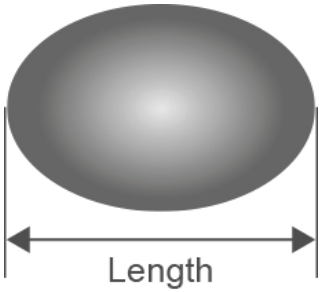
2 Select the **Rt.Renal Vol** button. The touch panel is switched to the sequence screen.

3 The **L** button is lit. Measure the length on the image of the longitudinal section.

4 The **W** button is lit. Measure the width on the image of the transverse section.

5 The **AP** button is lit. Measure the anteroposterior diameter on the image of the transverse section.

6 Press the **SET** button. The Rt.Renal measurement is finalized and the volume is calculated.




**To measure renal artery diameter**

1 On a frozen 2D image of the liver (longitudinal or transverse), select the **Rt.Renal Art** button.

2 The touch panel is switched and a caliper mark (+) is displayed on the monitor.

3 Measure the diameter of the renal artery and press the **SET** button. The Rt.Renal Art measurement is finalized.

**Note** | Perform measurement so that L, W, and AP are crossed at right angles

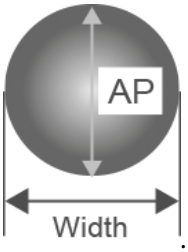



**Table 5-159: Renal measurement items**

| Rt. Renal Vol | | | Measurement item |
|---|---|---|---|
| L | __._ | cm | Length |
| W | __._ | cm | Width |
| AP | __._ | cm | Anteroposterior diameter |
| Vol. | __._ | $cm^3$ | Renal volume |

| Rt. RenalArt | | | Measurement item |
|---|---|---|---|
| Dist | __._ | mm | Renal artery diameter |

## Adrenal Size Measurement

The size of the adrenal is measured.

This section explains the procedure for measuring the right adrenal as an example.

Both the right and left adrenals are measured with the same procedure.

**To measure adrenal size**

**1** On a frozen 2D image of the adrenal, select the **Renal** tab on the touch panel.

**2** Select the **Rt.Adrenal Size** button. The touch panel is switched to the sequence screen.

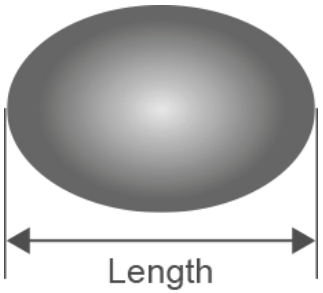
**3** The **L** button is lit. Measure the length on the image of the longitudinal section.

**4** The **W** button is lit. Measure the width on the image of the transverse section.

**5** The **AP** button is lit. Measure the anteroposterior diameter on the image of the transverse section.

**6** Press the **SET** button. The Adrenal Size measurement is finalized.

**Note** | Perform measurement so that L, W, and AP are crossed at right angles



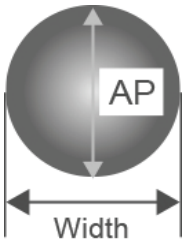




**Table 5-160: Adrenal measurement items**

| Rt Adrenal Size | | | Measurement item |
|---|---|---|---|
| L | __._ | cm | Length |
| W | __._ | cm | Width |
| AP | __._ | cm | Anteroposterior diameter |

## Aorta Measurement

The blood vessel diameter of the aorta and CIA is measured.

This section explains the procedure for measuring Aorta AP prox. as an example.

Other vessels and regions such as AP/trans and prox./mid/dist are measured with the same procedure.

**To measure the aorta**

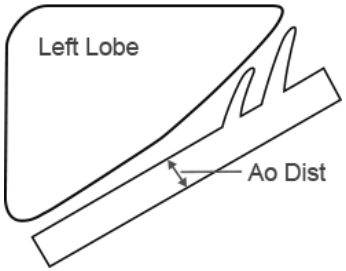
**1** On a frozen 2D image of the aorta, select the **Aorta** on the touch panel.

**2** Select the **prox. of Aorta AP** and measure the proximal region (prox) of the aorta.

3 Select the **mid** button to measure the middle region (mid.) of the aorta.

4 Select the **dist** button to measure the distal region (dist.) of the aorta.

5 Press the **SET** button. The Aorta AP prox. measurement is finalized.




**Note**

Not all the regions (prox., mid. and dist.) need to be measured. When performing the measurement only at a target region, select the corresponding button directly.

**Table 5-161: Aorta measurement items**

| Aorta AP | | | Measurement item |
|---|---|---|---|
| prox | __._ | mm | Proximal region |
| mid | __._ | mm | Middle region |
| dist | __._ | mm | Distal region |

## Bowel Measurement

The diameter and wall thickness of the appendix and pylorus are measured.

This section explains the procedure for measuring the appendix as an example.

Each region is measured with the same procedure.

**To measure the bowel**

1 On a frozen 2D image of the appendix, select the **Bowel** tab on the touch panel.

2 Select the **Appendix** button.

3 The touch panel is switched and a caliper mark (+) is displayed on the monitor.

**4** Measure the appendix diameter and press the **SET** button. The Appendix measurement is finalized.

**Table 5-162: Bowel measurement items**

| Appendix | | | Measurement item |
|---|---|---|---|
| Dist | __._ | cm | Appendix diameter |

# D-mode

## Aorta Measurement

The blood flow of Aorta, CIA, Celiac Art, SMA, Hepatic Art, Splenic Art, IMA, etc. is measured.

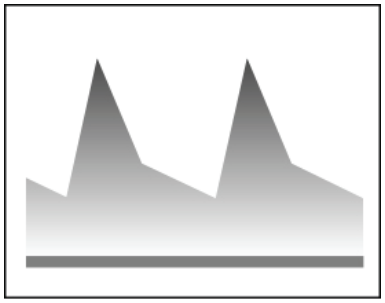
The measurement regions of each vessel are right/left (Rt./Lt.), longitudinal/transverse section (AP/trans), proximal/middle/distal (prox/mid/dist), etc.

This section explains the procedure for measuring Aorta AP prox. as an example. Other vessels and regions are measured with the same procedure.

**To measure the aorta**

**1** On a frozen Doppler trace of the aorta, select the Aorta 1 tab on the touch panel.

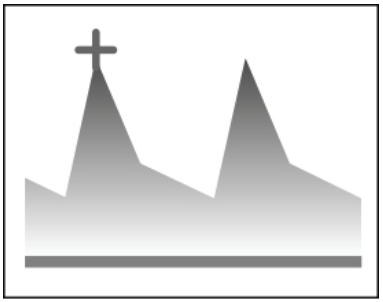
**2** Select the prox. of Aorta AP. The touch panel screen is switched.



**3** To measure peak V:

**a** Select the Peak V button.

**b** Place the caliper on the Peak V point and press the SET button to finalize the measurement.

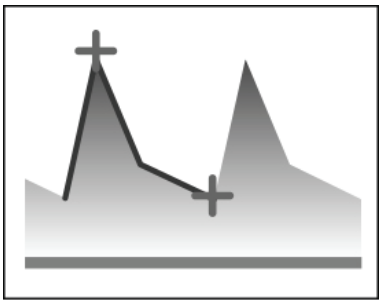


**4** To measure PI and RI:

**a** Select the PI,RI button.

**b** Use the caliper to trace the target waveform.

**c** Press the SET button. The measurement is finalized and the MnV, PI, RI and S/D values are calculated.



As the methods for tracing the Doppler waveform, Velocity Trace (manual tracing) or Auto Velocity Trace can be selected. For details on the procedure of each method, see "Velocity trace" on page 269".

**Table 5-163: Aorta measurement items**

| Aorta AP prox. | | | Measurement item |
|---|---|---|---|
| Peak V | __._ | cm/s | Peak velocity |
| Max V | __._ | cm/s | Maximum velocity |
| Min V | __._ | cm/s | Minimum velocity |
| MnV | __._ | cm/s | Mean velocity |
| PI | __._ | | Pulsatility index |
| RI | __._ | | Resistance index |

**Table 5-163: Aorta measurement items**

| Aorta AP prox. | | | Measurement item |
|---|---|---|---|
| S/D | __._ | | S/D ratio |

## Renal Art (Renal Artery) Measurement

The blood flow of the liver is measured.

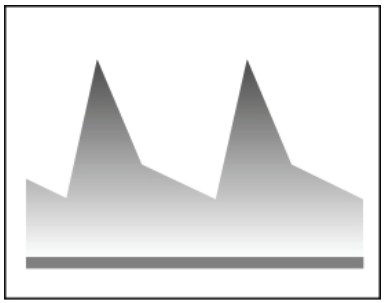
This section explains the procedure for measuring the right renal artery as an example.

Both the right and left renal arteries are measured with the same procedure.

**To measure the renal artery**

1 On a frozen Doppler image of the right renal artery, select the **Renal Art** tab on the touch panel.

2 Select the **Rt.Renal-A** button of Renal Art. The touch panel screen is switched.

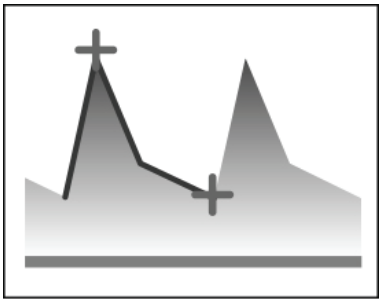


3 To measure PI and RI:

   **a** Select the **PI,RI** button.

   **b** Use the caliper to trace the target waveform.

4 Press the **SET** button. The measurement is finalized and the PSV, EDV, MnV, PI, RI and S/D values are calculated.



As the methods for tracing the Doppler waveform, Velocity Trace (manual tracing) or Auto Velocity Trace can be selected. For details on the procedure of each method, see "Velocity trace" on page 269".

**Table 5-164: Renal artery measurement items**

| Rt. Renal Art. | | | Measurement item |
|---|---|---|---|
| Max V | __._ | cm/s | Maximum velocity |
| Min V | __._ | cm/s | Minimum velocity |
| MnV | __._ | cm/s | Mean velocity |
| PI | __._ | | Pulsatility index |
| RI | __._ | | Resistance index |
| S/D | __._ | | S/D ratio |

## Vein Measurement

The blood flow of Hepatic Vein, PS Confluence, SMV, Splenic Vein, PV, Shunt is measured.

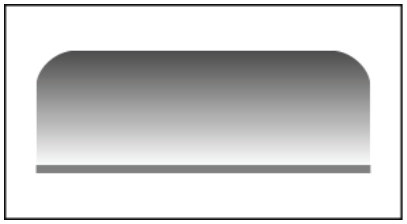
The measurement regions of each vessel are right/left (Rt./Lt.), anterior/proximal/middle/distal (pre/prox/mid/dist), etc.

This section explains the procedure for measuring Hepatic V. as an example. Other vessels and regions are measured with the same procedure.

**To measure veins**

**1** On a frozen Doppler image of the hepatic vein, select the **Vein** tab on the touch panel.

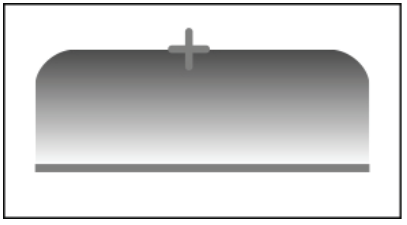
**2** Select the **Hepatic Vein** button. The touch panel screen is switched.



**3** To measure peak V:

**a** Select the **Peak V** button.

**b** Place the caliper on the Peak V point and press the **SET** button to finalize the measurement.

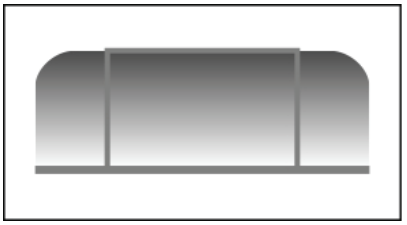


**4** To measure MnV:

**a** Select the **MnV** button.

**b** Use the caliper to trace the target waveform.

**c** Press the **SET** button. The measurement is finalized and the MnV value is calculated.



As the methods for tracing the Doppler waveform, Velocity Trace (manual tracing) or Auto Velocity Trace can be selected. For details on the procedure of each method, see "Velocity trace" on page 269".

**Table 5-165: Hepatic vein measurement items**

| Hepatic Vein | | | Measurement item |
|---|---|---|---|
| Peak V | __._ | cm/s | Peak velocity |
| MnV | __._ | cm/s | Mean velocity |

# 2D mode

## Hip Angle Measurement

The hip angle of neonate/infant is measured with the lateral approach.

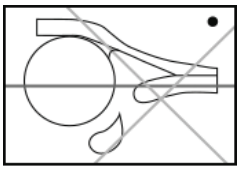
This section explains the procedure for measuring the angle of the right hip as an example.

Both the right and left hips are measured with the same procedure.

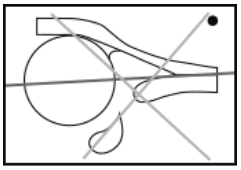
**To measure hip angle**

**1** On a frozen 2D image of the hip with the lateral approach, select the **Hip** tab on the touch panel.

**2** Select the **HipAngleRight** button. Three lines are displayed on the monitor.

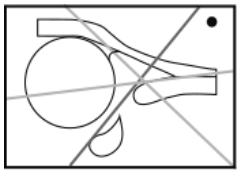


**3** Use the trackball to adjust the vertical position of the baseline, and rotate the multi dial to adjust the angle of the baseline.

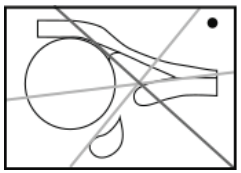


**4** Press the **SET** button. Line 2 for measuring the angle α can be adjusted.

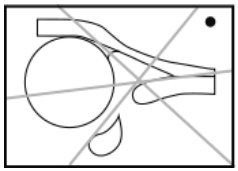
5 Use the trackball to adjust the vertical position of Line 2, and rotate the multi dial to adjust the angle of Line 2.



6 Press the **SET** button. Adjust Line 3 in the same way as Line 2 to measure the angle β.



7 Press the **SET** button. The Hip Angle measurement is finalized.



Line 2 is displayed with the angle α set to 60 degrees, and Line 3 is displayed with the angle β set to 55 degrees. Both angles can be measured based on these normal angles.

**Table 5-166: Hip angle measurement items**

| Rt.Angle | | | Measurement item |
|---|---|---|---|
| α | ___ | ° | Bony roof angle (Angle α) |
| β | ___ | ° | Cartilage roof angle (Angle β) |

# Worksheet/Report

## Report Display

This section explains the Report screen of the abdominal measurement.

The Abdominal report screen is divided into eight categories (Aorta, Bowel, GB, Liver/Spleen, PV/Shunt, Pancreas, Renal and Hip Angle) in addition to Study Information and Exam Information.

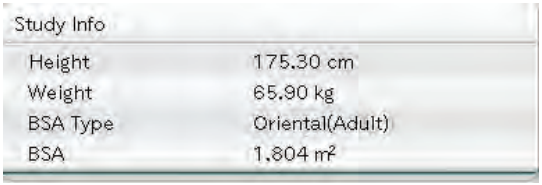



Figure 5-38: Study Information screen

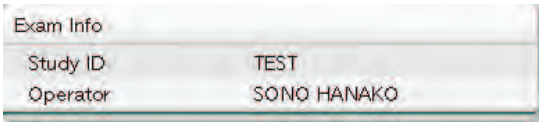



Figure 5-39: Exam Information screen

Figure 5-40: Abdominal Report screen <Report Screen (Category_Aorta (B)>

### Switching the page of Report screen

If the report results cannot be displayed within one page, the number of the report pages is displayed at the lower side of the touch panel.

To switch the page, operate the switch menu button under **Report Page**.

### Switching to the Worksheet

Select the Worksheet at the right side of the touch panel.

## Editing Values on Worksheet

This section explains the Abdominal Worksheet screen.

On the Worksheet screen, the measurement values (measurement results) of the abdominal measurement are displayed. The displayed values can also be corrected or deleted.

In addition, measurement items to be used and displayed can be specified on the Worksheet screen.

### Specifying information items on the Study / Exam Information screen

Information items to be displayed on the screens such as the **Report** screen can be specified by placing a check mark in the check box on the left-hand side of each information item (e.g. Refering Phys) on the worksheet.

### Specifying measurement items for the Abdominal measurement

The measurement items for the Abdominal measurement can be specified by placing a check mark in the check box on the left-hand side of each measurement item (e.g. Aorta (B)_Aorta AP_prox) on the worksheet.

### Switching the page of Worksheet

If the content of the worksheet cannot be displayed within one page, the number of the worksheet pages is displayed at the lower side of the touch panel.

To switch the page, operate the switch menu button under Worksheet Page.

### Switching to the Report screen

Select the **Report** button at the right side of the touch panel.

# Terms and Abbreviations

**Table 5-167: Liver/Spleen**

| Name | Formal Nomenclature |
|---|---|
| Liver | Liver |
| Spleen | Spleen |
| Hepatic Vein | Hepatic Vein |
| SMV | Superior Mesenteric Vein |
| Splenic Vein | Splenic Vein |
| PV | Portal Vein |
| PS Conflnce | PS Confluence |

**Table 5-168: Bile duct/Shunt**

| Name | Formal Nomenclature |
|---|---|
| CBD | Common Bile Duct |
| Shunt | Shunt |

**Table 5-169: Gall bladder**

| Name | Formal Nomenclature |
|---|---|
| GB | Gall Bladder |

**Table 5-170: Pancreas**

| Name | Formal Nomenclature |
|---|---|
| Pancreas | Pancreas |
| Pancreas Duct | Pancreas Duct |

**Table 5-171: Artery**

| Name | Formal Nomenclature |
|---|---|
| Aorta | Abdominal Aorta |
| CIA | Common Iliac Artery |

**Table 5-171: Artery**

| Name | Formal Nomenclature |
|---|---|
| Celiac Art | Celiac Artery |
| SMA | Superior Mesenteric Artery |
| Hepatic A | Hepatic Artery |
| Splenic A | Splenic Artery |
| IMA | Inferior Mesenteric Artery |
| Renal Artery | Renal Artery |

**Table 5-172: Kidney**

| Name | Formal Nomenclature |
|---|---|
| Kidney | Kidney |
| Adrenal | Adrenal |

**Table 5-173: Bowel**

| Name | Formal Nomenclature |
|---|---|
| Appendix | Appendix |
| Appendix Wall | Appendix Wall |
| Pylorus | Pylorus |
| Pylorus Wall | Pylorus Wall |

**Table 5-174: Hip joint**

| Name | Formal Nomenclature |
|---|---|
| Bony roof line | Bony roof line |
| Cartilage roof line | Cartilage roof line |

# Urological Measurement

## Functional Overview

**Table 5-175: 2D mode**

| Measurement item | Description |
|---|---|
| Seminal vesicles measurement | Distance |
| Testicular measurement | Distance<br>Volume |
| Bladder measurement<br>(prox · mid · dist) | Distance<br>Volume<br>Void Volume |
| | Distance<br>(Ureter) |
| Renal measurement | Distance<br>Volume |
| Renal cortex measurement | Distance |
| Adrenal measurement | Distance |

**Table 5-176: D-mode**

| Measurement item | Description |
|---|---|
| Renal artery measurement<br>(Right · Left)<br>(prox · mid · dist) | Peak Velocity<br>PSV , EDV<br>Mean Velocity<br>PI ,RI , S/D |
| Interlobular arteries measurement<br>(Right · Left)<br>(prox · mid · dist) | Peak Velocity<br>PSV , EDV<br>Mean Velocity<br>PI ,RI , S/D |
| Arcuate artery measurement<br>(Right · Left)<br>(prox · mid · dist) | Peak Velocity<br>PSV , EDV<br>Mean Velocity<br>PI ,RI , S/D |

# Built-in Measurement Functions

**Table 5-177: 2D mode**

| Measurement item | Display item | Unit |
|---|---|---|
| SV<br>(Seminal Vesicles)<br>(Right · Left) | AP<br>RL<br>SI | cm<br>cm<br>cm |
| Tst (Testis)<br>(Right · Left) | L<br>W<br>AP<br>Vol. | cm<br>cm<br>cm<br>$cm^3$ |
| Bladder | L<br>W<br>AP<br>Vol. | cm<br>cm<br>cm<br>ml |
| Pre-Bladder | L<br>W<br>AP<br>Vol. | cm<br>cm<br>cm<br>ml |
| Post-Bladder | L<br>W<br>AP<br>Vol. | cm<br>cm<br>cm<br>ml |
| Pre-Post Bl Vol. | Vol. | ml |
| Ureter<br>(Right · Left) | prox.<br>mid.<br>dist. | mm<br>mm<br>mm |
| Renal<br>(Right · Left) | L<br>W<br>AP<br>Vol. | cm<br>cm<br>cm<br>$cm^3$ |
| Cortex<br>(Right · Left) | T1<br>T2<br>T3 | mm<br>mm<br>mm |

**Table 5-177: 2D mode**

| Measurement item | Display item | Unit |
|---|---|---|
| Adrenal<br>(Right · Left) | L<br>W<br>AP | mm<br>mm<br>mm |

**Table 5-178: D-mode**

| Measurement item | Display item | Unit |
|---|---|---|
| Renal<br>(Right · Left)<br>-org.<br>-prox.<br>-mid.<br>-dist. | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | m/s<br>m/s<br>m/s<br>--<br>--<br>-- |
| InterLob Art.<br>(Right · Left)<br>-org.<br>-prox.<br>-mid.<br>-dist. | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | m/s<br>m/s<br>m/s<br>--<br>--<br>-- |
| Arcuate Art.<br>(Right · Left)<br>-org.<br>-prox.<br>-mid.<br>-dist. | PSV<br>EDV<br>MnV<br>PI<br>RI<br>S/D | m/s<br>m/s<br>m/s<br>--<br>--<br>-- |

# 2D mode

## SV (Seminal Vesicles) Size Measurement

The size of the seminal vesicles is measured.

This section explains the procedure for measuring the right seminal vesicle as an example.

Both the right and left seminal vesicles are measured with the same procedure.

**To measure seminal vesicles size**

1 On a frozen 2D image of the seminal vesicle (longitudinal and transverse sections), select the **SV/Testis** tab on the touch panel.

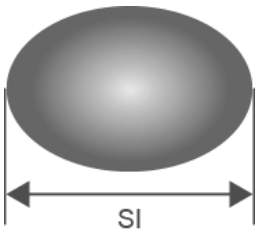
2 Press the **Rt.SV** button. The touch panel is switched to the sequence screen.

3 The **Rt.SV-RL** button is lit. Measure the right-left diameter on the image of the transverse section.

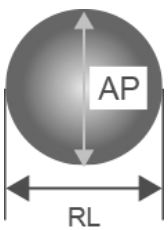
4 The **Rt.SV-SI** button is lit. Measure the supero-inferior diameter on the image of the longitudinal section.

5 The **Rt.SV-AP** button is lit. Measure the anteroposterior diameter on the image of the transverse section.

6 Press the **SET** button. The measurement of Rt.SV is finalized.




Longitudinal




Transverse

**Note** | Perform measurement so that RL, AP and SI are crossed at right angles.

**Table 5-179: Seminal vesicles measurement items**

| Rt. SV | | | Measurement item |
|---|---|---|---|
| RL | __._ | cm | Right-left diameter |
| SI | __._ | cm | Supero-inferior diameter |

**Table 5-179: Seminal vesicles measurement items**

| Rt. SV | | | Measurement item |
|---|---|---|---|
| AP | __._ | cm | Anteroposterior diameter |

## Testicular Volume Measurement

The volume of the testis is measured.

This section explains the procedure for measuring the right testis as an example.

Both the right and left testes are measured with the same procedure.

**To measure testicular volume**

1 On a frozen 2D image of the seminal vesicle (longitudinal and transverse sections), Select the **SV/Testis** tab on the touch panel.

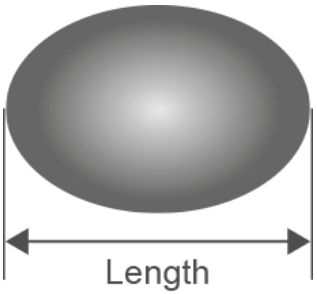
2 Select the **Rt.Testis** button. The touch panel is switched to the sequence screen.

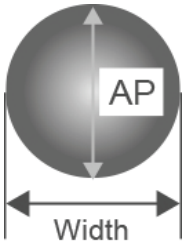
3 The **L** button is lit. Measure the length on the image of the longitudinal section.

4 The **W** button is lit. Measure the width on the image of the transverse section.

5 The **AP** button is lit. Measure the anteroposterior diameter on the image of the transverse section.

6 Press the **SET** button. The measurement of Rt.Testis is finalized and the volume is calculated.






**Note** | Perform measurement so that L, W and AP are crossed at right angles.

**Table 5-180: Testicular volume measurement items**

| Testicular Volume | | | Measurement item |
|---|---|---|---|
| L | __._ | cm | Length |
| W | __._ | cm | Width |
| AP | __._ | cm | Anteroposterior diameter |
| Vlo | __._ | $cm^3$ | Testicular volume |

## Bladder Size Measurement

This section explains the procedure for measuring the size of the bladder.

1 On a frozen 2D image of the bladder (longitudinal and transverse sections), press the **Bladder** tab on the touch panel.

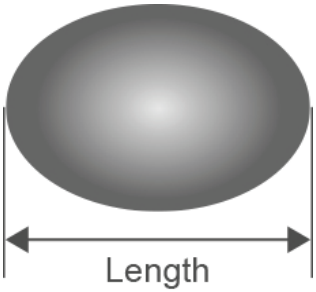
2 Select the **Bladder Size** button. The touch panel is switched to the sequence screen.

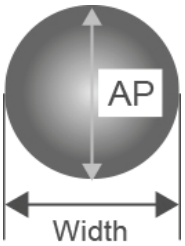
3 The **L** button is lit. Measure the length on the image of the longitudinal section.

4 The **W** button is lit. Measure the width on the image of the transverse section.

5 The **AP** button is lit. Measure the anteroposterior diameter on the image of the transverse section.

6 Press the **SET** button. The Bladder Size measurement is finalized.




**Note** | Perform measurement so that L, W and AP are crossed at right angles.

**Table 5-181: Bladder size measurement items**

| Bladder Size | | | Measurement item |
|---|---|---|---|
| L | __._ | cm | Length |
| W | __._ | cm | Width |
| AP | __._ | cm | Anteroposterior diameter |

## Bladder Volume Measurement

The void volume is measured by calculating the difference between the bladder volumes before and after urination.

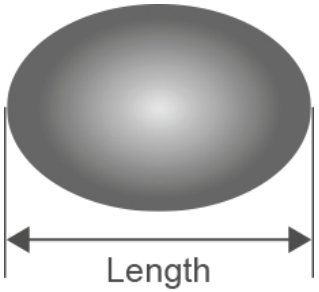
**To measure bladder volume before urination**

1 On a frozen 2D image of the bladder (longitudinal and transverse sections) before urination, select the **Bladder** tab on the touch panel.

2 Select the **Pre.BladderVol.** button. The touch panel is switched to the sequence screen.

3 Measure L, W and AP in the same way as the Bladder Size measurement.

4 Press the **SET** button. The measurement of Pre.BladderVol. is finalized and the volume is calculated.

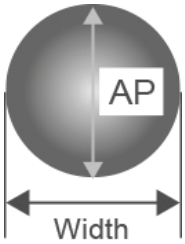



**To measure bladder volume after urination**

1 On a frozen 2D image of the bladder (longitudinal and transverse sections) after urination, measure L, W and AP in the same way as the Pre.BladderVol. measurement.

2 Press the **SET** button. The measurement of Post.BladderVol. is finalized and the volume is measured.

At the same time, the Void Volume is calculated.




**Note** | Perform measurement so that L, W and AP are crossed at right angles.

**Table 5-182: Bladder volume measurement items**

| Pre.Bladder Vol. | | | Measurement item |
|---|---|---|---|
| L | __._ | mm | Length |
| W | __._ | mm | Width |
| AP | __._ | mm | Anteroposterior diameter |
| Vol. | __._ | ml | Bladder volume |

| Post.Bladder Vol. | | | Measurement item |
|---|---|---|---|
| L | __._ | mm | Length |

| Post.Bladder Vol. | | | Measurement item |
|---|---|---|---|
| W | __._ | mm | Width |
| AP | __._ | mm | Anteroposterior diameter |
| Vol. | __._ | ml | Bladder volume |

| Void Vol. | | | Measurement item |
|---|---|---|---|
| Pre-Post | __._ | ml | Void volume |

## Ureter Distance Measurement

The diameter of the ureter is measured.

This section explains the procedure for measuring the size of the right ureter as an example.

Both the right and left ureters are measured with the same procedure.

**To measure ureter diameter**

**1** On a frozen 2D image of the ureter, select the **Bladder** tab on the touch panel.

**2** Press the **prox** button of **Rt.Ureter Distance** and measure the proximal region (prox.) of the ureter.

**3** Select the **mid** button and measure the middle region (mid.) of the ureter.

**4** Select the **dist** and measure the distal region (dist.) of the ureter.

**5** Press the **SET** button. The Ureter measurement is finalized.

Not all the regions (prox., mid. and dist.) need to be measured. When performing the measurement only at a target region, select the corresponding button directly.

**Table 5-183: Ureter distance measurement items**

| Rt.Ureter | | | Measurement item |
|---|---|---|---|
| prox | __._ | mm | Proximal region |
| mid | __._ | mm | Middle region |
| dist | __._ | mm | Distal region |

## Renal Volume Measurement

The volume of the kidney is measured.

This section explains the procedure for measuring the right kidney as an example.

Both the right and left kidneys are measured with the same procedure.

**To measure renal volume**

1 On a frozen 2D image of the kidney (longitudinal and transverse sections), select the **Renal** tab on the touch panel.

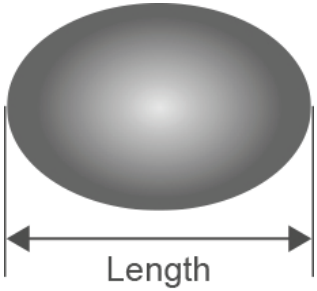
2 Select the **Rt.Renal** button. The touch panel is switched to the sequence screen.

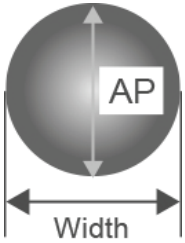
3 The **L** button is lit. Measure the length on the image of the longitudinal section.

4 The **W** button is lit. Measure the width on the image of the transverse section.

5 The **AP** button is lit. Measure the anteroposterior diameter on the image of the transverse section.

6 Press the **SET** button. The measurement of Rt.Renal is finalized and the volume is calculated




**Note** Perform measurement so that L, W and AP are crossed at right angles.

**Table 5-184: Renal volume measurement items**

| Rt. Renal | | | Measurement item |
|---|---|---|---|
| L | __._ | cm | Length |
| W | __._ | cm | Width |
| AP | __._ | cm | Anteroposterior diameter |
| Vol. | __._ | $cm^3$ | Renal volume |

## Cortex Thickness Measurement

The thickness of the renal cortex is measured.

This section explains the procedure for measuring the right cortex as an example.

Both the right and left cortices are measured with the same procedure.

**To measure the thickness of the renal cortex**

**1** On a frozen 2D image of the cortex, select the **Renal** tab on the touch panel.

**2** Select the **Rt.Cortex.** button. The touch panel is switched to the sequence screen.

**3** The **T1** button is lit. Measure the first position.

**4** The **T2** button is lit. Measure the second position.

**5** The **T3** button is lit. Measure the third position.

**6** Press the **SET** button. The Cortex measurement is finalized.

Not all the positions (T1, T2 and T3) need to be measured. When performing the measurement only at a target position, select the corresponding button directly.

**Table 5-185: Cortex thickness measurement items**

| Rt.Cortex | | | Measurement item |
|---|---|---|---|
| T1 | __._ | mm | Thickness1 |
| T2 | __._ | mm | Thickness2 |
| T3 | __._ | mm | Thickness3 |

## Adrenal Size Measurement

The size of the adrenal gland is measured.

This section explains the procedure for measuring the right adrenal gland as an example.

Both the right and left adrenal glands are measured with the same procedure.

**To measure adrenal gland size**

**1** On a frozen2 D image of the adrenal gland, select the **Renal** tab on the touch panel.

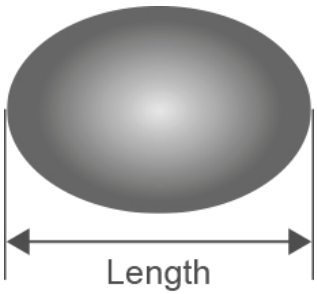
**2** Select the **Rt.Adrenal** button. The touch panel is switched to the sequence screen.

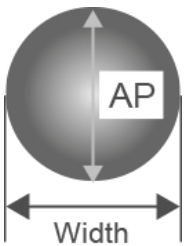
**3** The **L** button is lit. Measure the length on the image of the longitudinal section.

**4** The **W** button is lit. Measure the width on the image of the transverse section.

**5** The **AP** button is lit. Measure the anteroposterior diameter on the image of the transverse section.

**6** Press the **SET** button. The Adrenal Size measurement is finalized.




**Note** | Perform measurement so that L, W and AP are crossed at right angles.

**Table 5-186: Adrenal size measurement items**

| Adrenal Size | | | Measurement item |
|---|---|---|---|
| L | __._ | mm | Length |
| W | __._ | mm | Width |
| AP | __._ | mm | Anteroposterior diameter |

# D-mode

## Renal Art (Renal Artery) Measurement

The blood flow of the kidney is measured.

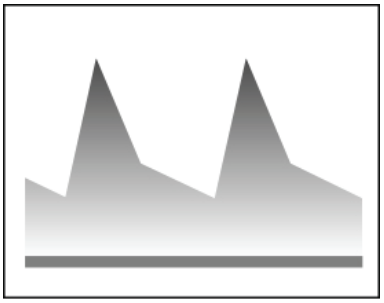
This section explains the procedure for measuring the right renal artery as an example.

Both the right and left renal arteries are measured with the same procedure. Other items are also measured in the same way.

**To measure the renal artery**

**1** On a frozen Doppler image of the right renal artery, Select the Renal Art tab on the touch panel.

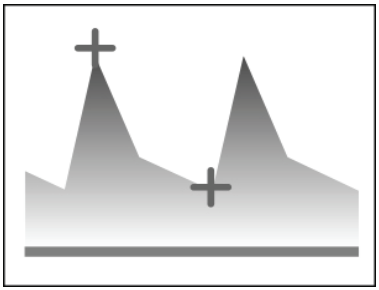
**2** Select the org. button of Rt.Renal. The touch panel is switched.



**3** To measure PSV and EDV:

**a** Select the PSV,EDV button.

**b** Place the caliper on each point and press the SET button to finalize the measurement.

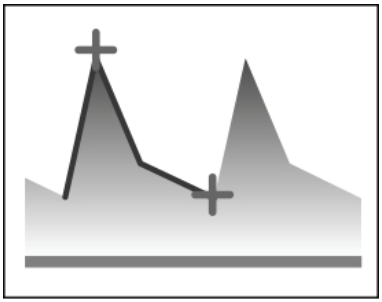


**4** To measure PI and RI:

**a** Select the PI,RI button.

**b** Use the caliper to trace the target waveform.

**c** Press the SET button. The measurement is finalized and the MnV, PI, RI and S/D values are calculated.



As the methods for tracing the Doppler waveform, Velocity Trace (manual tracing) or Auto Velocity Trace can be selected.

For details on the procedure of each method, see “4.18.5 Velocity Trace”.

**Table 5-187: Renal artery measurement items**

| Rt. Renal Art | | | Measurement item |
|---|---|---|---|
| ⊿t (ET) | __._ | ms | Ejection time |
| HR | __._ | bpm | Heart rate |
| MaxV | __._ | m/s | Maximum velocity |
| MinV | __._ | m/s | Minimum velocity |
| MnV | __._ | | Mean velocity |

**Table 5-187: Renal artery measurement items**

| Rt. Renal Art | | | Measurement item |
|---|---|---|---|
| ⊿t | —·— | | Time between two points |
| PI | | | Pulsatility Index |
| RI | | | Resistance Index |
| S/D | | | S/D ratio |
| | | beat | Number of heartbeats |

# Worksheet/Report

## Report Display

This section explains the Report screen of the urological measurement.

The URO report screen is divided into four categories (SV, Testis, Bladder and Renal) in addition to Study Information and Exam Information.

Figure 5-41: Study Information screen

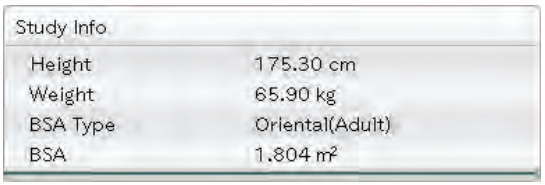



Figure 5-42: Exam Information screen

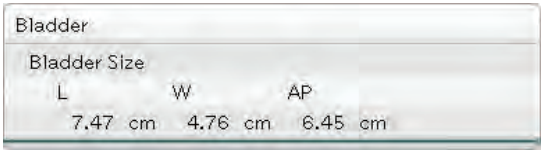



Figure 5-43: URO_Report screen <Report Screen (Category_SV>

### Switching the page of Report screen

If the report results cannot be displayed within one page, the number of the report pages is displayed at the lower side of the touch panel.

To switch the page, operate the switch menu button under Report Page.

### Switching to the Worksheet

Select the Worksheet at the right side of the touch panel.

## Editing Values on Worksheet

This section explains the URO Worksheet screen.

On the Worksheet screen, the measurement values (measurement results) of the urological measurement are displayed. The displayed values can also be corrected or deleted.

In addition, measurement items to be used and displayed can be specified on the Worksheet screen.

### Specifying information items on the Study / Exam Information screen

Information items to be displayed on the screens such as the Report screen can be specified by placing a check mark in the check box on the left-hand side of each information item (e.g. Refering Phys) on the worksheet.

### Specifying measurement items for the Urological measurement

The measurement items for the Urological measurement can be specified by placing a check mark in the check box on the left-hand side of each measurement item (e.g. URO_SV-AP_Rt.) on the worksheet.

### Switching the page of Worksheet

If the content of the worksheet cannot be displayed within one page, the number of the worksheet pages is displayed at the lower side of the touch panel.

To switch the page, operate the switch menu button under Worksheet Page.

### Switching to the Report screen

Select the Report button at the right side of the touch panel.

# Terms and abbreviations

**Table 5-188: Measurement terms and abbreviations**

| Term/Abbreviation | Formal Nomenclature |
|---|---|
| Adrenal | Adrenal |
| AP | Antero posterior diameter |
| Arcuate | Arcuate Artery |
| BIF | Bifurcation |
| Bladder | Bladder |
| Cortex | Renal cortex |
| dist. | distal |
| EDV | end diastolic velocity |
| InterLob | Interlobular Arteries |
| L | Length |
| Lt. | Left |
| mid. | mid |
| PI | pulsatility index |
| Post Bladder Vol. | Post Bladder Volume |
| Pre Bladder Vol. | Pre Bladder Volume |
| prox. | proximal |
| PSV | peak systolic flow velocity |
| Renal | Renal |
| Renal Art | Renal Artery |
| RI | resistance index |
| RL | Right-Left diameter |
| Rt. | Right |
| S/D | systolic diastolic ratio, SD ratio |
| SI | Supero inferior diameter |

**Table 5-188: Measurement terms and abbreviations**

| Term/Abbreviation | Formal Nomenclature |
|---|---|
| SV | Seminal Vesicles |
| T1 | Cortex Thickness 1 |
| T2 | Cortex Thickness 2 |
| T3 | Cortex Thickness 3 |
| Testis Vol. | Testicular Volume |
| Ureter | Ureter |
| Void Vol. | Void Bladder Volume |
| Vol. | Volume |
| W | Width |

CHAPTER 6

# Chapter 6: References for Measurement Accuracy

## Measurement accuracy

The measurements provided by the system do not define a specific physiological or anatomical parameter. Rather, the measurements are of a physical property, such as distance, for the clinician to evaluate. The accuracy values require that you can place the calipers over one pixel. The values do not include acoustic anomalies of the body.

The linear distance measurement components have the accuracy and range shown in the following tables.

### Table 6-1: 2D measurement, calculation accuracy, and range

| 2D mode measurement accuracy and range | System tolerance[1] | Accuracy by | Test method[2] | Range (cm) |
|---|---|---|---|---|
| Axial distance | < ±2% plus 1% of full scale | Acquisition | Phantom | 0-26 cm |
| Lateral distance | < ±2% plus 1% of full scale | Acquisition | Phantom | 0-35 cm |
| Diagonal distance | < ±2% plus 1% of full scale | Acquisition | Phantom | 0-44 cm |
| Area[3] | < ±4% plus (2% of full scale/ smallest dimension) * 100 plus 0.5% | Acquisition | Phantom | 0.01-720 $cm^2$ |
| Circumference[4] | < ±3% plus (1.4% of full scale/ smallest dimension) * 100 plus 0.5% | Acquisition | Phantom | 0.01-96 cm |

1. Full scale for distance implies the maximum depth of the image.
2. An RMI 413a model phantom with 0.7 dB/cm MHz attenuation was used.
3. The area accuracy is defined using the following equation:% tolerance = ((1 + lateral error) * (1 + axial error) – 1) * 100 + 0.5%.
4. The circumference accuracy is defined as the greater of the lateral or axial accuracy and by the following equation: % tolerance = ( (maximum of 2 errors) * 100) + 0.5%.

### Table 6-2: M- mode measurement, calculation accuracy, and range

| M mode measurement accuracy and range | System tolerance | Accuracy by | Test method | Range |
|---|---|---|---|---|
| Distance | < +/- 2% plus 1% of full scale[1] | Acquisition | Phantom[2] | 0-26 cm |
| Time | < +/- 2% plus 1% of full scale[3] | Acquisition | Phantom[4] | 0.01-10 sec |
| Heart Rate | < +/- 2% plus (Full Scale[3] * Heart Rate/100) % | Acquisition | Phantom[4] | 5-923 bpm |

1. Full scale for distance implies the maximum depth of the image.
2. An RMI 413a model phantom with 0.7 dB/cm MHz attenuation was used.
3. Full scale for time implies the total time displayed on the scrolling graphic image.
4. FUJIFILM SonoSite special test equipment was used.

### Table 6-3: PW Doppler mode measurement, calculation accuracy, and range

| Doppler mode measurement accuracy and range | System tolerance | Accuracy by | Test method[1] | Range |
|---|---|---|---|---|
| Velocity cursor | < +/- 2% plus 1% of full scale[2] | Acquisition | Phantom | 0.01 cm/sec - 550 cm/sec |

**Table 6-3: PW Doppler mode measurement, calculation accuracy, and range**

| Doppler mode measurement accuracy and range | System tolerance | Accuracy by | Test method[1] | Range |
|---|---|---|---|---|
| Time | < +/- 2% plus 1% of full scale[3] | Acquisition | Phantom | 0.01 - 10 sec |

1. FUJIFILM SonoSite special text equipment was used.
2. Full scale for frequency or velocity implies the total frequency or velocity magnitude, displayed on the scrolling graphic image.
3. Full scale for time implies the total time displayed on the scrolling graphic image.

# Sources of measurement errors

In general, two types of errors can be introduced into the measurement:

- Acquisition Error

  This includes errors introduced by the ultrasound system electronics relating to signal acquisition, signal conversion, and signal processing for display. Additionally, computational and display errors are introduced by the generation of the pixel scale factor, application of that factor to the caliper positions on the screen, and the measurement display.

- Algorithmic Error

  The error introduced by measurements, which are input to higher order calculations. This error is associated with floating-point versus integer-type math, which is subject to errors introduced by rounding versus truncating results for display of a given level of significant digit in the calculation.

# Measurement publications and terminology

The following topics list the publications and terminology used for each calculation result.

Terminology and measurements comply with AIUM published standards.

## Cardiac references

### Acceleration (ACC) in cm/s$^2$

Zwiebel, W.J. *Introduction to vascular ultrasonography*. 4th ed., W.B. Saunders Company, (2000), 52.

ACC = abs (delta velocity/delta time)

## Acceleration time (AT) in msec

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual*. 2nd ed., Lippincott, Williams, and Wilkins, (1999), 219.

## Aortic valve area (AVA) by continuity equation in $cm^2$

Reynolds, Terry. *The echocardiographer's pocket reference*. 2nd ed., School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 393, 442.

$A_2 = A_1 * V_1/V_2$

where:

- $A_2$ = Ao valve area
- $A_1$ = LVOT area; $V_1$ = LVOT velocity; $V_2$ = Ao valve velocity
- LVOT = Left Ventricular Outflow Tract
- AVA $(PV_{LVOT}/PV_{AO}) * CSA_{LVOT}$

AVA $(VTI_{LVOT}/VTI_{AO}) * CSA_{LVOT}$

## Body surface area (BSA) in $m^2$

Grossman, W. *Cardiac catheterization and angiography*. Philadelphia: Lea and Febiger, (1980), 90.

$BSA = 0.007184 * Weight^{0.425} * Height^{0.725}$

Weight = kilograms

Height = centimeters

## Cardiac index (CI) in l/min/$m^2$

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual*. 2nd ed., Lippincott, Williams, and Wilkins, (1999), 59.

CI = CO/BSA

where:

- CO = Cardiac Output
- BSA = Body Surface Area

## Cardiac output (CO) in l/min

Oh, J.K., J.B. Seward, A.J. Tajik *The echo manual*. 2nd ed., Lippincott, Williams, and Wilkins, (1999), 59.

CO = (SV * HR)/1000

where:

- CO = Cardiac Output
- SV = Stroke Volume
- HR = Heart Rate

## Cross sectional area (CSA) in $cm^2$

Reynolds, Terry. *The echocardiographer's pocket reference*. 2nd ed., School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 383.

$CSA = 0.785 * D^2$

where:

- D = diameter of the anatomy of interest

## Deceleration time in msec

Reynolds, Terry. *The echocardiographer's pocket reference*. 2nd ed., School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 453.

|time a - time b|

## Delta pressure: delta time (dP:dT) in mmHg/s

Otto, C.M. *Textbook of clinical echocardiography*. 2nd ed., W.B. Saunders Company, (2000), 117, 118.

32 mmHg/time interval in seconds

## E:A ratio in cm/sec

E:A = velocity E/velocity A

## E/Ea ratio

Reynolds, Terry. *The echocardiographer's pocket reference*. 2nd ed., School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 225.

E Velocity/Ea velocity

where:

- E velocity = Mitral Valve E velocity

- Ea = annular E velocity, also known as: E prime

## Effective regurgitant orifice (ERO) in $mm^2$

Reynolds, Terry. *The echocardiographer's pocket reference*. 2nd ed., School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 455.

ERO = 6.28 ($r^2$) * Va/MR Vel

where:

- r = radius
- Va = aliasing velocity

## Ejection fraction (EF), percent

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual*. 2nd ed., Lippincott, Williams, and Wilkins, (1999), 40.

EF = ((LVEDV – LVESV)/LVEDV) * 100%

where:

- EF = Ejection Fraction
- LVEDV = Left Ventricular End Diastolic Volume
- LVESV = Left Ventricular End Systolic Volume

## Elapsed time (ET) in msec

ET = time between velocity cursors in milliseconds

## Heart rate (HR) in bpm

HR = 3-digit value input by user or measured on M Mode and Doppler image in one heart cycle

## Interventricular septum (IVS) fractional thickening, percent

Laurenceau, J. L., M.C. Malergue. *The essentials of echocardiography*. Le Hague: Martinus Nijhoff, (1981), 71.

IVSFT = ((IVSS – IVSD)/IVSD) * 100%

where:

- IVSS = Interventricular septum thickness, end systole
- IVSD = Interventricular septum thickness, end diastole

## Isovolumic relaxation time (IVRT) in msec

Reynolds, Terry. *The echocardiographer's pocket reference*. School of Cardiac Ultrasound, Arizona Heart Institute, (1993), 146.

|time a - time b|

## Left atrium/aorta (LA/Ao)

Feigenbaum, H. *Echocardiography*. Philadelphia: Lea and Febiger, (1994), 206, Figure 4-49.

## Left ventricular end volumes (Teichholz) in ml

Teichholz, L.E., T. Kreulen, M.V. Herman, et. al. "Problems in echocardiographic volume determinations: Echocardiographic-angiographic correlations in the presence or absence of asynergy." *American Journal of Cardiology* (1976), 37:7.

$LVESV = (7.0 * LVDS^3)/(2.4 + LVDS)$

where:

- LVESV = Left Ventricular End Systolic Volume
- LVDS = Left Ventricular Dimension at Systole
- $LVEDV = (7.0 * LVDD^3)/(2.4 + LVDD)$

where:

- LVEDV = Left Ventricular End Diastolic Volume
- LVDD = Left Ventricular Dimension at Diastole

## Left ventricular mass in gm

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual*. 2nd ed., Lippincott, Williams, and Wilkins, (1999), 39.

$LV\ Mass = 1.04\ [(LVID + PWT + IVST)^3 - LVID^3] * 0.8 + 0.6$

where:

- LVID = Internal Dimension
- PWT = Posterior Wall Thickness
- IVST = Interventricular Septal Thickness
- 1.04 = Specific gravity of the myocardium
- 0.8 = Correction factor

## Left ventricular volume: biplane method in ml

Schiller, N.B., P.M. Shah, M. Crawford, et.al. "Recommendations for quantitation of the left ventricle by two-dimensional echocardiography," *Journal of American Society of Echocardiography* September-October 1989, 2:362.

$$V = \left(\frac{\pi}{4}\right) \sum_{i=1}^{n} a_i b_i \left(\frac{L}{n}\right)$$

where:

- V = Volume in ml
- a = Diameter
- b = Diameter
- n = Number of segments (n=20)
- L = Length
- i = Segment

## Left ventricular volume: single plane method in ml

Schiller, N.B., P.M. Shah, M. Crawford, et.al. "Recommendations for quantitation of the left ventricle by two-dimensional echocardiography," *Journal of American Society of Echocardiography* September-October 1989, 2:362.

$$V = \left(\frac{\pi}{4}\right) \sum_{i=1}^{n} a_i^2 \left(\frac{L}{n}\right)$$

where:

- V = Volume
- a = Diameter
- n = Number of segments (n=20)
- L = Length
- i = Segment

## Left ventricular dimension (LVD) fractional shortening, percent

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual* 2nd ed., Lippincott, Williams, and Wilkins, (1994), 43-44.

LVDFS = ((LVDD – LVDS)/LVDD) * 100%

where:

- LVDD = Left Ventricle Dimension at Diastole
- LVDS = Left Ventricle Dimension at Systole

## Left ventricular posterior wall fractional thickening (LVPWFT), percent

Laurenceau, J. L., M.C. Malergue. *The essentials of echocardiography*. Le Hague: Martinus Nijhoff, (1981), 71.

LVPWFT = ((LVPWS – LVPWD)/LVPWD) * 100%

where:

- LVPWS = LV posterior wall thickness, end systole
- LVPWD = LV posterior wall thickness, end diastole

## Mean velocity (Vmean) in cm/s

Vmean = mean velocity

## Mitral valve area (MVA) in $cm^2$

Reynolds, Terry. *The echocardiographer's pocket reference.* 2nd ed., School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 391, 452.

MVA = 220/PHT

where:

- PHT = pressure half time

**Note** 220 is an empirical derived constant and may not accurately predict mitral valve area in mitral prosthetic heart valves. The mitral valve area continuity equation may be used in mitral prosthetic heart valves to predict the effective orifice area.

## MV flow rate in cc/sec

Reynolds, Terry. *The echocardiographer's pocket reference*. 2nd ed., School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 396.

Flow = 6.28 ($r^2$) * Va

where:

- r = radius

- Va = aliasing Velocity

## Pressure gradient (PGr) in mmHG

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual*. 2nd ed., Lippincott, Williams, and Wilkins, (1999), 64.

$PGr = 4 * (Velocity)^2$

Peak E Pressure Gradient (E PG)

$E\ PG = 4 * PE^2$

Peak A Pressure Gradient (A PG)

$A\ PG = 4 * PA^2$

Peak Pressure Gradient (PGmax)

$PGmax = 4 * PV^2$

Mean Pressure Gradient (PGmean)

PGmean = Average of pressure gradients/Duration of flow

## Pressure half time (PHT) in msec

Reynolds, Terry. *The echocardiographer's pocket reference*. 2nd ed., School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 391.

$PHT = DT * 0.29$

where:

- DT = deceleration time

## Proximal isovelocity surface area (PISA) in $cm^2$

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual*. 2nd ed., Lippincott, Williams, and Wilkins, (1999), 125.

$PISA = 2\pi r^2$

where:

- $2\pi = 6.28$
- r = aliasing radius

## Qp/Qs

Reynolds, Terry. *The echocardiographer's pocket reference*. 2nd ed., School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 400.

Qp/Qs = SV Qp site/SV Qs site

SV sites vary depending upon the location of the shunt.

## Regurgitant fraction (RF) in percent

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual*. 2nd ed., Lippincott, Williams, and Wilkins, (1999), 125.

RF = RV/ MV SV

where:

- RV = Regurgitant Volume
- MV SV = Mitral Stroke Volume

## Regurgitant volume (RV) in cc

Reynolds, Terry. *The echocardiographer's pocket reference*. School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 396, 455.

RV = ERO * MR VTI

## Right ventricular systolic pressure (RVSP) in mmHg

Reynolds, Terry. *The echocardiographer's pocket reference*. School of Cardiac Ultrasound, Arizona Heart Institute, (1993), 152.

$RVSP = 4 * (Vmax\ TR)^2 + RAP$

where:

- RAP = Right Atrial Pressure

## S/D

Reynolds, Terry. *The echocardiographer's pocket reference*. 2nd ed., School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 217.

S velocity/ D velocity

where:

- S velocity = Pulmonary vein S wave
- D velocity= Pulmonary vein D wave

## Stroke index (SI) in cc/m$^2$

*Mosby's medical, nursing, & allied health dictionary*, 4th ed. (1994), 1492.

SI = SV/BSA

where:

- SV = Stroke Volume
- BSA = Body Surface Area

## Stroke volume (SV) Doppler in ml

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual*. 2nd ed. Lippincott, Williams, and Wilkins, (1999), 40, 59, 62.

SV = (CSA * VTI)

where:

- CSA = Cross-Sectional Area of the orifice (LVOT area)
- VTI = Velocity Time Integral of the aortic valve

## Stroke volume (SV) 2D and M mode in ml

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual*. 2nd ed. Lippincott, Williams, and Wilkins, (1994), 44.

SV = (LVEDV – LVESV)

where:

- SV = Stroke Volume
- LVEDV = End Diastolic Volume
- LVEDSV = End Systolic Volume

## Velocity time integral (VTI) in cm

Reynolds, Terry. *The echocardiographer's pocket reference*. 2nd ed. School of Cardiac Ultrasound, Arizona Heart Institute, (2000), 383.

VTI = sum of abs (velocities [n])

where:

- Auto Trace = distance (cm) blood travels with each ejection period. Velocities are absolute values.

# Obstetrical references

## Estimated date of delivery (EDD) by last menstrual period (LMP)

The date entered into the patient information for LMP must precede the current date.

Results are displayed as month/day/year.

EDD = LMP date + 280 days.

## Gestational age (GA) by last menstrual period (LMP)

The gestational age derived from the LMP date entered on the patient information form.

Result is displayed in weeks and days, and is calculated as follows:

GA(LMP) = System date – LMP date

## Gestational age (GA) by last menstrual period (LMPd) derived from established due date (Estab. DD)

Same as GA by Estab. DD.

The gestational age derived from the system derived LMP using the Established Due Date entered on the patient information form.

Result is displayed in weeks and days, and is calculated as follows:

GA(LMPd) = System Date – LMPd

## Last menstrual period derived (LMPd) by established due date (Estab. DD)

Result is displayed as month/day/year.

LMPd(Estab. DD) = Estab. DD – 280 days

# General references

## +/x or S/D ratio

+/x = abs (Velocity A/Velocity B)

where:

- A = velocity cursor +
- B = velocity cursor x

## Acceleration index (ACC)

Zwiebel, W.J. *Introduction to vascular ultrasonography*, 4th ed., W.B. Saunders Company, (2000), 52.

ACC = abs (delta velocity/delta time)

## Elapsed time (ET)

ET = time between velocity cursors in milliseconds

## Hip angle/d:D ratio

Graf, R. "Fundamentals of sonographic diagnosis of infant hip dysplasia," *Journal of Pediatric Orthopedics* Vol. 4, No. 6: 735-740, 1984.

Morin, C., Harcke, H., MacEwen, G. "The infant hip: Real-time US assessment of acetabular development," *Radiology* 177: 673-677, December 1985.

## Intima media thickness (IMT)

Howard G, Sharrett AR, Heiss G, Evans GW, Chambless LE, Riley WA, et al. "Carotid artery intima-medial thickness distribution in general populations as evaluated by B-mode ultrasound." ARIC Investigators. Atherosclerosis Risk in Communities. *Stroke* (1993), 24:1297-1304.

O'Leary, Daniel H., MD and Polak, Joseph, F., MD, et al. "Use of sonography to evaluate carotid atherosclerosis in the elderly. The Cardiovascular Health study," *Stroke* (September 1991), 22,1155-1163.

Redberg, Rita F., MD and Vogel, Robert A., MD, et al. "Task force #3—What is the spectrum of current and emerging techniques for the noninvasive measurement of atherosclerosis?" *Journal of the American College of Cardiology* (June 4, 2003), 41:11, 1886-1898.

## Percent area reduction

Taylor K.J.W., P.N. Burns, P. Breslau. *Clinical applications of Doppler ultrasound*, Raven Press, N.Y., (1988), 130-136.

Zwiebel W.J., J.A. Zagzebski, A.B. Crummy, et al. "Correlation of peak Doppler frequency with lumen narrowing in carotid stenosis," *Stroke* 3: (1982), 386-391.

% Area Reduction = (1 - A2($cm^2$)/A1($cm^2$)) * 100

where:

- A1 = original area of the vessel in square cm
- A2 = reduced area of the vessel in square cm

## Percent diameter reduction

Handa, Nobuo et al., "Echo-Doppler velocimeter in the diagnosis of hypertensive patients: The renal artery Doppler technique," *Ultrasound in Medicine and Biology* 12:12 (1986), 945-952.

% Diameter Reduction = (1 - D2(cm)/D1(cm)) * 100

where:

- D1 = original diameter of the vessel in cm
- D2 = reduced diameter of the vessel in cm

## Pressure gradient (PGr) in mmHG

Oh, J.K., J.B. Seward, A.J. Tajik. *The echo manual*. 2nd ed., Lippincott, Williams, and Wilkins, (1999), 64.

4 * $(Velocity)^2$

Peak E Pressure Gradient (E PG)

E PG = 4 * $PE^2$

Peak A Pressure Gradient (A PG)

A PG = 4 * $PA^2$

Peak Pressure Gradient (PGmax)

PGmax = 4 * $PV^2$

Mean Pressure Gradient (PGmean)

PGmean = 4 * $Vmax^2$

## Pulsatility index (PI)

Kurtz, A.B., W.D. Middleton. *Ultrasound--the requisites*. Mosby Year Book, Inc., (1996), 469.

PI = (PSV – EDV)/V

where:

- PSV = peak systolic velocity
- EDV = end diastolic velocity
- V = mean flow velocity throughout the entire cardiac cycle

## Resistance index (RI)

Kurtz, A.B., W.D. Middleton. *Ultrasound--the requisites*. Mosby Year Book, Inc., (1996), 467.

RI = abs ((Velocity A – Velocity B)/Velocity A) in measurements

where:

- A = velocity cursor +
- B = velocity cursor x

## Time averaged mean (TAM) in cm/s

TAM = mean (mean Trace)

## Time averaged peak (TAP) in cm/s

TAP = peak (peak Trace)

## Volume (Vol)

Beyer, W.H. *Standard mathematical tables*, 28th ed., CRC Press, Boca Raton, FL, (1987), 131.

## Volume flow (VF) in ml/min

Allan, Paul L. et al. *Clinical Doppler ultrasound*, 4th ed. Harcourt Publishers Limited. (2000), 36-38.

One of the following, depending on the Live Trace setting:

VF = CSA * TAM * .06

VF = CSA * TAP * .06

CHAPTER 7

# Chapter 7: Troubleshooting and maintenance

This chapter contains information that will help you correct problems with system operation, enter a software license, and take proper care of the system, transducer, and accessories.

## Troubleshooting

If you encounter difficulty with the system, check whether your problem and its solution are in the following list. If they are not, or if the problem persists, contact FUJIFILM SonoSite Technical Support.

### System does not turn on

1 Check all power connections.

2 Remove the AC adapter and battery, wait for 10 seconds, and then reinstall the battery and reconnect the AC adapter.

3 Ensure that the battery is charged.

### System image quality is poor

1 Adjust the viewing angle of the display.

2 Adjust the brightness.

3 Adjust the gain.

For details on how to adjust the gain, see "Adjusting the depth and gain of the image" on page 111.

### There is no CPD image

- Adjust the gain.

For details on how to adjust the gain, see "Adjusting the depth and gain of the image" on page 111.

## There is no color image

- Adjust the gain or the PRF scale.

  For details on how to adjust the gain, see "Adjusting the depth and gain of the image" on page 111.

  For more information on the PRF scale, see "Indirect controls" on page 539.

## There are no measurement selections

- Ensure the desired exam type has been selected and that the image is frozen. Press the **CALCS** button.

## Printing does not work

1. Set Start in Output Management to ON. For the detailed procedure, see "Managing the output queue of examinations and images" on page 199.
2. Select the printer on the Store Button setup page.

   For more information on assigning functions to Store buttons, see "Configuring Store buttons" on page 29.
3. Check the printer connections.
4. Ensure that the printer is turned on and set up properly.
5. Review the printer manufacturer's instructions.

## Printing does not work with UP-X898MD

**Caution**

After installation of the UP-X898MD printer, you must configure the printer to emulate the **DRV: 897** driver.

If you do not switch to the appropriate printer driver, the printer will not work.

1. On the printer, press the joystick (menu lever) to display the menu.
2. Using the joystick, scroll to **DIGITAL**, and then press the joystick to select.
3. Using the joystick, scroll to **DRIVER**, and then press the joystick to start.
4. Using the joystick, scroll to **DRV: 897**, and then press the joystick to select.

## System does not recognize the transducer

- Disconnect and reconnect the transducer.

## System does not mount the USB memory

1 Make sure that:

- Password protection is not enabled for the USB memory.
- The USB memory is not defective.

2 Use the USB memory included with the system.

## System does not accept the data imported from USB

1 Make sure that the data are present in the DICOM format on the USB memory.

2 Re-export the original data in the DICOM format onto the USB memory.

3 Contact your system administrator.

## The external video is not working

1 Make sure that the system is securely attached to the DVD Recorder.

Note that the system does not work with the Image Store function.

2 Delete any unwanted images or clips from the patient exam.

See "Deleting images" on page 197.

## Patient information cannot be edited during examinations

- Images transferred to DICOM Storage exist.
- The work list is in use.

In the cases above, the patient information cannot be edited.

If Exam in Progress is selected in the "Setting timing for DICOM network storage" on page 50, the patient information can also be edited by selecting OFF for Start on the Output Management screen while there is no transferred image. For details, see "Managing the output queue of examinations and images" on page 199.

## Patient information cannot be edited after examinations

- Images transferred to DICOM Storage exist.
- The work list is in use.
- An examination has been output or input to the USB drive.
- Images have accumulated in the output queue.

In the cases above, the Edit button is unavailable.

## Edited patient information is not reflected to the image

Information in the header of the saved image has not been updated.

Information in the header is reflected only to the DICOM tag information.

## Barcode cannot be read correctly

**1** Set the peripheral used to a barcode.

See "Barcode reader and magnetic card reader setting" on page 42.

If the above procedures cannot solve problems, it is necessary to specify a barcode reader correctly. See the following examples for reference to set correctly.

Barcode reader can read the following three types.

Code128, NW-7(CODABAR), and/or Code39

### Patient ID Reading by Barcode [CODE128]

**1** Specify a barcode reader.

See "To specify a barcode reader" on page 42.

**Table 7-1: Barcode reader parameter**

| Item | Parameter (DataLogic) | Parameter (Jadak) |
|---|---|---|
| Patient ID Start Position | 0 | 0 |
| Patient ID Length | 8 | 8 |
| Accession No. Start Position | 9 | 9 |
| Accession No. Length | 1 | 1 |

**2** Press the PATIENT button.

**3** Read the following Table 7-2 barcode by means of barcode reader.

**Table 7-2: Barcode value**

| Item | Value | Barcode |
|---|---|---|
| ID | ABCabc01 | |

### Patient ID Reading by Barcode [NW-7(CODABAR)]

**1** Specify a barcode reader.

See "To specify a barcode reader" on page 42.

**Table 7-3: Barcode reader parameter**

| Item | Parameter (DataLogic) | Parameter (Jadak) |
|---|---|---|
| Patient ID Start Position | 1 | 0 |
| Patient ID Length | 5 | 5 |
| Accession No. Start Position | 7 | 7 |
| Accession No. Length | 1 | 1 |

**2** Press the PATIENT button.

**3** Read the following Table 7-4 barcode by means of barcode reader.

**Table 7-4: Barcode value**

| Item | Value | Barcode |
|---|---|---|
| ID | 00123 | |

### Patient ID Reading by Barcode [CODE39]

**1** Specify a barcode reader.

See "To specify a barcode reader" on page 42.

**Table 7-5: Barcode reader parameter**

| Item | Parameter (DataLogic) | Parameter (Jadak) |
|---|---|---|
| Patient ID Start Position | 0 | 0 |
| Patient ID Length | 8 | 8 |
| Accession No. Start Position | 9 | 9 |
| Accession No. Length | 1 | 1 |

**2** Press the PATIENT button.

**3** Read the following Table 7-6 barcode by means of barcode reader.

**Table 7-6: Barcode value**

| Item | Value | Barcode |
|---|---|---|
| ID | ABC01234 | |

### Receipt Number Reading by Barcode [CODE128]

**1** Specify a barcode reader.

See "To specify a barcode reader" on page 42.

**Table 7-7: Barcode reader parameter**

| Item | Parameter (DataLogic) | Parameter (Jadak) |
|---|---|---|
| Patient ID Start Position | 9 | 9 |
| Patient ID Length | 1 | 1 |
| Accession No. Start Position | 0 | 0 |
| Accession No. Length | 8 | 8 |

**2** Press the PATIENT button.

**3** Read the following Table 7-8 barcode by means of barcode reader.

**Table 7-8: Barcode value**

| Item | Value | Barcode |
|---|---|---|
| Receipt number | ABCabc01 | |

### Receipt Number Reading by Barcode [NW-7(CODABAR)]

**1** Specify a barcode reader.

See "To specify a barcode reader" on page 42.

**Table 7-9: Barcode reader parameter**

| Item | Parameter (DataLogic) | Parameter (Jadak) |
|---|---|---|
| Patient ID Start Position | 7 | 7 |
| Patient ID Length | 1 | 1 |
| Accession No. Start Position | 1 | 0 |
| Accession No. Length | 5 | 5 |

**2** Press the PATIENT button.

**3** Read the following Table 7-10 barcode by means of barcode reader.

**Table 7-10: Barcode value**

| Item | Value | Barcode |
|---|---|---|
| Receipt number | 00123 | |

### Receipt Number Reading by Barcode [CODE39]

**1** Specify a barcode reader.

See "To specify a barcode reader" on page 42.

**Table 7-11: Barcode reader parameter**

| Item | Parameter (DataLogic) | Parameter (Jadak) |
|---|---|---|
| Patient ID Start Position | 9 | 9 |
| Patient ID Length | 1 | 1 |
| Accession No. Start Position | 0 | 0 |
| Accession No. Length | 8 | 8 |

**2** Press the PATIENT button.

**3** Read the following Table 7-12 barcode by means of barcode reader.

**Table 7-12: Barcode value**

| Item | Value | Barcode |
|---|---|---|
| Receipt number | ABC01234 | |

### Patient ID and Receipt Number Reading by Barcode [CODE128]

**1** Specify a barcode reader.

See "To specify a barcode reader" on page 42.

**Table 7-13: Barcode reader parameter**

| Item | Parameter (DataLogic) | Parameter (Jadak) |
|---|---|---|
| Patient ID Start Position | 0 | 0 |
| Patient ID Length | 5 | 5 |
| Accession No. Start Position | 5 | 5 |
| Accession No. Length | 7 | 7 |

**2** Press the PATIENT button.

**3** Read the following Table 7-14 barcode by means of barcode reader.

**Table 7-14: Barcode value**

| Item | Value | Barcode |
|---|---|---|
| ID | ID123 | |
| Receipt number | AN12345 | |

### Patient ID and Receipt Number Reading by Barcode [NW-7(CODABAR)]

**1** Specify a barcode reader.

See "To specify a barcode reader" on page 42.

**Table 7-15: Barcode reader parameter**

| Item | Parameter (DataLogic) | Parameter (Jadak) |
|---|---|---|
| Patient ID Start Position | 1 | 0 |
| Patient ID Length | 5 | 5 |
| Accession No. Start Position | 6 | 5 |
| Accession No. Length | 7 | 7 |

**2** Press the PATIENT button.

**3** Read the following Table 7-16 barcode by means of barcode reader.

**Table 7-16: Barcode value**

| Item | Value | Barcode |
|---|---|---|
| ID | 00123 | |
| Receipt number | 1234567 | |

### Patient ID and Receipt Number Reading by Barcode [CODE39]

**1** Specify a barcode reader.

See "To specify a barcode reader" on page 42.

**Table 7-17: Barcode reader parameter**

| Item | Parameter (DataLogic) | Parameter (Jadak) |
|---|---|---|
| Patient ID Start Position | 0 | 0 |
| Patient ID Length | 5 | 5 |
| Accession No. Start Position | 5 | 5 |
| Accession No. Length | 7 | 7 |

**2** Press the PATIENT button.

**3** Read the following Table 7-18 barcode by means of barcode reader.

**Table 7-18: Barcode value**

| Item | Value | Barcode |
|---|---|---|
| ID | ID123 | |
| Receipt number | AN12345 | |

## Patient information link with C@RNACORE cannot be used

- Check that the patient ID entered on the FC1 **Patient Info** screen is correct.
- Check that the LAN cable is connected.
- Check that the C@RNACORE version support patient information link. See "Server connection settings" on page 44.
- Check that a device name compatible with C@RNACORE has been entered. For more information, see "Server connection settings" on page 44.

## Order link with C@RNACORE cannot be used

- Check that the FC1 is turned on.
- Check that the LAN cable is connected.
- Check that the examination screen or **Patient Info** screen is displayed.
- Check that the DICOM and DICOM MWL settings are correct. See "Specifying DICOM settings" on page 45 and "DICOM MWL setting" on page 46.

- Check that the C@RNACORE version support order link. See "Server connection settings" on page 44.
- Check that a device name compatible with C@RNACORE has been entered. For more information, see "Server connection settings" on page 44.

## When using order link with C@RNACORE, the examination cannot be started with the transducer I want to use

- Check that the transducer is connected.
- Check that the examination type setting is appropriate. For more information about the settings, see "Configuring examination defaults (Exam Type Setting)" on page 67.

# Software licensing

FUJIFILM SonoSite software is controlled by a license key. After you install new software, the system prompts you for a license key. You must obtain one key for each system or transducer that uses the software.

The software will operate for a short time (the grace period) without a license key. During the grace period, all system functions are available. After the grace period, you cannot use the system until you enter a valid license key

| | |
|---|---|
| **Caution** | After the grace period expires, all system functions except licensing are unavailable until a valid license key is entered. |

To obtain a license key for your software, contact FUJIFILM SonoSite Technical Support. You will need to provide the following information. For the steps to obtain this information, see "Viewing system information" on page 77.

The following information is required to obtain a license key:

- ARM version
- PCBA serial number
- Name of person installing the upgrade
- System serial number (can be found on the bottom of the system)

After you obtain a license key, enter it into the system.

**To enter a license key**

1 Turn on the system.

The license update screen appears.

2 Type the license key in the **Enter license number** field.

3 Select **OK** on-screen.

4 If you entered a valid license key but the license update screen appears, verify that you entered the license key correctly.

   If the license update screen still appears, contact FUJIFILM SonoSite Technical Support.

5 When you are prompted to restart the system, press the **POWER** button ( ) to turn the system off, and then press it again to turn it back on.

# Maintenance

**WARNING** | Do not modify the FC1 ultrasound system.

No periodic or preventive maintenance is required for the system, transducer, or accessories other than cleaning and disinfecting the transducer after every use (see "Cleaning and disinfecting" on page 489). There are no internal components that require periodic testing or calibration. All maintenance requirements are described in this *User guide*. Performing maintenance procedures not described in this *User guide* may void the product warranty.

Contact FUJIFILM SonoSite Technical Support for any maintenance questions.

CHAPTER 8

# Chapter 8: Cleaning and disinfecting

This section updates the instructions for cleaning and disinfecting the ultrasound system, transducers, and accessories.

Use the FUJIFILM SonoSite recommendations when cleaning or disinfecting your ultrasound system, transducer, and accessories. Use the cleaning recommendations in the peripheral manufacturer's instructions when cleaning or disinfecting your peripherals.

The system and transducers must be cleaned and disinfected after each exam. It is important to follow these cleaning and disinfecting instructions without skipping any steps.

See **www.sonosite.com/transducers**, for transducer images.

## Before getting started

- Follow the disinfectant manufacturer's recommendations regarding appropriate personal protective equipment (PPE), such as protective eyewear and gloves.
- Inspect the system 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 SonoSite or your local representative.
- Confirm that cleaning and disinfecting materials are appropriate for your facility's use. FUJIFILM SonoSite tests cleaners and disinfectants for use with the FUJIFILM SonoSite systems and transducers.
- Disinfectants and cleaning methods listed in this chapter are recommended by FUJIFILM SonoSite for efficacy and material compatibility with the products.
- Ensure that the disinfectant type and the solution strength and duration are appropriate for the equipment and application.
- Follow manufacturer recommendations and local regulations, when preparing, using and disposing of chemicals.

**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 connectors, or transducer connector.

Do not use strong solvents such as thinner or benzene, or abrasive cleansers, since these will damage the exterior surfaces. Use only FUJIFILM SonoSite recommended cleaners or disinfectants.

# Determining the required cleaning and disinfecting level

**WARNING**

The cleaning instructions contained in this chapter are based on requirements mandated by the American Food and Drug Administration (FDA). Failure to follow these instructions may result in cross contamination and patient infection.

The level of cleaning and disinfecting required for the system is dictated by the type of tissue it contacts during use. Use Table 8-1 to determine the level of cleaning and disinfecting required.

**Table 8-1: Choosing a cleaning and disinfecting method**

| Did any part of the system or transducer come in contact with broken skin, blood, mucosal membranes, or bodily fluids? | | | |
|---|---|---|---|
| **YES** | Came in contact with broken skin, blood, mucosal membranes, or bodily fluids. | → | **Option A**<br>Go to "Clean and disinfect system and transducer to a high level (semi-critical uses)" on page 491 |
| **OR** | | | |
| **NO** | Did not come in contact with broken skin, blood, mucosal membranes, or bodily fluids. | → | **Option B**<br>Go to "Clean and disinfect system and transducer to a low level (non-critical uses)" on page 496 |

## Spaulding classifications

Spaulding classifications (non-critical, semi-critical) determine the approach for cleaning and disinfecting medical equipment based on the device, the way it has been used, and the risk of infection. The system and transducers are designed for use within the Spaulding classifications of non-critical and semi-critical uses.

# Option A Clean and disinfect system and transducer to a high level (semi-critical uses)

Use this procedure to clean and high-level disinfect the ultrasound system and transducer **whenever it has come into contact with blood, broken skin, mucosal membranes, or bodily fluids**.

Follow the manufacturer's instructions when using cleaners and disinfectants. The cleaners and disinfectants listed in the procedure are both chemically compatible and have been tested for efficacy with the system and transducers. Confirm that the cleaners and disinfectants are appropriate for your facility's use.

**WARNING**

To avoid electrical shock, before cleaning, disconnect the system from the power supply.

Wear the appropriate personal protective equipment (PPE) recommended by the chemical manufacturer, such as eyewear and gloves.

**Caution**

Do not skip any steps or abbreviate the cleaning and disinfecting process in any way.

Do not spray cleaners or disinfectants directly on the system surfaces or on system and transducer connectors. Doing so may cause solution to leak into the system, damaging it and voiding the warranty.

Do not attempt to disinfect a transducer or transducer cable using a method or chemical that is not included here. This can damage the transducer and void the warranty.

Use only FUJIFILM SonoSite recommended cleaners and disinfectants. Using a non- recommended disinfecting solution or incorrect solution strength can damage the System and transducer and void the warranty. Follow the disinfectant manufacturer's recommendations for solutions strengths.

**Note**

You must clean and disinfect both the ultrasound system and the transducer after each use, but only the transducer can be disinfected to a high level.

**To clean and disinfect the system and transducer**

1 **Turn off** the system by pressing the **Power button.**

2 **Unplug** the power cord from the outlet.

3 **Remove** the disposable transducer sheath, if applicable.

4 **Disconnect** the transducer from the system. Temporarily place it where it will not cross-contaminate clean equipment or surfaces while you clean the ultrasound system.

5 **Clean** the exterior surfaces of the **ULTRASOUND SYSTEM** to remove any debris or bodily fluids. Use the following procedure:

**a** Use either a pre-moistened wipe or a soft cloth dampened with cleaner or disinfectant. Choose a cleaner from the list of approved cleaners.

**Approved cleaners/disinfectants for the ultrasound system:**

| Cleaner/disinfectant | Minimum wet contact time[a] |
|---|---|
| SaniCloth AF3[b] | 3 minutes |
| SaniCloth Plus | 3 minutes |
| PI-Spray II | 10 minutes |

[a] For maximum effectiveness, the component being cleaned must remain wet with disinfectant for a minimum period of time.
[b] Qualified for use as an intermediate-level disinfectant for mycobacteria. Refer to the cleaners and disinfection document available at **www.sonosite.com** for a complete list of the most current cleaners and disinfectants.

**b** Remove all gel, debris, and bodily fluids from the system.

**c** With a new wipe, clean the system, including the display, by wiping from clean areas to the soiled areas. This method helps to avoid cross-contamination.

**d** Observe the minimum wet contact time and refer to manufacturer's instructions. Monitor the system for wet appearance. Re-apply with a new wipe if no longer wet.

**e** Allow the ultrasound system to air dry in a clean, well-ventilated space.

6 **Clean** the ultrasound system **STAND** to remove any debris or bodily fluids.

7 **Clean** the **TRANSDUCER CABLE AND BODY** to remove any debris or bodily fluids. Use the following procedure:

**a** Use either a premoistened wipe or a soft cloth dampened with cleaner or disinfectant. Choose a cleaner from the list of approved cleaners.

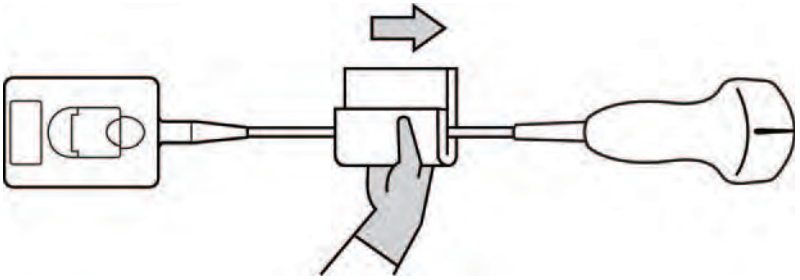
**Approved cleaners/disinfectants for the transducer:**

| Product | Compatible Transducer | Minimum wet contact time[a] |
|---|---|---|
| SaniCloth AF3[b] | C11xp, C35xp, C60xf, HFL38xp, HFL50xp, ICTxp, L25xp, L38xp, P21xp | 3 minutes |
| SaniCloth Plus | HFL38xp, HFL50xp, ICTxp | 3 minutes |
| PI-Spray II | C11xp, C60xf, HFL38xp, HFL50xp, ICTxp, L25xp, L38xp, P21xp | 10 minutes |

[a] For maximum effectiveness, the component being cleaned must remain wet with disinfectant for a minimum period of time.
[b] Qualified for use as an intermediate-level disinfectant for mycobacteria. Refer to the cleaners and disinfection document available at **www.sonosite.com** for a complete list of the most current cleaners and disinfectants.

**b** Remove all gel, debris, and bodily fluids from the transducer.

**c** With a new wipe, clean the cable and transducer, starting from the cable, wiping toward the scanhead. This method helps to avoid cross-contamination.



**Caution** Do not allow moisture near the electronic components of the connector.

**d** Observe the minimum wet contact time and refer to manufacturer's instructions. Monitor the transducer for wet appearance. Re-apply with a new wipe if no longer wet.

**8** **Verify** that all gel, debris, and bodily fluids have been removed from the system and transducer. If necessary, repeat steps 5, 6, and 7 with a new wipe.

**WARNING** Failure to remove all gel, debris, and bodily fluid could leave contaminants on the probe.

**9** **Prepare** the disinfectant for use.

**a** Choose a high-level disinfectant from the list of approved disinfectants.

**High-level disinfectants compatible with FC1 transducers:**

| Disinfectant[a] | Compatible transducers | Temperature | Disinfectant soak duration |
|---|---|---|---|
| Cidex | C11xp, C35xp, C60xf, HFL38xp, HFL50xp, ICTxp, L25xp, L38xp, P21xp | 25°C, 77°F | 45 minutes |
| Cidex OPA | C11xp, C60xf, HFL38xp, HFL50xp, ICTxp, L25xp, L38xp, P21xp | 20°C, 68°F | 12 minutes |
| Revital-Ox RESERT | C35xp | 20°C, 68°F | 8 minutes |

Refer to the cleaners and disinfection document available at **www.sonosite.com** for a complete list of the most current cleaners and disinfectants.

**b** Check the expiration date on the bottle to ensure the disinfectant has not expired.

**c** Mix or check that the disinfection chemicals have the concentration recommended by the manufacturer (for example, a chemical strip test).

**d** Check that the temperature of the disinfectant is within the manufacturer's recommended limits.

10 **Perform** a high-level disinfection of the transducer. Use the following procedure:

**a** Immerse the transducer in a high-level disinfectant solution.

**WARNING**

High-level disinfectants can cause harm to the patient if not completely removed from the transducer. Follow the manufacturer's rinse instructions to remove chemical residue.

**Caution**

Do not soak the transducer longer than recommended by the chemical manufacturer.

Do not immerse the transducer connector in any disinfectant solution.

Use only FUJIFILM SonoSite recommended cleaners and disinfectants. Using a non- recommended disinfecting solution or incorrect solution strength can damage or discolor the transducer and void the warranty.

**b** Ensure that the connector and most of the cable remain out of the fluid. You may submerge 2 inches (5 cm) of the cable proximal to the transducer scanhead.

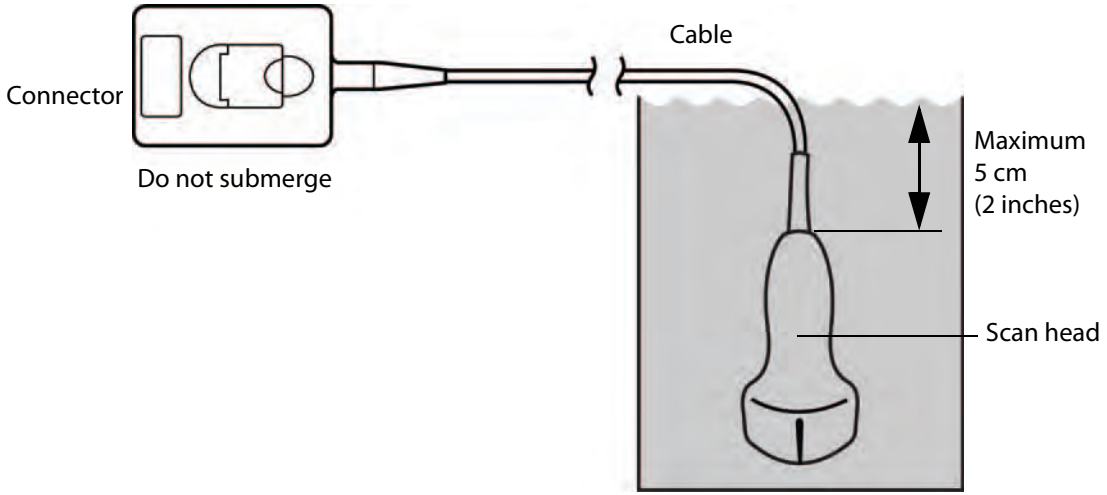



Figure 8-1: Transducer component names

11 **Rinse** the transducer **3 separate times** using the following procedure:

**a** Rinse the transducer in clean, running water according to the disinfectant manufacturer's instructions (at least 1 minute).

**b** Ensure that the connector and at least 12-18 inches (31-46 cm) of the cable from the connector remain out of the fluid.

**c** Replace the rinse water before beginning the next rinse.

12 **Dry** the transducer with a sterile lint-free cloth.

13 **Dispose** of the disinfectant according to the manufacturer's guidelines.

14 **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 SonoSite or your local representative.

## Option B Clean and disinfect system and transducer to a low level (non-critical uses)

Use the following procedure to clean and disinfect the ultrasound system and transducer **if it <u>has</u> <u>not</u> come into contact with blood, broken skin, mucosal membranes, or bodily fluids**.

**WARNING**

If the system or transducer has come into contact with any of the following, use the high-level cleaning and disinfection procedure. See "Clean and disinfect system and transducer to a high level (semi-critical uses)" on page 491.

- Blood
- Broken skin
- Mucosal membranes
- Bodily fluids

Follow the manufacturer's instructions when using cleaners and disinfectants. The materials listed in the table below are chemically compatible with the system and transducers. Confirm that the cleaners and disinfectants are appropriate for your facility's use.

**WARNING**

To avoid electrical shock, before cleaning, disconnect the system from the power supply.

Wear the appropriate personal protective equipment (PPE) recommended by the chemical manufacturer, such as eyewear and gloves.

**Caution**

Do not spray cleaners or disinfectants directly on the system surfaces or on system and transducer connectors. Doing so may cause solution to leak into the system, damaging it and voiding the warranty.

Use only FUJIFILM SonoSite-recommended cleaners and disinfectants. Using a non- recommended disinfecting solution or incorrect solution strength can damage the System and transducer and void the warranty. Follow the disinfectant manufacturer's recommendations for solutions strengths.

Do not attempt to disinfect a transducer or transducer cable using a method or chemical that is not included here. Doing so can damager the transducer and void the warranty.

**To clean and disinfect the system and transducer**

1 **Turn off** the system by pressing the **Power button.**

2 **Unplug** the power cord from the outlet.

3 **Remove** the transducer sheath, if applicable.

4 **Disconnect** the transducer from the system. Temporarily place it where it will not cross-contaminate clean equipment or surfaces while you clean the ultrasound system.

5 **Clean** the exterior surfaces of the **ULTRASOUND SYSTEM** to remove any debris or bodily fluids. Use the following procedure:

**a** Use either a pre-moistened wipe or a soft cloth dampened with cleaner and disinfectant. Choose a cleaner from the list of approved cleaners.

**Approved cleaners/disinfectants for the ultrasound system:**

| Cleaner/disinfectant | Minimum wet contact time[a] |
|---|---|
| SaniCloth AF3[b] | 3 minutes |
| SaniCloth Plus | 3 minutes |
| PI-Spray II | 10 minutes |

[a] For maximum effectiveness, the component being cleaned must remain wet with disinfectant for a minimum period of time.
[b] Qualified for use as an intermediate-level disinfectant for mycobacteria. Refer to the cleaners and disinfection document available at **www.sonosite.com** for a complete list of the most current cleaners and disinfectants.

**b** Remove all gel, debris, and bodily fluids from the system.

**c** With a new wipe, clean the system, including the display, by wiping from clean areas to the soiled areas. This method helps to avoid cross-contamination.

**d** Observe the minimum wet contact time and refer to manufacturer's instructions. Monitor the system for wet appearance. Re-apply with a new wipe if no longer wet.

6 **Clean** the ultrasound system **STAND** to remove any debris or bodily fluids.

7 **Clean** the **TRANSDUCER CABLE AND BODY** to remove any debris or bodily fluids. Use the following procedure:

**a** Use either a pre-moistened wipe or a soft cloth dampened with cleaner or disinfectant. Choose a cleaner from the list of approved cleaners.

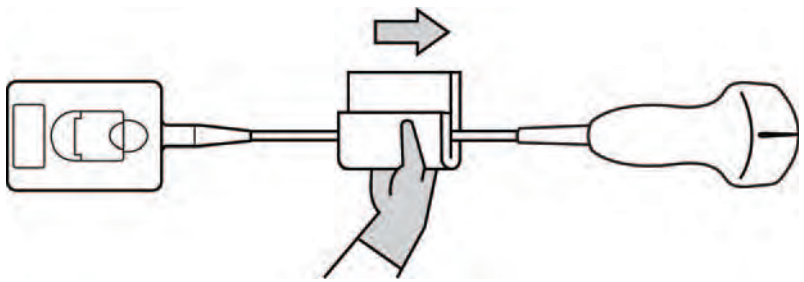
**Approved cleaners/disinfectants for the transducer:**

| Product | Compatible Transducer | Minimum wet contact time[a] |
|---|---|---|
| SaniCloth AF3[b] | C11xp, C35xp, C60xf, HFL38xp, HFL50xp, ICTxp, L25xp, L38xp, P21xp | 3 minutes |
| SaniCloth Plus | HFL38xp, HFL50xp, ICTxp | 3 minutes |
| PI-Spray II | C11xp, C60xf, HFL38xp, HFL50xp, ICTxp, L25xp, L38xp, P21xp | 10 minutes |

[a] For maximum effectiveness, the component being cleaned must remain wet with disinfectant for a minimum period of time.
[b] Qualified for use as an intermediate-level disinfectant for mycobacteria. Refer to the cleaners and disinfection document available at **www.sonosite.com** for a complete list of the most current cleaners and disinfectants.

**b** Remove all gel, debris, and bodily fluids from the transducer.

**c** With a new wipe, clean the cable and transducer, starting from the cable, wiping toward the scanhead. This method helps to avoid cross-contamination.



**Caution** | Do not allow moisture near the electronic components of the connector.

**d** Observe the required wet contact time and refer to manufacturer's instructions. Monitor the transducer for wet appearance. Re-apply with a new wipe if no longer wet.

**8** **Verify** that all gel, debris, and bodily fluids have been removed from the system and transducer. If necessary, repeat steps 5, 6, and 7 with a new wipe.

**9** **Allow** the ultrasound system, including the console and transducer, to air dry in a clean, well-ventilated space.

10 **Examine** the system, transducer and cable for damage, such as cracks or splitting where fluid can enter.

If damage is evident, do not use the transducer. Instead, contact FUJIFILM SonoSite or your local representative.

# Storing the transducer

**To store the transducer**

1 Make sure the transducer has been cleaned and disinfected as detailed in the previous section.

2 Store the transducer so that it hangs freely and vertically, and observe the following precautions:

- Store the transducer away from any contaminated transducers.
- Store the transducer in an environment that is safe and has good airflow. Do not store the transducer in closed containers or where condensation may occur.
- Avoid direct sunlight and exposure to x-rays. Recommended storage temperature range is between 0° C (32° F) and +45° C (113° F).
- If using a wall-mounted rack for storage, ensure that:
  - It is securely mounted.
  - The storage slots do not mar the transducer or cause damage to the cable.
  - The rack is sized and positioned to prevent the transducer from inadvertently falling.
  - Make sure the connector is supported and secure.

# Transporting the transducer

When transporting the transducer, you must take precautions to protect the transducer from damage and avoid cross-contamination. Be sure to use a container approved by your organization.

**To transport a soiled transducer for cleaning**

A soiled transducer is one that has been contaminated and must be cleaned before using it in an exam.

1 Place the transducer in a clean, approved container.

**WARNING**

To prevent cross-contamination or unprotected exposure of personnel to biological material, containers used to transport contaminated transducers should carry an ISO biohazard label similar to the following:

**Caution**

Ensure the transducer is dry before placing it in a closed container. Condensation from a damp transducer can damage the connector.

2 Transport the transducer in the container to the point of processing. Do not open the container until the transducer is ready to be cleaned.

**Caution**

Do not leave the transducer in a sealed container for long periods of time.

### To transport a clean transducer

A clean transducer is one that has completed the cleaning and disinfection process, has been stored properly, and is ready to be used in an examination.

1 Place the transducer in a clean, approved container. To identify the transducer as clean, containers used to transport clean transducers should carry a cleanliness verification sticker or certificate.

2 Transport the transducer in the container to the point of use. Do not open the container until the transducer is ready to be used.

### To ship a transducer

**WARNING**

Whenever possible, avoid shipping a contaminated transducer. Before shipping, ensure the transducer has been cleaned and disinfected using the steps detailed in this chapter or according to special instructions received from FUJIFILM SonoSite. If you are returning the transducer to FUJIFILM SonoSite, document the disinfection on a "Declaration of Cleanliness," and attach it to the packing list.

1 Place the transducer in the shipping container and seal it. Do not allow any part of the transducer to protrude from the container.

2 Ship the transducer using the following precautions:

- Clearly label the container as fragile.

- Do not stack items on top of the shipping container.
- Do not exceed the shipping temperature range: -35° C (-31° F) to +65° C (149° F).
- Do not open the shipping container until it reaches its final destination.
- After arrival, the transducer must be cleaned and disinfected before it can be used in an exam.

# Accessories

To clean and disinfectant the stand or Triple Transducer Connect, (TTC), see **"Cleaning and disinfecting the stand or Triple Transducer Connect (TTC)"** on page 502.

To clean the footswitch see **"Cleaning the footswitch"** on page 502.

To clean ECG cables, see **"Cleaning ECG cables"** on page 503.

To clean the ECG slave cable, refer to the *ECG Slave Cable & Adapter Kit User Guide*.

To clean the battery, see **"Cleaning and disinfecting the battery"** on page 504.

To clean the trackball, see **"Cleaning the trackball"** on page 504.

Use the cleaning and disinfecting recommendations in the peripheral manufacturer's instructions when cleaning or disinfecting peripherals.

## Cleaning and disinfecting accessories

Clean accessories prior to disinfecting. You can disinfect the exterior surface of accessories using a recommended disinfectant. Refer to the cleaners and disinfection document available at **www.sonosite.com**.

**WARNING** To avoid electrical shock, always disconnect the power supply before cleaning the PowerPark.

**To clean and disinfect accessories**

1. If necessary, unplug the power supply, and detach any cables.
2. Clean the exterior surfaces of the accessory using a soft cloth lightly dampened in a mild soap or detergent cleaning solution to remove any particulate matter or body fluids.

   Apply the solution to the cloth rather than the surface.
3. Mix the disinfectant solution compatible with the accessory, following disinfectant label instructions for solution strengths and disinfectant contact duration. Refer to the cleaners and disinfection document available at **www.sonosite.com**.

4 Wipe surfaces with the disinfectant solution. Follow the manufacturer's instructions for the disinfecting solution, including exposure time and temperature for effective disinfection.

5 Air dry or towel dry with a clean cloth.

## Cleaning and disinfecting the stand or Triple Transducer Connect (TTC)

**To clean and disinfect the stand or TTC**

You can clean and disinfect the exterior surface of the stand or TTC using a recommended cleaner or disinfectant.

1 Do one of the following:

- If cleaning the stand, unplug the power supply, detach any cables from the system, and remove the system.
- If cleaning the TTC, remove it from the system platform.

2 Clean the surfaces using a soft cloth lightly dampened in a mild soap or detergent cleaning solution.

Apply the solution to the cloth rather than the surface.

3 Wipe the surfaces with the disinfecting solution. Follow the manufacturer's instructions for the disinfecting solution, including exposure time and temperature for effective disinfection.

4 Air dry or towel dry with a clean cloth.

## Cleaning the footswitch

**Caution** To avoid damaging the footswitch, do not sterilize. It is not intended for use in a sterile environment.

**To clean the footswitch**

Use the disinfecting recommendations in the peripheral manufacturer's instructions when disinfecting the footswitch.

1 Dampen a non-abrasive cloth with a recommended cleaner or disinfectant.

2 Wring out cloth until slightly wet and then gently rub soiled area until clean.

## Cleaning ECG cables

**Note** | ECG cables are reusable, and are non-sterile when provided.

### To clean ECG cables

**WARNING** | Do not immerse ECG cables in any liquid.

You may clean ECG cables as many as 15 times using the following procedure:

1 Remove the cables from the system.

2 Clean the surface using a soft cloth or gauze pad lightly dampened with one of the following agents:

- Green soap
- Green soap tincture (US Pharmacopoeia) or alcohol free hand soap
- 2% glutaraldehyde solution (e.g. Cidex)
- Sodium hypochlorite (10% bleach solution)

Apply the solution to the cloth rather than the surface.

3 Wipe all exposed surfaces with the dampened cloth.

4 Repeat step 2 and 3 with a clean cloth or gauze pad.

5 Dry all exposed surfaces with a clean, dry cloth or gauze pad.

### To sterilize the ECG cable

**Caution** | Do not use an autoclave, gamma radiation, or steam to sterilize the ECG cable.

To avoid damage, sterilize ECG cables only when necessary. Replace cables after 10 sterilization cycles.

1 Sterilize ECG cables using ethylene oxide (EtO) sterilization methods.

2 To dissipate the ethylene oxide, aerate the cables. Follow all necessary safety precautions.

## Cleaning and disinfecting the battery

**Caution** To avoid damaging the battery, do not allow cleaning solution or disinfectant to come in contact with the battery terminals.

**To clean and disinfect a battery (wipe method)**

1 Remove the battery from the system.

2 Clean the surface using a soft cloth lightly dampened in a mild soap or detergent cleaning solution.

**Note** Apply the solution to the cloth rather than the surface.

3 Wipe the surfaces with the disinfection solution. Sani-Cloth HB, Sani-Cloth Wipes, or 70% isopropyl alcohol is recommended.

4 Air dry.

## Cleaning the trackball

If any foreign matter (such as dust) gets under the trackball, remove the trackball (following the procedure below) and then clean the inside of the device. To clean the trackball itself, see the User's Guide.

**To remove the trackball**

1 Remove the trackball retainer by rotating it counterclockwise and lifting it out.

Figure 8-2: Removing the trackball retainer

At this point the trackball is exposed.

Figure 8-3: Trackball retainer removed

**2** Remove the trackball.

Figure 8-4: Trackball removed

CHAPTER 9

# Chapter 9: Safety

This chapter contains ergonomic, electrical, and clinical safety information required by regulatory agencies. The information applies to the ultrasound system, transducer, accessories, and peripherals. This chapter also defines labeling symbols, specifications, and standards.

For safety information regarding the "As low as reasonably achievable" (ALARA) principle and acoustic output, see "Acoustic Output" on page 537.

## Ergonomic considerations

These guidelines for healthy scanning are intended to assist you in the comfortable and effective use of your ultrasound system.

**WARNING**

Use of an ultrasound system may be linked to musculoskeletal disorders (MSDs)[1,2,3]. Use of an ultrasound system is defined as the physical interaction between the operator, the ultrasound system, and the transducer.

To prevent musculoskeletal disorders, follow the guidelines in this section:

When using an ultrasound system, as with many similar physical activities, you may experience occasional discomfort in your hands, fingers, arms, shoulders, eyes, back, or other parts of your body. However, if you experience symptoms such as constant or recurring discomfort, pain, throbbing, aching, tingling, numbness, burning sensations, or stiffness, do not ignore these warning signs. Promptly see a qualified health professional. Symptoms such as these can be linked with MSDs. MSDs can be painful and may result in potentially disabling injuries to the nerves, muscles, tendons, or other parts of the body. Examples of MSDs include carpal tunnel syndrome and tendonitis.

While researchers are not able to definitively answer many questions about MSDs, there is a general agreement that certain factors are associated with their occurrence, including preexisting medical and physical conditions, overall health, equipment and body position while doing work, frequency of work, duration of work, and other physical activities [4]. This chapter provides guidelines that may help you work more comfortably and may reduce your risk of MSDs[5,6].


1. Magnavita, N., L. Bevilacqua, P. Mirk, A. Fileni, and N. Castellino. "Work-related musculoskeletal complaints in sonologists." *Occupational Environmental Medicine*. 41:11 (1999), 981-988.
2. Craig, M. "Sonography: An occupational hazard?" *Journal of Diagnostic Medical Sonography.* 3 (1985), 121-125.
3. Smith, C.S., G.W. Wolf, G. Y. Xie, and M. D. Smith. "Musculoskeletal pain in cardiac ultrasonographers: Results of a random survey." *Journal of American Society of Echocardiography*. (May1997), 357-362.
4. Wihlidal, L.M. and S. Kumar. "An injury profile of practicing diagnostic medical sonographers in Alberta." *International Journal of Industrial Ergonomics*. 19 (1997), 205-216.
5. Habes, D.J. and S. Baron. "Health hazard report 99-0093-2749." *University of Medicine and Dentistry of New Jersey*. (1999).
6. Vanderpool, H.E., E.A. Friis, B.S. Smith, and K.L. Harms. "Prevalence of carpal tunnel syndrome and other work-related musculoskeletal problems in cardiac sonographers." *Journal of Medicine.* 35:6 (1993), 605-610.


# Positioning the system

**To promote comfortable shoulder, arm, and hand postures**

- Use a stand to support the weight of the ultrasound system.

**To minimize eye and neck strain**

- If possible, position the system within reach.
- Adjust the angle of the clinical display to minimize glare.

- If using a stand, adjust its height so that the display is at or slightly below eye level. When lowering the stand, do not hold the handle, but instead hold the portion of the stand close to the column pole.

# Positioning yourself

**To support your back during an exam**

- Use a chair that
  - Supports your lower back
  - Adjusts to your work surface height
  - Promotes a natural body posture
  - Allows quick height adjustments
- Always sit or stand upright. Avoid bending or stooping.

**To minimize reaching and twisting**

- Use a bed that is height-adjustable.
- Position the patient as close to you as possible.
- Face forward.

  Avoid twisting your head or body.
- Move your entire body front to back, and position your scanning arm next to or slightly in front of you.
- To minimize reaching, stand for difficult exams.
- Position the ultrasound system or display directly in front of you.
- Provide an auxiliary monitor for patient viewing.

**To promote comfortable shoulder and arm postures**

- Keep your elbows close to your side.
- Relax your shoulders in a level position.
- Support your arm on a support cushion or pillow, or rest it on the bed.

**To promote comfortable hand, wrist, and finger postures**

- Hold the transducer lightly in your fingers.
- Minimize the pressure that you apply on the patient.
- Keep your wrist in a straight position.

# Taking breaks, exercising, and varying activities

**To effectively allow your body to recover from physical activity and help you avoid MSDs**

- Minimize scanning time.
- Take breaks.

Some ultrasound tasks may require longer or more frequent breaks. However, simply changing tasks can help some muscle groups relax while others remain or become active.

- To work efficiently, use the software and hardware features correctly.
- Keep moving.

  To avoid sustaining the same posture, vary your head, neck, body, arm, and leg positions.
- Do targeted exercises.

  Targeted exercises can strengthen muscle groups, which may help you avoid MSDs.

Contact a qualified health professional to determine stretches and exercises that are right for you.

# Electrical safety

This system meets EN60601-1, Class I/internally powered equipment requirements and Type BF and Type CF isolated patient-applied parts safety requirements.

This system complies with the applicable medical equipment requirements published in the Canadian Standards Association (CSA), European Norm Harmonized Standards, and Underwriters Laboratories (UL) safety standards.

For maximum safety, observe the following warnings and cautions.

| | |
|---|---|
| **WARNING** | To avoid discomfort or minor risk of patient injury, keep hot surfaces away from the patient. |
| **WARNING** | Under certain circumstances, the transducer connector and back of the display enclosure can reach temperatures that exceed EN60601-1 limits for patient contact. Therefore, only the operator shall handle the system. This does not include the transducer face.<br>If the connector exceeds the specified temperature and is exposed to the patient, it may make the patient uncomfortable or injure him or her. Do not allow patient contact with parts of the system other than the transducers or ECG leads. |
| **WARNING** | To avoid the risk of injury, do not operate the system in the presence of flammable gases or anesthetics. Explosion can result. |

**WARNING**

To avoid the risk of electrical shock or injury, do not open the system enclosures. All internal adjustments and replacements, except battery replacement, must be made by a qualified technician.

Check all fasteners and connections to avoid injury.

To avoid the risk of electrical shock:

- This equipment must be connected only to a supply mains with protective grounding.
- Use only properly grounded equipment. Shock hazards exist if the power supply is not properly grounded. Grounding reliability can be achieved only when the equipment is connected to a receptacle marked “Hospital Only,” “Hospital Grade,” or an equivalent. The grounding wire must not be removed or disabled.
- When using the system in an environment where the integrity of the protective earth conductor arrangement is in doubt, operate the system on battery power only, without using the power supply.

**WARNING**

- Do not touch any of the following, under these conditions:
  - The power supply and the patient at the same time
  - The ungrounded signal input/output connectors on the back of the ultrasound system
  - The system battery contacts (inside the battery compartment)
  - The system transducer connector, when the transducer or Triple Transducer Connect (TTC) is disconnected
  - The system transducer connector on the TTC, if no transducers are connected

- Do not connect the system's power supply or a FC1 stand system to a multiple portable socket outlet (MPSO) or extension cord.
- Before using the transducer, inspect the face of the transducer elements, housing, and cable.
- Do not use the transducer if the transducer or cable is damaged.
- Always disconnect the power supply from the system before cleaning the system.
- Do not use any transducer that has been immersed beyond the specified cleaning or disinfection level.

  See "Troubleshooting and maintenance" on page 477.

**WARNING**

- Use only accessories and peripherals recommended by FUJIFILM SonoSite, including the power supply.

  Connection of accessories and peripherals not recommended by FUJIFILM SonoSite could result in electrical shock. Contact FUJIFILM SonoSite or your local representative for a list of accessories and peripherals available from or recommended by FUJIFILM SonoSite.
- Use commercial-grade peripherals recommended by FUJIFILM SonoSite on battery power only. Do not connect these products to AC mains power when using the system to scan or diagnose a patient/subject.

  Contact FUJIFILM SonoSite or your local representative for a list of the commercial-grade peripherals available from or recommended by FUJIFILM SonoSite.

To avoid the risk of electrical shock and fire hazard:

- Inspect the power supply, AC power cords, cables, and plugs on a regular basis to ensure that they are not damaged.

**WARNING**

- Use the power cord set that connects the power supply of the ultrasound system or the stand to mains power only with the power supply or FC1 stand system.

  You must not use them to connect other devices to mains power.

**WARNING**

To prevent injury to the operator or a bystander, remove the transducer from patient contact before the application of a high-voltage defibrillation pulse.

- To avoid possible electrical shock or electromagnetic interference, verify proper operation and compliance with relevant safety standards for all equipment before clinical use.

**WARNING**

- Connecting additional equipment to the ultrasound system constitutes configuring a medical system.

**Caution**

Do not use the system if an error message appears on the image display. Instead:

1. Note the error code.
2. Call FUJIFILM SonoSite or your local representative.
3. Turn off the system by pressing and holding the power key until the system powers down.

To avoid increasing the system and transducer connector temperature, do not block the airflow to the ventilation holes on the side of the system

To avoid burn injury, while using the device, do not touch the AC adapter, as it becomes hot.

# Electrical safety classification

**Table 9-1: Electrical classifications for system elements**

| Electrical classification | System element |
|---|---|
| Class I equipment | The ultrasound system is classified as Class I equipment when powered from the AC power supply or mounted on the stand, because the AC power supply is a Class 1 protectively grounded power supply.<br>The stand has no protective grounding. Ground bond testing is not applicable to the ultrasound system or the stand.<br>AC powered peripherals that may be used with the system are Class I and are individually protectively grounded. Ground bond testing may be conducted on each AC powered peripheral. |
| Internally powered equipment | Ultrasound system not connected to the power supply (battery only) |
| Type BF applied parts | Ultrasound transducers |
| Type CF applied parts | ECG module/ECG leads |
| IPX-7 (watertight equipment) | Ultrasound transducers |
| IPX-8 (watertight equipment) | Foot switch |
| Non AP/APG | Ultrasound system power supply, FC1 stand system, and peripherals. Equipment is not suitable for use in the presence of flammable anesthetics. |

# Equipment safety

To protect your ultrasound system, transducer, and accessories, follow these precautions.

**Caution**

Excessive bending or twisting of cables can cause a failure or intermittent operation.

Improper cleaning or disinfecting of any part of the system can cause permanent damage. For cleaning and disinfecting instructions, see "Maintenance" on page 488.

Do not submerge the transducer connector in solution. The cable is not liquid-tight beyond the transducer connector/cable interface.

Do not use solvents such as thinner or benzene, or abrasive cleaners on any part of the system.

Remove the battery from the system if the system is not likely to be used for some time.

Do not spill liquid on the system.

When lowering the stand of the stand cart, do not hold the handle; instead, hold the portion of the stand close to the column pole.

Close the FC1 display before transporting the system, to avoid injury.

# Battery safety

To prevent the battery from bursting, igniting, or emitting fumes and causing personal injury or equipment damage, observe the following precautions.

**WARNING**

The battery has a safety device. Do not disassemble or alter the battery.

Charge the batteries only when the ambient temperature is between 0° and 40°C (32° and 104°F).

Do not short-circuit the battery by directly connecting the positive and negative terminals with metal objects.

Do not touch battery contacts.

Do not heat the battery or discard it in a fire.

Do not expose the battery to temperatures over 60°C (140°F). Keep it away from fire and other heat sources.

Do not charge the battery near a heat source, such as a fire or heater.

Do not leave the battery in direct sunlight.

Do not pierce the battery with a sharp object, hit it, or step on it.

Do not use a damaged battery.

Do not solder a battery.

The polarity of the battery terminals is fixed and cannot be switched or reversed. Do not force the battery into the system.

Do not connect the battery to an electrical power outlet.

**WARNING**

Do not continue recharging the battery if it does not recharge after two successive six-hour charging cycles.

Do not ship a damaged battery without instructions from FUJIFILM SonoSite Technical Support.

If the battery leaks or emits an odor, remove it from all possible flammable sources.

Periodically check to make sure that the battery charges fully. If the battery fails to charge fully, replace it.

**Caution**

To avoid having the battery become damaged and causing equipment damage, observe the following precautions:

- Do not immerse the battery in water or allow it to get wet.
- Do not put the battery into a microwave oven or pressurized container.
- If the battery emits an odor or heat, is deformed or discolored, or in any way appears abnormal during use, recharging or storage, immediately remove it and stop using it. If you have any questions about the battery, consult FUJIFILM SonoSite or your local representative.
- Store the battery between -20°C (-4°F) and 60°C (140°F).
- Use only FUJIFILM SonoSite batteries.
- Do not use or charge the battery with non-FUJIFILM SonoSite equipment. Only charge the battery with the system.

# Clinical safety

**WARNING**

Nonmedical (commercial)-grade peripheral monitors have not been verified or validated by FUJIFILM SonoSite as being suitable for diagnosis.

To avoid the risk of a burn hazard, do not use the transducer with high-frequency surgical equipment. Such a hazard may occur in the event of a defect in the high-frequency surgical neutral electrode connection.

Do not use the system if it exhibits erratic or inconsistent behavior. Discontinuities or nonimage display in the scanning sequence indicate a hardware failure that must be corrected before use.

Some transducer sheaths contain natural rubber latex and talc, which can cause allergic reactions in some individuals. Refer to 21 CFR 801.437, User labeling, for devices that contain natural rubber.

After attaching the transducer cover to the transducer, make sure that the cover is free from holes or crevices.

Perform ultrasound procedures prudently. Use the ALARA ("as low as reasonably achievable") principle and follow the prudent use information concerning the mechanical index (MI) and the thermal index (TI).

FUJIFILM SonoSite does not currently recommend a specific brand of acoustic standoff. If an acoustic standoff is used, it must have a minimum attenuation of .3dB/cm/MHz.

Some FUJIFILM SonoSite transducers are approved for intraoperative applications if a market-cleared sheath is used.

To avoid injury or reduce the risk of infection to the patient, observe the following:

- Follow Universal Precautions when inserting and maintaining a medical device for interventional and intraoperative procedures.
- Appropriate training in interventional and intraoperative procedures as dictated by current relevant medical practices as well as in proper operation of the ultrasound system and transducer is required. During vascular access, the potential exists for serious complications, including (without limitation) the following: pneumothorax, arterial puncture, guidewire misplacement, and risks normally associated with local or general anesthesia, surgery, and postoperative recovery.

**WARNING** To avoid device damage or patient injury, do not use the P21xp needle guide bracket on patients with pacemakers or medical electronic implants. The needle guide bracket for the P21xp transducers contains a magnet that is used to ensure that the bracket is correctly oriented on the transducer. The magnetic field, in direct proximity to the pacemaker or medical electronic implant, may have an adverse effect.

**WARNING** The foot switch is not designed to be sterilized. Avoid using the foot switch in an environment where sterilization is required.

# Hazardous materials

**WARNING** Products and accessories may contain hazardous materials. Ensure that products and accessories are disposed of in an environmentally responsible manner and meet federal and local regulations for disposing of hazardous materials.

**WARNING** The liquid crystal display (LCD) contains mercury. Dispose of the LCD properly in accordance with local regulations.

# Electromagnetic compatibility

The ultrasound system has been tested and found to comply with the electromagnetic compatibility (EMC) limits for medical devices to IEC60601-1-2:2007. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation.

**WARNING** The FC1 ultrasound system should not be used adjacent to or stacked with other equipment. If such use occurs, verify that the FC1 ultrasound system operates normally in that configuration.

**Caution** Medical electrical equipment requires special precautions regarding EMC and must be installed and operated according to these instructions. Portable and mobile RF communications equipment can affect the ultrasound system. Electromagnetic interference (EMI) from other equipment or interference sources could result in performance disruption of the ultrasound system. Evidence of disruption may include image degradation or distortion, erratic readings, equipment ceasing to operate, or other incorrect functioning. If this occurs, survey the site to determine the source of disruption, and take the following actions to eliminate the source(s):

**Caution**

- Turn equipment in the vicinity off and on to isolate disruptive equipment.
- Relocate or re-orient interfering equipment.
- Increa se distance between the interfering equipment and your ultrasound system.
- Manage use of frequencies close to ultrasound system frequencies.
- Remove devices that are highly susceptible to EMI.
- Lower power from internal sources within facility control (such as paging systems).
- Label devices susceptible to EMI.
- Educate clinical staff to recognize potential EMI-related problems.
- Eliminate or reduce EMI with technical solutions (such as shielding).
- Restrict use of personal communicators (cell phones, computers) in areas with devices susceptible to EMI.
- Share relevant EMI information with others, particularly when evaluating new equipment purchases that may generate EMI.
- Purchase medical devices that comply with IEC 60601-1-2 EMC Standards.

**Caution**

To avoid the risk of increased electromagnetic emissions or decreased immunity, use only accessories and peripherals recommended by FUJIFILM SonoSite. Connection of accessories and peripherals not recommended by FUJIFILM SonoSite to the ultrasound system may result in malfunction of the ultrasound system or other medical electrical devices in the area. Contact FUJIFILM SonoSite or your local representative for a list of accessories and peripherals available from or recommended by FUJIFILM SonoSite. See the FUJIFILM SonoSite accessories user guide.

The FC1 ultrasound systems contains an IEEE 802.11 transmitter that utilizes ISM frequency bands from 2.412 to 2.484 GHz and implements three different methods of transmissions:

- 802.11b with Direct Sequence Spread Spectrum (DSSS) at 17 dBm $\pm$ 2.0 dBm @ 11 Mbps
- 802.11g with Orthogonal Frequency Division Multiplexing (OFDM) at 14 dBm $\pm$ 2 dBm @ 54 Mbps
- 802.11n with Orthogonal Frequency Division Multiplexing (OFDM) at 14 dBm + 2 dBm @ MCS7

# Electrostatic discharge

**Caution**

Electrostatic discharge (ESD), or static shock, is a naturally occurring phenomenon. ESD is common in conditions of low humidity, which can be caused by heating or air conditioning. ESD is a discharge of the electrical energy from a charged body to a lesser or noncharged body. The degree of discharge can be significant enough to cause damage to a transducer or an ultrasound system. The following precautions can help reduce ESD: antistatic spray on carpets, antistatic spray on linoleum, and antistatic mats.

**WARNING**

Unless following ESD precautionary procedures, do not connect to or touch (with body or hand-held tools) pins (contacts) of connectors that have the ESD Sensitive Devices label:

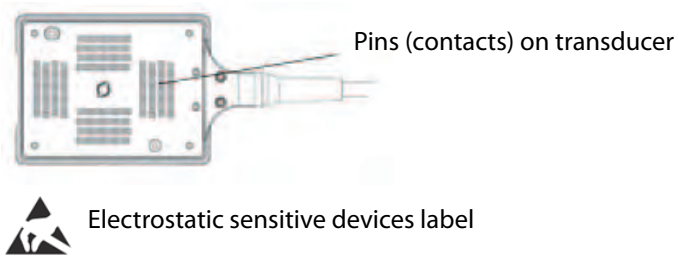



Figure 9-1: The transducer connector is an example of an electrostatically-sensitive device.

ESD precautionary procedures include the following:

- All staff involved must receive training about ESD, including the following at a minimum: an explanation of the ESD warning symbol, ESD precautionary procedures, an introduction to the physics of electrostatic charge, the voltage levels that can occur in normal practice, and the damage that can occur to electronic components if equipment is touched by an individual who is electrostatically charged (IEC 60601-1-2, section 5.2.1.2 d).
- Prevent the buildup of electrostatic charge. For example, use humidification, conductive floor coverings, nonsynthetic clothing, ionizers, and minimizing insulating materials.
- Discharge your body to earth.
- Use a wrist strap to bond yourself to the ultrasound system or to earth.

# Separation distance

## Recommended separation distances between portable and mobile RF communications equipment and the FC1 ultrasound system

The FC1 ultrasound system is intended for use in an electromagnetic environment in which radiated radio frequency (RF) disturbances are controlled. The customer or the user of the FC1 ultrasound system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the FC1 ultrasound system as recommended below, according to the maximum output power of the communications equipment.

**Table 9-2: Recommendations for separation distance**

| Rated maximum output power of transmitter (Watts) | Separation distance according to frequency of transmitter (Meters) | | |
|---|---|---|---|
| | 150 kHz to 80 MHz $d=1.2\sqrt{P}$ | 80 MHz to 800 MHz $d=1.2\sqrt{P}$ | 800 MHz to 2.5 GHz $d=2.3\sqrt{P}$ |
| 0.01 | 0.12 | 0.12 | 0.23 |
| 0.1 | 0.38 | 0.38 | 0.73 |
| 1 | 1.2 | 1.2 | 2.3 |
| 10 | 3.8 | 3.8 | 7.3 |
| 100 | 12 | 12 | 23 |

For transmitters rated at a maximum output power not listed above, the recommended separation distance (d) in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

*At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.*

# Compatible accessories and peripherals

FUJIFILM SonoSite has tested the FC1 ultrasound system with the following accessories and peripherals and has demonstrated compliance with the requirements of IEC60601-1-2:2007.

You may use these FUJIFILM SonoSite accessories and third-party peripherals with the FC1ultrasound system.

**WARNING**

Use of the accessories with medical systems other than the FC1 ultrasound system may result in increased emissions or decreased immunity of the medical system.

Use of accessories other than those specified may result in increased emissions or decreased immunity of the ultrasound system.

**Table 9-3: Accessories and peripherals compatible with FC1 ultrasound system**

| Description | Maximum cable length | Part number |
|---|---|---|
| C11xp transducer[a] | 6.0 ft/1.8 m | P14564 |
| C35xp transducer[a] | 5.5 ft/1.7 m | P19617 |
| C60xf transducer[a] | 5.5 ft/1.7 m | P18024 |
| HFL38xp transducer[a] | 5.7 ft/1.7 m | P16038 |
| HFL50xp transducer[a] | 5.7 ft/1.7 m | P14567 |
| ICTxp transducer[a] | 5.7 ft/1.7 m | P14562 |
| L25xp transducer[a] | 7.5 ft/2.3m | P14566 |
| L38xp transducer[a] | 5.5 ft/1.7 m | P14565 |
| P21xp Transducer[a] | 6.0 ft/1.8 m | P14563 |
| AC adapter bracket | — | P17141 |
| Accessory Box | — | P17309 |
| Battery pack | — | P17147 |
| Barcode scanner | 4.9ft/1.5m | P14166 |
| Barcode scanner (Japan only) | 6.3 ft/1.9 m | P18738 |
| Black & white printer | — | P13745 |
| Black & white printer | — | P20006 |
| Color printer (Japan only) | — | P18248 |
| Color printer box/bracket (Japan only) | — | P18702 |

**Table 9-3: Accessories and peripherals compatible with FC1 ultrasound system**

| Description | Maximum cable length | Part number |
|---|---|---|
| Digital video recorder (Japan only) | — | P18286 |
| ECG module (Japan) | 5.8 ft/1.8 m | P15170 |
| ECG module (EU) | 5.8 ft/1.8 m | P15171 |
| ECG leads | 2.0 ft/0.6 m | |
| FC1 Stand | — | P17313 |
| Footswitch | 9.8 ft/3.0 m | P14689 |
| Magnetic card reader | 5.8 ft/1.8 m | P18739 |
| Power supply | 4.9 ft/1.5 m | P18011 |
| Triple transducer connect | — | P18967 |
| USB keyboard | 4.6ft/1.4m | P11856 |
| USB memory | — | P16967 |
| USB memory stick with data security functionality | — | P21206 |
| AC power cord | 7.9 ft/2.4 m | |
| DVR brick | 5.8 ft/1.8 m | |
| HDMI cable | 3.3 ft/1.0 m | |
| LAN cable | 49.2 ft/15.0 m | |

[a]For transducers, maximum cable length is measured between the strain reliefs. The stated lengths do not include the lengths of cable in the following locations: underneath the strain reliefs, inside the transducer enclosure, or inside the transducer connector.

# Guidance and manufacturer's declaration

**WARNING** Other equipment, even equipment that complies with CISPR emission requirements, can interfere with the FC1 ultrasound system.

The FC1 ultrasound system is intended for use in the electromagnetic environment specified in the following tables. The customer or the user of the FC1 ultrasound system should assure that it is used in such an environment.

**Table 9-4: Guidance and manufacturer's declaration - Electromagnetic emissions**

| Emissions test | Compliance | Electromagnetic environment |
|---|---|---|
| RF emissions<br>CISPR 11 | Group 1 | The FC1 ultrasound system uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference with nearby electronic equipment. |
| RF emissions<br>CISPR 11 | Class A | The FC1 ultrasound system is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes. |
| Harmonic emissions<br>IEC 61000-3-2 | Class A | |
| Voltage fluctuations/flicker emissions<br>IEC 61000-3-3 | Complies | |

**Table 9-5: Guidance and manufacturer's declaration - Electromagnetic immunity**

| Immunity test | IEC 60601 test level | Compliance level | Electromagnetic environment |
|---|---|---|---|
| Electrostatic Discharge (ESD)<br>IEC 61000-4-2 | ±2.0KV, ±4.0KV, ± 6.0KV contact<br>±2.0KV, ±4.0KV, ± 8.0KV air | ± 2.0KV, ±4.0KV, ±6.0KV contact<br>± 2.0KV, ±4.0KV, ±8.0KV air | Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%. |
| Electrical fast Transient/burst<br>IEC 61000-4-4 | ± 2KV on the mains<br>± 1KV on signal lines | ± 2KV on the mains<br>± 1KV on signal lines | Mains power quality should be that of a typical commercial or hospital environment. |

**Table 9-5: Guidance and manufacturer's declaration - Electromagnetic immunity**

| Immunity test | IEC 60601 test level | Compliance level | Electromagnetic environment |
|---|---|---|---|
| Surge<br>IEC 61000-4-5 | +/-1KV line(s) to line(s)<br>+/-2KV line(s) to earth | +/-1KV line(s) to line(s)<br>+/-2KV line(s) to earth | Mains power quality should be that of a typical commercial or hospital environment. |
| Voltage dips, short interruptions, and voltage variations on power supply input lines<br>IEC61000-4-11 | <5% $U_T$ (>95% dip in $U_T$) for 0.5 cycle<br>40% $U_T$ (60% dip in $U_T$) for 5 cycles<br>70% $U_T$ (30% dip in $U_T$) for 25 cycles<br><5% $U_T$ (>95% dip in $U_T$) for 5s | <5% $U_T$ (>95% dip in $U_T$) for 0.5 cycle<br>40% $U_T$ (60% dip in $U_T$) for 5 cycles<br>70% $U_T$ (30% dip in $U_T$) for 25 cycles<br><5% $U_T$ (>95% dip in $U_T$) for 5s | Mains power quality should be that of a typical commercial or hospital environment. If the user of the FC1 ultrasound system requires continued operation during power mains interruptions, it is recommended that the FC1 ultrasound system be powered from an uninterruptible power supply or a battery. |
| Power Frequency Magnetic Field<br>IEC 61000-4-8 | 3 A/m | 3 A/m | Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment. |
| Conducted RF<br>IEC 61000-4-6 | 3 Vrms<br>150 kHz to 80 MHz | 3 Vrms | Portable and mobile RF communications equipment should be used no closer to any part of the FC1 ultrasound system, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.<br>Recommended separation distance:<br>$d = 1.2\sqrt{P}$ |

**Table 9-5: Guidance and manufacturer's declaration - Electromagnetic immunity**

| Immunity test | IEC 60601 test level | Compliance level | Electromagnetic environment |
|---|---|---|---|
| Radiated RF<br>IEC 61000-4-3 | 3 Vim<br>80MHz to 2.5 GHz | 3 V/m | $d = 1.2\sqrt{P}$<br>80 MHz to 800 MHz<br>$d = 2.3\sqrt{P}$<br>800 MHz to 2.5 GHz<br>Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).<br>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a],should be less than the compliance level in each frequency range[b].<br>Interference may occur in the vicinity of equipment marked with the following symbol:<br> |

$U_T$ is the AC mains voltage before application of the test level.

At 80 MHz and 800 MHz, the higher frequency range applies.

These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

[a]Field strengths from fixed transmitters such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the FUJIFILM SonoSite ultrasound system is used exceeds the applicable RF compliance level above, the FUJIFILM SonoSite ultrasound system should be observed to verify normal operation. If abnormal performance is observed,

additional measures may be necessary, such as re-orienting or relocating the FUJIFILM SonoSite ultrasound system.

[b]Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

**Caution**

**FCC**: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.
- This device must accept any interference received, including interference that may cause undesired operation.

# Immunity testing requirements

The FC1 ultrasound system complies with the essential performance requirements specified in IEC 60601-1-2 and IEC 60601-2-37. Results of immunity testing show that the FC1 ultrasound system meets these requirements and is free from the following:

- Noise on a waveform or artifacts or distortion in an image or error of a displayed numerical value that cannot be attributed to a physiological effect and that may alter the diagnosis
- Display of incorrect numerical values associated with the diagnosis to be performed
- Display of incorrect safety-related indications
- Production of unintended or excessive ultrasound output
- Production of unintended or excessive transducer assembly surface temperature
- Production of unintended or uncontrolled motion of transducer assemblies intended for intra-corporeal use

# Labeling symbols

The following symbols are used on the products, packaging, and containers.

**Table 9-6: Labeling symbols**

| Symbol | Definition |
|---|---|
| | Alternating current (AC) |

**Table 9-6: Labeling symbols**

| Symbol | Definition |
|---|---|
| | Class 1 device indicating manufacturer's declaration of conformance with Annex VII of 93/42/EEC |
| | Class 1 device requiring verification by the Notified Body of sterilization or measurement features, or to a Class IIa, IIb, or III device requiring verification or auditing by the Notified Body to applicable Annex(es) of 93/42/EEC |
| | Attention; see the *User guide*. |
| | Device complies with relevant Australian regulations for electronic devices. |
| | Batch code, date code, or lot code type of control number |
| | Biological risk |
| | Device complies with relevant Brazilian regulations for electromedical devices. |
| | Canadian Standards Association. The "C" and "US" indicators next to this mark signify that the product has been evaluated according to the applicable CSA and ANSI/UL Standards, for use in Canada and the US, respectively. |
| | Canadian Standards Association component certification mark. |
| | Catalog number |
| | Collect separately from other household waste (see European Commission Directive 93/86/EEC). Refer to local regulations for disposal. |
| | Corrugated recycle |
| | Dangerous voltage |

**Table 9-6: Labeling symbols**

| Symbol | Definition |
|---|---|
| | Date of manufacture |
| | Manufacturer |
| | Direct current (DC) |
| | Do not get wet. |
| | Do not stack over n high, where n represents the number on the label. |
| | Electrostatic-sensitive devices |
| | Device complies with relevant FCC regulations for electronic devices. |
| | Fragile |
| GEL | Gel |
| | Sterilized using irradiation |
| | Sterilized using ethylene oxide |
| | Hot |
| | Device emits a static (DC) magnetic field. |
| | Nonionizing radiation |
| | Paper recycle |

**Table 9-6: Labeling symbols**

| Symbol | Definition |
|---|---|
| | Serial number type of control number |
| | Temperature limitation |
| | Atmospheric pressure limitation |
| | Humidity limitation |
| | Submersible. Protected against the effects of temporary immersion. |
| | Watertight equipment. Protected against the effects of extended immersion. |
| | Handle transducer with care. |
| | Follow manufacturer's instructions for disinfecting time. |
| | Disinfect transducer. |
| | Type BF patient applied part<br>(B = body, F = floating applied part) |
| | Defibrillator proof type CF patient applied part |
| | Pollution Control Logo. (Applies to all parts/products listed in the China RoHS disclosure table. May not appear on the exterior of some parts/products because of space limitations.) |
| | China Compulsory Certificate mark ("CCC Mark"). A compulsory safety mark for compliance with Chinese national standards for many products sold in the People's Republic of China. |
| | Follow instructions for use. |

**Table 9-6: Labeling symbols**

| Symbol | Definition |
| --- | --- |
| | Total weight of equipment with its safe working load installed. |

# The label position on the FC1 system

# Specifications

## Dimensions

### System

- Length: 13.0 in. (33.1 cm)
- Width: 12.25 in. (31.1 cm)
- Height: 3.0 in (7.7 cm) (when the monitor is closed)

### Display

- Length: 9.6 in. (24.3 cm)
- Height: 7.33 in. (18.6 cm)
- Diagonal: 12.1 in. (30.6 cm)

## Environmental limits

**Note** The temperature, pressure, and humidity limits apply only to the ultrasound system, transducers, and battery.

### Operating (system, battery, and transducer)

10– 35°C (50–95°F), 15–95% R.H.

700 to 1060hPa (0.7 to 1.05 ATM)

### Shipping and storage (system and transducer)

-35–65°C (-31–149°F), 15–95% R.H.

500 to 1060hPa (0.5 to 1.05 ATM)

### Shipping and storage (battery)

-20–60°C (-4–140°F) (1 month), -20–45°C (-4–113°F) (3 month), -20–20°C (-4–68°F) (1 year), 15–95% R.H.

500 to 1060hPa (0.5 to 1.05 ATM)

### Operating (bracket and needle guide)

10– 35°C (50–95°F), 15–95% R.H.

### Shipping and storage (bracket and needle guide)

-35–65°C (-31–149°F), 15–95% R.H.

## Electrical specifications

### Power supply: PN P18011

- Input: 100-240 VAC, 2.5-1.2A , 50/60 Hz
- Output: +13.5VDC, 11.1A, 150W Max, Class 1, continuous operation.

### FC1 stand

Input: 100-240 VAC, 50/60 Hz, 8.0-3.3 A

## Battery specifications

The battery comprises twelve lithium-ion cells plus electronics, a temperature sensor, and battery contacts.

Run time is up to 1 hour, depending on imaging mode and display brightness.

# Standards

## Electrical safety standards

IEC 60601-1: Edition 3.1 (2012-08) + Corr..1 (2012) – Medical electrical equipment - Part 1: General requirement for basic safety and essential performance

IEC 60601-2-37:2007 Medical Electrical Equipment – Part 2-37: Particular requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment (for use in conjunction with IEC60601-1:2005/2012)

Mains connected components shall comply with nationally recognized standards such as CAN/CSA-C22.2 No. 60601-1:08 and ANSI/AAMI ES60601-1:2005

IEC 61157:1992 – Standard Means for the Reporting of the Acoustic Output of Medical Diagnostic Ultrasonic Equipment.

## EMC standards classification

CISPR 11, International Electrotechnical Commission, International Special Committee on Radio Interference. Industrial, Scientific, and Medical (ISM) Equipment—Radio-Frequency Disturbance Characteristics—Limits and Methods of Measurement. Classification for the ultrasound system, FC1 Stand system, accessories, and peripherals when configured together: Group 1, Class A.

IEC 60601-1-2:2007, Medical Electrical Equipment—Part 1-2: General Requirements for Safety—Collateral Standard: Electromagnetic Compatibility—Requirements and Tests.

## Acoustic standards

NEMA UD 2-2004, Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment.

NEMA UD 3-2004, Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment, American Institute of Ultrasound in Medicine.

# Biocompatibility standards

AAMI/ANSI/ISO 10993-1, Biological evaluation of medical devices—Part 1: Evaluation and testing (2009).

AAMI/ANSI/ISO 10993-5, Biological evaluation of medical devices—Part 5: Tests for In Vitro cytotoxicity (2009).

AAMI/ANSI/ISO 10993-10, Biological evaluation of medical devices—Part 10: Tests for irritation and delayed-type hypersensitivity (2002).

AAMI/ANSI/ISO 10993-11, Biological evaluation of medical devices—Part 11: Tests for systemic toxicity (2006).

AAMI/ANSI/ISO 10993-12, Biological evaluation of medical devices—Part 12: Sample preparation and reference materials (2007).

CHAPTER 10

# Chapter 10: Acoustic Output

This chapter contains safety information required by regulatory agencies pertaining to acoustic output. The information applies to the ultrasound system, transducer, accessories, and peripherals.

## ALARA principle

"As low as reasonably achievable" (ALARA) is the guiding principle for the use of diagnostic ultrasound. Sonographers and other qualified ultrasound users, using good judgment and insight, determine the exposure that is "as low as reasonably achievable." There are no set rules to determine the correct exposure for every situation. The qualified ultrasound user determines the most appropriate way to keep exposure low and bioeffects to a minimum, while obtaining a diagnostic examination.

A thorough knowledge of the imaging modes, transducer capability, system setup, and scanning technique is necessary. The imaging mode determines the nature of the ultrasound beam. A stationary beam results in a more concentrated exposure than a scanned beam, which spreads that exposure over the area of scanning. The transducer capability depends on the frequency, penetration, resolution, and field of view. The default system presets are reset with each new patient. It is the scanning technique of the qualified ultrasound user along with patient variability that determines the system settings throughout the exam.

The variables that affect the way the qualified ultrasound user implements the ALARA principle include patient body size, location of the bone relative to the focal point, attenuation in the body, and ultrasound exposure time. Exposure time is an especially useful variable, because the qualified ultrasound user can control it. The ability to limit the exposure over time supports the ALARA principle.

## Applying the ALARA principle

The system imaging mode that the qualified ultrasound user selects is determined by the diagnostic information required.

- 2D imaging provides anatomical information.

- CPD imaging provides information about the energy or amplitude strength of the Doppler signal over time at a given anatomical location and is used for detecting the presence of blood flow.
- Color imaging provides information about the energy or amplitude strength of the Doppler signal over time at a given anatomical location and is used for detecting the presence, velocity, and direction of blood flow.
- Tissue Harmonic Imaging uses higher received frequencies to reduce clutter and artifact, and improve resolution on the 2D image.

Understanding the nature of the imaging mode used allows the qualified ultrasound user to apply the ALARA principle.

Prudent use of ultrasound requires that patient exposure to ultrasound be limited to the lowest ultrasound output for the shortest time necessary to achieve acceptable diagnostic results. Decisions that support prudent use are based on the type of patient, exam type, patient history, ease or difficulty of obtaining diagnostically useful information, and potential localized heating of the patient due to transducer surface temperature.

The system has been designed to ensure that temperature at the face of the transducer elements will not exceed the limits established in Section 42 of IEC 60601-2-37: Particular requirement for the safety of ultrasound medical diagnostic and monitoring equipment. See "Transducer surface temperature rise" on page 541. In the event of a device malfunction, redundant controls will limit transducer power. This is accomplished by an electrical design that limits both power supply current and voltage to the transducer.

The sonographer uses the system controls to adjust image quality and limit ultrasound output. The system controls are divided into three categories relative to output:

- Controls that directly affect output
- Controls that indirectly affect output
- Receiver controls

## Direct controls

The system does not exceed a spatial peak temporal average intensity (ISPTA) of 720 mW/cm² for all imaging modes. The mechanical index (MI) and thermal index (TI) may exceed values greater than 1.0 on some transducers in some imaging modes. You can monitor the MI and TI values and adjust the controls to reduce these values. For more information, see "Guidelines for reducing MI and TI" on page 539. An additional way to fulfill the ALARA principle is to set the MI or TI values to a low index value and then to modify this level until a satisfactory image or Doppler mode is obtained. For more information on MI and TI, see IEC 60601-2-37:2007: Annex CC.

## Indirect controls

The controls that affect imaging mode, freeze, and depth also indirectly affect output. The imaging mode determines the nature of the ultrasound beam. Tissue attenuation is directly related to transducer frequency. The higher the PRF (pulse repetition frequency), the more output pulses occur over a period of time.

## Receiver controls

The receiver controls are the gain controls. Receiver controls do not affect output. They should be used, if possible, to improve image quality before using controls that directly or indirectly affect output.

# Acoustic artifacts

An acoustic artifact is information, present or absent in an image, that does not properly indicate the structure or flow being imaged. Helpful artifacts aid in diagnosis; others hinder proper interpretation. Examples of artifacts include:

- Shadowing
- Through transmission
- Aliasing
- Reverberations
- Comet tails

For more information on detecting and interpreting acoustic artifacts, see Kremkau, Frederick W. *Diagnostic ultrasound: Principles and instruments*. 7th ed., W.B. Saunders Company (Oct. 17, 2005).

# Guidelines for reducing MI and TI

The following are general guidelines for reducing MI or TI. If multiple parameters are given, the best results may be achieved by minimizing these parameters simultaneously. In some modes, changing these parameters does not affect MI or TI. Changes to other parameters may also result in MI and TI reductions. Please note the MI and TI values on the screen.

MI: Higher Frequency Settings

TI: Lower frame rate or shallower focus depth

# Output display

The system meets the AIUM output display standard for MI and TI (See "Related guidance documents" on page 541). MI and TI shall be displayed when either the MI or TI is greater than or equal to a value of 1.0

Even when MI is less than 1.0, the system provides a continuous real-time display of MI in all imaging modes, in increments of 0.1.

The system meets the output display standard for TI and provides a continuous real-time display of TI in all imaging modes, in increments of 0.1.

**Note**

The TI consists of three user-selectable indices, and only one of these is displayed at any one time. In order to display TI properly and meet the ALARA principle, the user selects an appropriate TI, based on the specific exam being performed. FUJIFILM SonoSite provides a copy of AIUM Medical Ultrasound Safety, which contains guidance on determining which TI is appropriate (see "Related guidance documents" on page 541).

## MI and TI output display accuracy

The accuracy result for the MI is stated statistically. With 95% confidence, 95% of the measured MI values will be within +15% to -22% of the displayed MI value.

The accuracy result for the TI is stated statistically. With 95% confidence, 95% of the measured TI values will be within +19% to -33% of the displayed TI value. The values equate to +1dB to -3dB.

A displayed value of 0.0 for MI or TI means that the calculated estimate for the index is less than 0.05.

# Factors that contribute to display uncertainty

The net uncertainty of the displayed indices is derived by combining the quantified uncertainty from three sources: measurement uncertainty, system and transducer variability, and engineering assumptions and approximations made when calculating the display values.

Measurement errors of the acoustic parameters when taking the reference data are the major source of error that contributes to the display uncertainty. Measurement error is described in "Acoustic measurement precision and uncertainty" on page 602.

The displayed MI and TI values are based on calculations using a set of acoustic output measurements that were made using a single reference ultrasound system with a single reference transducer that is representative of the population of transducers of that type. The reference system and transducer are chosen from a sample population of systems and transducers taken from early production units, and they are selected based on having an acoustic output that is representative of the nominal expected acoustic output for all transducer/system combinations that might occur. Of course, every transducer/system combination has its own unique characteristic acoustic output, and will not match the nominal output on which the display estimates are

based. This variability between systems and transducers introduces an error into displayed value. By testing sample acoustic output during production, the amount of error introduced by the variability is bounded. The sampling testing ensures that the acoustic output of transducers and systems being manufactured stays within a specified range of the nominal acoustic output.

Another source of error is the assumptions and approximations that are made when deriving the estimates for the display indices. Chief among these assumptions is that the acoustic output, and thus the derived display indices, are linearly correlated with the transmit drive voltage of the transducer. Generally, this assumption is very good, but it is not exact, and thus some error in the display can be attributed to the assumption of voltage linearity.

# Related guidance documents

*Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers*, FDA, 1997.

*Medical Ultrasound Safety, American Institute of Ultrasound in Medicine* (AIUM), 1994. (A copy is included with each system.)

*Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment*, NEMA UD2-2004.

*Acoustic Output Measurement and Labeling Standard for Diagnostic Ultrasound Equipment*, American Institute of Ultrasound in Medicine, 1993.

*Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment*, NEMA UD3-2004.

*Guidance on the interpretation of TI and MI to be used to inform the operator*, Annex HH, BS EN 60601-2-37 reprinted at P05699.

# Transducer surface temperature rise

The following table lists the measured surface temperature rise from ambient (23°C ± 3°C) of transducers used on the ultrasound system. The temperatures were measured in accordance with EN 60601-2-37 section 42, with controls and settings positioned to give maximum temperatures.

**Table 10-1: Transducer surface temperature rise, external use (°C)**

| Test | C60xf | HFL38xp | HFL50xp | L25xp | P21xp | C35xp | C11xp | L38xp | ICTxp |
|---|---|---|---|---|---|---|---|---|---|
| Still air | 13.7 | 9.6 | 11.5 | 12.6 | 16.3 | 13.7 | 12.6 | 10.3 | 7.6 |
| Simulated use | 8.1 | 7.7 | 8.0 | 8.7 | 9.1 | 8.0 | 7.3 | 7.2 | 3.9 |

# Acoustic output measurement

Since the initial use of diagnostic ultrasound, the possible human biological effects (bioeffects) from ultrasound exposure have been studied by various scientific and medical institutions. In October 1987, the American Institute of Ultrasound in Medicine (AIUM) ratified a report from its Bioeffects Committee ("Bioeffects Considerations for the Safety of Diagnostic Ultrasound," *J Ultrasound Med*., Sept. 1988: Vol. 7, No. 9 Supplement). The report, sometimes referred to as the Stowe Report, reviewed available data on possible effects of ultrasound exposure. Another report, "Bioeffects and Safety of Diagnostic Ultrasound," dated January 28, 1993, provides more current information.

The acoustic output for this ultrasound system has been measured and calculated in accordance with "Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment" (NEMA UD2-2004), and "Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment" (NEMA UD3-2004).

# In situ, derated, and water value intensities

All intensity parameters are measured in water. Since water does not absorb acoustic energy, these water measurements represent a worst-case value. Biological tissue does absorb acoustic energy. The true value of the intensity at any point depends on the amount of energy, the type of tissue, and the frequency of the ultrasound passing through the tissue. The intensity value in the tissue, *In situ*, has been estimated by using the following formula:

*In situ* = Water $[e^{-(0.23alf)}]$

where:

- *In situ* = *In situ* intensity value
- Water = Water intensity value
- e = 2.7183
- a = attenuation factor (dB/cm MHz)

Attenuation factor (a) for various tissue types are given below:

- Brain = 0.53
- Heart = 0.66
- Kidney = 0.79
- Liver = 0.43
- Muscle = 0.55
- l = skinline to measurement depth in cm
- f = center frequency of the transducer/system/mode combination in MHz

Since the ultrasonic path during the exam is likely to pass through varying lengths and types of tissue, it is difficult to estimate the true *in situ* intensity. An attenuation factor of 0.3 is used for general reporting purposes; therefore, the *in situ* value commonly reported uses the formula:

*In situ* (derated) = Water [e $^{-(0.069lf)}$]

Since this value is not the true *in situ* intensity, the term “derated” is used to qualify it.

The maximum derated and the maximum water values do not always occur at the same operating conditions. Therefore, the reported maximum water and derated values may not be related by the *in situ* (derated) formula. For example: Consider a multizone array transducer that has maximum water value intensities in its deepest zone, but also has the smallest derating factor in that zone. The same transducer may have its largest derated intensity in one of its shallowest focal zones.

# Tissue models and equipment survey

Tissue models are necessary to estimate attenuation and acoustic exposure levels in situ from measurements of acoustic output made in water. Currently, available models may be limited in their accuracy because of varying tissue paths during diagnostic ultrasound exposures and uncertainties in the acoustic properties of soft tissues. No single tissue model is adequate for predicting exposures in all situations from measurements made in water, and continued improvement and verification of these models is necessary to make exposure assessments for specific exam types.

A homogeneous tissue model with attenuation coefficient of 0.3 dB/cm MHz throughout the beam path is commonly used when estimating exposure levels. The model is conservative in that it overestimates the *in situ* acoustic exposure when the path between the transducer and site of interest is composed entirely of soft tissue. When the path contains significant amounts of fluid, as in many first and second-trimester pregnancies scanned transabdominally, this model may underestimate the *in situ* acoustic exposure. The amount of underestimation depends on each specific situation.

Fixed-path tissue models, in which soft-tissue thickness is held constant, sometimes are used to estimate *in situ* acoustic exposures when the beam path is longer than 3 cm and consists largely of fluid. When this model is used to estimate maximum exposure to the fetus during transabdominal scans, a value of 1 dB/cm MHz may be used during all trimesters.

Existing tissue models that are based on linear propagation may underestimate acoustic exposures when significant saturation due to nonlinear distortion of beams in water is present during the output measurement.

The maximum acoustic output levels of diagnostic ultrasound devices extend over a broad range of values:

- A survey of 1990 equipment models yielded MI values between 0.1 and 1.0 at their highest output settings. Maximum MI values of approximately 2.0 are known to occur for currently available equipment. Maximum MI values are similar for real-time 2D-mode and M-mode imaging.

- Computed estimates of upper limits to temperature elevations during transabdominal scans were obtained in a survey of 1988 and 1990 pulsed Doppler equipment. The vast majority of models yielded upper limits less than 1° and 4°C (1.8° and 7.2°F) for exposures of first-trimester fetal tissue and second-trimester fetal bone, respectively. The largest values obtained were approximately 1.5°C (2.7°F) for first-trimester fetal tissue and 7°C (12.6°F) for second-trimester fetal bone. Estimated maximum temperature elevations given here are for a "fixed path" tissue model and are for devices having ISPTA values greater than 500 mW/cm². The temperature elevations for fetal bone and tissue were computed based on calculation procedures given in Sections 4.3.2.1-4.3.2.6 in "Bioeffects and Safety of Diagnostic Ultrasound" (AIUM, 1993).

# Acoustic output tables

The tables in this section indicate the acoustic output for the system and transducer combinations with a TI or MI equal to or greater than one. These tables are organized by transducer model and imaging mode. For a definition of terms used in the tables, see "Terms used in the acoustic output tables" on page 601.

Transducer model: C60xf Operating mode: 2D (B) ..... 546
Transducer model: C60xf Operating mode: 2D (B)/M ..... 547
Transducer model: C60xf Operating mode: 2D (B)/Color ..... 548
Transducer model: C60xf Operating mode: PW Doppler ..... 549
Transducer model: C60xf Operating mode: 2D (B)/ PW Doppler ..... 550
Transducer model: C60xf Operating mode: 2D (B)/Color/PW Doppler (Triplex) ..... 551
Transducer model: HFL38xp Operating mode: 2D (B) ..... 552
Transducer model: HFL38xp Operating mode: 2D (B)/M ..... 553
Transducer model: HFL38xp Operating mode: 2D (B)/Color ..... 554
Transducer model: HFL38xp Operating mode: PW Doppler ..... 555
Transducer model: HFL38xp Operating mode: 2D (B)/PW Doppler ..... 556
Transducer model: HFL38xp Operating mode: 2D (B)/Color/PW Doppler (Triplex) ..... 557
Transducer model: HFL50xp Operating mode: 2D (B) ..... 558
Transducer model: HFL50xp Operating mode: 2D (B)/M mode ..... 559
Transducer model: HFL50xp Operating mode: 2D (B)/Color ..... 560
Transducer model: HFL50xp Operating mode: PW Doppler ..... 561
Transducer model: HFL50xp Operating mode: 2D (B)/PW Doppler ..... 562
Transducer model: HFL50xp Operating mode: 2D (B)/Color/PW Doppler (Triplex) ..... 563
Transducer model: L25xp Operating mode: 2D (B) ..... 564
Transducer model: L25xp Operating mode: 2D (B)/M ..... 565
Transducer model: L25xp Operating mode: 2D (B)/Color ..... 566
Transducer model: L25xp Operating mode: PW Doppler ..... 567
Transducer model: L25xp Operating mode: 2D (B)/PW Doppler ..... 568

Transducer model: L25xp Operating mode: 2D (B)/Color/PW Doppler (Triplex) ..... 569
Transducer model: P21xp Operating mode: 2D (B) ..... 570
Transducer model: P21xp Operating mode: 2D (B)/M ..... 571
Transducer model: P21xp Operating mode: 2D (B)/Color ..... 572
Transducer model: P21xp Operating mode: PW Doppler ..... 573
Transducer model: P21xp Operating mode: 2D (B)/PW Doppler ..... 574
Transducer model: P21xp Operating mode: 2D (B)/Color/PW Doppler (Triplex) ..... 575
Transducer model: P21xp Operating mode: CW Doppler ..... 576
Transducer Model: L38xp Operating Mode: 2D ..... 577
Transducer Model: L38xp Operating Mode: 2D/M ..... 578
Transducer Model: L38xp Operating Mode: 2D/color ..... 579
Transducer Model: L38xp Operating Mode: PW Doppler ..... 580
Transducer Model: L38xp Operating Mode: 2D/PW Doppler ..... 581
Transducer Model: L38xp Operating Mode: 2D/color/PW Doppler (Triplex) ..... 582
Transducer Model: C11xp Operating Mode: 2D ..... 583
Transducer Model: C11xp Operating Mode: 2D/M ..... 584
Transducer Model: C11xp Operating Mode: 2D/Color ..... 585
Transducer Model: C11xp Operating Mode: PW Doppler ..... 586
Transducer Model: C11xp Operating Mode: 2D/PW Doppler ..... 587
Transducer Model: C11xp Operating Mode: 2D/Color/PW Doppler (Triplex) ..... 588
Transducer Model: ICTxp Operating Mode: 2D ..... 589
Transducer Model: ICTxp Operating Mode: 2D/M ..... 590
Transducer Model: ICTxp Operating Mode: 2D/Color ..... 591
Transducer Model: ICTxp Operating Mode: PW Doppler ..... 592
Transducer Model: ICTxp Operating Mode: 2D/PW Doppler ..... 593
Transducer Model: ICTxp Operating Mode: 2D/Color/PW Doppler (Triplex) ..... 594
Transducer Model: C35xp Operating Mode: 2D ..... 595
Transducer Model: C35xp Operating Mode: 2D/M ..... 596
Transducer Model: C35xp Operating Mode: 2D/Color ..... 597
Transducer Model: C35xp Operating Mode: PW Doppler ..... 598
Transducer Model: C35xp Operating Mode: 2D/PW Doppler ..... 599
Transducer Model: C35xp Operating Mode: 2D/Color/PW Doppler (Triplex) ..... 600

**Table 10-2: Transducer model: C60xf** **Operating mode: 2D (B)**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.0 | 0.4 | - | - | - | 1.0 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.56 | | | | | |
| | $W_0$ | (mW) | | 34.0 | - | | - | 125.0 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | - | |
| | $z@PII_{.3max}$ | (cm) | 4.7 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | - | |
| | $F_c$ | (MHz) | 2.22 | 2.59 | - | - | - | 2.18 |
| | Dim of $A_{aprt}$ | X (cm) | | 5.6 | - | - | - | 5.7 |
| | | Y (cm) | | 1.3 | - | - | - | 1.3 |
| Other information | PD | (µsec) | 0.63 | | | | | |
| | PRF | (Hz) | 2416 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.14 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | - | |
| | Focal Length | $FL_x$ (cm) | | 10 | - | - | | 13 |
| | | $FL_y$ (cm) | | 7.1 | - | - | | 7.1 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 146.7 | | | | | |
| Operating control conditions | Control 1: Frequency | | 4 MHz | 5 MHz | | | | 4 MHz |
| | Control 2: THI | | On | On | | | | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-3: Transducer model: C60xf** **Operating mode: 2D (B)/M**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.0 | 0.4 | - | 0.1 | 0.3 | 1.1 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.56 | | | | | |
| | $W_0$ | (mW) | | 31.7 | - | | 8.5 | 129.6 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | 8.7 | | |
| | $z_1$ | (cm) | | | | 3.1 | | |
| | $Z_{bp}$ | (cm) | | | | 2.9 | | |
| | $Z_{sp}$ | (cm) | | | | | 4.3 | |
| | $z@PII_{.3max}$ | (cm) | 4.7 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.37 | |
| | $F_c$ | (MHz) | 2.22 | 2.59 | - | 2.18 | 2.22 | 2.18 |
| | Dim of $A_{aprt}$ | X (cm) | | 5.6 | - | 2.3 | 1.3 | 5.7 |
| | | Y (cm) | | 1.3 | - | 1.3 | 1.3 | 1.3 |
| Other information | PD | (µsec) | 0.63 | | | | | |
| | PRF | (Hz) | 2229 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.14 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.34 | |
| | Focal Length | $FL_x$ (cm) | | 10 | - | 13 | | 13 |
| | | $FL_y$ (cm) | | 7.1 | - | 7.1 | | 7.1 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 146.7 | | | | | |
| Operating control conditions | Control 1: Frequency | | 4 MHz | 5 MHz | | 4 MHz | | 4 MHz |
| | Control 2: THI | | On | On | | On | | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-4: Transducer model: C60xf** **Operating mode: 2D (B)/Color**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.0 | 0.3 | - | - | - | 0.6 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.56 | | | | | |
| | $W_0$ | (mW) | | 21.2 | - | | - | 69.3 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | - | |
| | $z@PII_{.3max}$ | (cm) | 4.7 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | - | |
| | $F_c$ | (MHz) | 2.22 | 3.17 | - | - | - | 3.14 |
| | Dim of $A_{aprt}$ | X (cm) | | 4.5 | - | - | - | 4.5 |
| | | Y (cm) | | 1.3 | - | - | - | 1.3 |
| Other information | PD | (µsec) | 0.63 | | | | | |
| | PRF | (Hz) | 479 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.14 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | - | |
| | Focal Length | $FL_x$ (cm) | | 16 | - | - | | 20 |
| | | $FL_y$ (cm) | | 7.1 | - | - | | 7.1 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 146.7 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 4 MHz / On | 5 MHz / On | | | | 4 MHz / On |
| | Control 2: Color Frequency | | 3.2 MHz | 3.2 MHz | | | | 3.2 MHz |
| | Control 3: Color Box Size | | Narrow | Narrow | | | | Narrow |
| | Control 4: Color PRF | | 3226 Hz | 3226 Hz | | | | 3226 Hz |
| | Control 5: | | | | | | | |

**Table 10-5: Transducer model: C60xf** **Operating mode: PW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | - | - | 0.7 | 2.1 | 1.3 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.25 | | | | | |
| | $W_0$ | (mW) | | - | - | | 60.0 | 113.2 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | 39.1 | | |
| | $z_1$ | (cm) | | | | 3.2 | | |
| | $Z_{bp}$ | (cm) | | | | 3.3 | | |
| | $Z_{sp}$ | (cm) | | | | | 3.8 | |
| | $z@PII_{.3max}$ | (cm) | 1.2 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.35 | |
| | $F_c$ | (MHz) | 3.16 | - | - | 2.23 | 2.25 | 2.23 |
| | Dim of $A_{aprt}$ | X (cm) | | - | - | 2.9 | 1.2 | 2.9 |
| | | Y (cm) | | - | - | 1.3 | 1.3 | 1.3 |
| Other information | PD | (µsec) | 0.82 | | | | | |
| | PRF | (Hz) | 2000 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.06 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.33 | |
| | Focal Length | $FL_x$ (cm) | | - | - | 13 | | 13 |
| | | $FL_y$ (cm) | | - | - | 7.1 | | 7.1 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 119.8 | | | | | |
| Operating control conditions | Control 1: Frequency | | 3.2 MHz | | | 2.22 MHz | 2.22 MHz | 2.22 MHz |
| | Control 2: PRF | | 2000 Hz | | | 3125 Hz | 9091 Hz | 3125 Hz |
| | Control 3: Sample Volume Position | | 6.0 cm | | | 13 cm | 5.0 cm | 13 cm |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-6: Transducer model: C60xf** **Operating mode: 2D (B)/ PW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.0 | 0.4 | - | 0.8 | 1.9 | 1.6 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.61 | | | | | |
| | $W_0$ | (mW) | | 35.8 | - | | 56.7 | 141.0 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | 70.7 | | |
| | $z_1$ | (cm) | | | | 3.2 | | |
| | $Z_{bp}$ | (cm) | | | | 3.3 | | |
| | $Z_{sp}$ | (cm) | | | | | 4.3 | |
| | $z@PII_{.3max}$ | (cm) | 4.8 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.34 | |
| | $F_c$ | (MHz) | 2.63 | 2.57 | - | 2.23 | 2.24 | 2.23 |
| | Dim of $A_{aprt}$ | X (cm) | | 5.7 | - | 2.9 | 1.3 | 2.9 |
| | | Y (cm) | | 1.3 | - | 1.3 | 1.3 | 1.3 |
| Other information | PD | (µsec) | 0.50 | | | | | |
| | PRF | (Hz) | 500 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.28 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.32 | |
| | Focal Length | $FL_x$ (cm) | | 16 | - | 13 | | 16 |
| | | $FL_y$ (cm) | | 7.1 | - | 7.1 | | 7.1 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 186.3 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 5 MHz / On | 5 MHz / On | | 4 MHz / Off | 4 MHz / On | 5 MHz / On |
| | Control 2: PW Frequency | | 3.2 MHz | 3.2 MHz | | 2.22 MHz | 2.22 MHz | 2.22 MHz |
| | Control 3: PW PRF | | 2000 Hz | 1000 Hz | | 3125 Hz | 3125 Hz | 3125 Hz |
| | Control 4: PW Sample Volume Position | | 6.0 cm | 16 cm | | 13 cm | 6.0 cm | 16 cm |

**Table 10-7: Transducer model: C60xf Operating mode: 2D (B)/Color/PW Doppler (Triplex)**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.0 | 0.3 | - | 0.8 | 1.6 | 1.8 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.61 | | | | | |
| | $W_0$ | (mW) | | 19.8 | - | | 44.9 | 169.4 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | 70.7 | | |
| | $z_1$ | (cm) | | | | 3.2 | | |
| | $Z_{bp}$ | (cm) | | | | 3.3 | | |
| | $Z_{sp}$ | (cm) | | | | | 3.8 | |
| | $z@PII_{.3max}$ | (cm) | 4.8 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.35 | |
| | $F_c$ | (MHz) | 2.63 | 3.15 | - | 2.23 | 2.25 | 2.23 |
| | Dim of $A_{aprt}$ | X (cm) | | 4.8 | - | 2.9 | 1.2 | 2.9 |
| | | Y (cm) | | 1.3 | - | 1.3 | 1.3 | 1.3 |
| Other information | PD | (µsec) | 0.50 | | | | | |
| | PRF | (Hz) | 250 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.28 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.35 | |
| | Focal Length | $FL_x$ (cm) | | 20 | - | 13 | | 16 |
| | | $FL_y$ (cm) | | 7.1 | - | 7.1 | | 7.1 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 186.3 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 5 MHz / On | 5 MHz / On | | 4 MHz / Off | 4 MHz / On | 5 MHz / On |
| | Control 2: Color Frequency | | 2.5 MHz | 3.2 MHz | | 3.2 MHz | 2.5 MHz | 3.2 MHz |
| | Control 3: PW Frequency | | 3.2 MHz | 2.22 MHz | | 2.22 MHz | 2.22 MHz | 2.22 MHz |
| | Control 4: PW PRF | | 2000 Hz | 3125 Hz | | 3521 Hz | 6579 Hz | 3125 Hz |
| | Control 5: PW Sample Vol Position | | 6.0 cm | 20 cm | | 13 cm | 5.0 cm | 16 cm |

**Table 10-8: Transducer model: HFL38xp** **Operating mode: 2D (B)**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.5 | - | - | - | 0.8 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.98 | | | | | |
| | $W_0$ | (mW) | | 18.3 | - | | - | 38.9 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | - | |
| | $z@PII_{.3max}$ | (cm) | 1.5 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | - | |
| | $F_c$ | (MHz) | 4.96 | 5.87 | - | - | - | 5.44 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.0 | - | - | - | 3.0 |
| | | Y (cm) | | 0.4 | - | - | - | 0.4 |
| Other information | PD | (µsec) | 0.33 | | | | | |
| | PRF | (Hz) | 5000 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.35 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | - | |
| | Focal Length | $FL_x$ (cm) | | 5 | - | - | | 5 |
| | | $FL_y$ (cm) | | 2.5 | - | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 175.9 | | | | | |
| Operating control conditions | Control 1: Frequency | | 9 MHz | 10 MHz | | | | 10 MHz |
| | Control 2: THI | | On | On | | | | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-9: Transducer model: HFL38xp** **Operating mode: 2D (B)/M**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.4 | 0.1 | - | 0.1 | 0.7 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.98 | | | | | |
| | $W_0$ | (mW) | | 16.2 | 1.9 | | 1.9 | 34.4 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.4 | |
| | $z@PII_{.3max}$ | (cm) | 1.4 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.32 | |
| | $F_c$ | (MHz) | 4.96 | 5.87 | 5.87 | - | 5.23 | 5.44 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.0 | 0.9 | - | 0.9 | 3.0 |
| | | Y (cm) | | 0.4 | 0.4 | - | 0.4 | 0.4 |
| Other information | PD | (µsec) | 0.33 | | | | | |
| | PRF | (Hz) | 4417 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.35 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.31 | |
| | Focal Length | $FL_x$ (cm) | | 5 | 8 | - | | 5 |
| | | $FL_y$ (cm) | | 2.5 | 2.5 | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 175.9 | | | | | |
| Operating control conditions | Control 1: 2D Frequency | | 9 MHz | 10 MHz | 10 MHz | | 10 MHz | 10 MHz |
| | Control 2: THI | | On | On | On | | On | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-10: Transducer model: HFL38xp** **Operating mode: 2D (B)/Color**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.4 | - | - | - | 0.4 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.98 | | | | | |
| | $W_0$ | (mW) | | 12.3 | - | | - | 19.0 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | - | |
| | $z@PII_{.3max}$ | (cm) | 1.4 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | - | |
| | $F_c$ | (MHz) | 4.96 | 6.99 | - | - | - | 5.38 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.9 | - | - | - | 1.9 |
| | | Y (cm) | | 0.4 | - | - | - | 0.4 |
| Other information | PD | (µsec) | 0.33 | | | | | |
| | PRF | (Hz) | 447 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.35 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | - | |
| | Focal Length | $FL_x$ (cm) | | 5 | - | - | | 5 |
| | | $FL_y$ (cm) | | 2.5 | - | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 175.9 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 9 MHz / On | 10 MHz / On | | | | 10 MHz / On |
| | Control 2: Color Frequency | | 7.27 MHz | 7.27 MHz | | | | 5.34 MHz |
| | Control 3: Color Box Size | | Narrow | Narrow | | | | Narrow |
| | Control 4: Color PRF | | 4000 Hz | 10000 Hz | | | | 11364 Hz |
| | Control 5: | | | | | | | |

**Table 10-11: Transducer model: HFL38xp** **Operating mode: PW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | - | 0.6 | - | 1.3 | 0.9 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.63 | | | | | |
| | $W_0$ | (mW) | | - | 23.3 | | 16.4 | 23.3 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.5 | |
| | $z@PII_{.3max}$ | (cm) | 1.6 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.16 | |
| | $F_c$ | (MHz) | 5.40 | - | 5.37 | - | 5.44 | 5.37 |
| | Dim of $A_{aprt}$ | X (cm) | | - | 0.8 | - | 0.6 | 0.8 |
| | | Y (cm) | | - | 0.4 | - | 0.4 | 0.4 |
| Other information | PD | (µsec) | 0.53 | | | | | |
| | PRF | (Hz) | 5000 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.09 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.15 | |
| | Focal Length | $FL_x$ (cm) | | - | 6 | - | | 6 |
| | | $FL_y$ (cm) | | - | 2.5 | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 154.7 | | | | | |
| Operating control conditions | Control 1: Frequency | | 5.34 MHz | | 5.34 MHz | | 5.34 MHz | 5.34 MHz |
| | Control 2: PRF | | 5000 Hz | | 8064 Hz | | 13514 Hz | 8064 Hz |
| | Control 3: Sample Volume Position | | 2.5 cm | | 6.0 cm | | 2.5 cm | 6.0 cm |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-12: Transducer model: HFL38xp** **Operating mode: 2D (B)/PW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.5 | 0.5 | - | 1.0 | 1.2 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.98 | | | | | |
| | $W_0$ | (mW) | | 18.3 | 16.4 | | 13.1 | 48.7 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.5 | |
| | $z@PII_{.3max}$ | (cm) | 1.4 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.16 | |
| | $F_c$ | (MHz) | 4.96 | 5.87 | 7.01 | - | 5.44 | 5.87 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.0 | 0.8 | - | 0.6 | 3.0 |
| | | Y (cm) | | 0.4 | 0.4 | - | 0.4 | 0.4 |
| Other information | PD | (µsec) | 0.33 | | | | | |
| | PRF | (Hz) | 1000 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.35 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.15 | |
| | Focal Length | $FL_x$ (cm) | | 8 | 4 | - | | 8 |
| | | $FL_y$ (cm) | | 2.5 | 2.5 | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 175.9 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 9 MHz / On | 10 MHz / On | 10 MHz / On | | 9 MHz / On | 10 MHz / On |
| | Control 2: PW Frequency | | 5.34 MHz | 7.27 MHz | 7.27 MHz | | 5.34 MHz | 7.27 MHz |
| | Control 3: PW PRF | | 5000 Hz | 3125 Hz | 11111 Hz | | 13514 Hz | 3125 Hz |
| | Control 4: PW Sample Volume Position | | 2.0 cm | 8.0 cm | 4.0 cm | | 2.5 cm | 8.0 cm |
| | Control 5: | | | | | | | |

**Table 10-13: Transducer model: HFL38xp Operating mode: 2D (B)/Color/PW Doppler (Triplex)**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.3 | 0.5 | - | 1.0 | 0.9 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.98 | | | | | |
| | $W_0$ | (mW) | | 10.5 | 16.4 | | 13.1 | 26.5 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.5 | |
| | $z@PII_{.3max}$ | (cm) | 1.4 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.16 | |
| | $F_c$ | (MHz) | 4.96 | 6.99 | 7.01 | - | 5.44 | 5.37 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.5 | 0.8 | - | 0.6 | 0.8 |
| | | Y (cm) | | 0.4 | 0.4 | - | 0.4 | 0.4 |
| Other information | PD | (µsec) | 0.33 | | | | | |
| | PRF | (Hz) | 500 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.35 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.15 | |
| | Focal Length | $FL_x$ (cm) | | 5 | 4 | - | | 6 |
| | | $FL_y$ (cm) | | 2.5 | 2.5 | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 175.9 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 9 MHz / On | 10 MHz / On | 10 MHz / On | | 8 MHz / Off | 10 MHz / On |
| | Control 2: Color Frequency | | 7.27 MHz | 7.27 MHz | 7.27 MHz | | 7.27 MHz | 7.27 MHz |
| | Control 3: PW Frequency | | 5.34 MHz | 7.27 MHz | 7.27 MHz | | 7.27 MHz | 5.34 MHz |
| | Control 4: PW PRF | | 5000 Hz | 3125 Hz | 11111 Hz | | 4032 Hz | 8064 Hz |
| | Control 5: PW Sample Volume Position | | 2.0 cm | 5.0 cm | 4.0 cm | | 2.5 cm | 6.0 cm |

**Table 10-14: Transducer model: HFL50xp** **Operating mode: 2D (B)**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.3 | - | - | - | 0.6 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 2.12 | | | | | |
| | $W_0$ | (mW) | | 12.5 | - | | - | 36.0 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | - | |
| | $z@PII_{.3max}$ | (cm) | 1.5 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | - | |
| | $F_c$ | (MHz) | 5.62 | 4.89 | - | - | - | 4.89 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.8 | - | - | - | 3.8 |
| | | Y (cm) | | 0.4 | - | - | - | 0.4 |
| Other information | PD | (µsec) | 0.21 | | | | | |
| | PRF | (Hz) | 5375 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.51 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | - | |
| | Focal Length | $FL_x$ (cm) | | 8 | - | - | | 8 |
| | | $FL_y$ (cm) | | 2.5 | - | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 212.9 | | | | | |
| Operating control conditions | Control 1: Frequency | | 12 MHz | 10 MHz | | | | 10 MHz |
| | Control 2: THI | | On | On | | | | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-15: Transducer model: HFL50xp** **Operating mode: 2D (B)/M mode**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.4 | ≤0.1 | - | 0.1 | 0.7 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 2.12 | | | | | |
| | $W_0$ | (mW) | | 12.3 | 1.0 | | 1.2 | 36.4 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.6 | |
| | $z@PII_{.3max}$ | (cm) | 1.5 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.19 | |
| | $F_c$ | (MHz) | 5.62 | 6.69 | 6.67 | - | 4.97 | 6.69 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.8 | 0.9 | - | 0.6 | 3.8 |
| | | Y (cm) | | 0.4 | 0.4 | - | 0.4 | 0.4 |
| Other information | PD | (µsec) | 0.21 | | | | | |
| | PRF | (Hz) | 250 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.51 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.18 | |
| | Focal Length | $FL_x$ (cm) | | 8 | 8 | - | | 8 |
| | | $FL_y$ (cm) | | 2.5 | 2.5 | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 212.9 | | | | | |
| Operating control conditions | Control 1: Frequency | | 12 MHz | 7 MHz | 7 MHz | | 10 MHz | 7 MHz |
| | Control 2: THI | | On | Off | Off | | On | Off |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-16: Transducer model: HFL50xp** **Operating mode: 2D (B)/Color**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.4 | - | - | - | 0.5 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 2.20 | | | | | |
| | $W_0$ | (mW) | | 12.0 | - | | - | 21.6 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | - | |
| | $z@PII_{.3max}$ | (cm) | 1.5 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | - | |
| | $F_c$ | (MHz) | 5.95 | 7.46 | - | - | - | 7.46 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.2 | - | - | - | 2.2 |
| | | Y (cm) | | 0.4 | - | - | - | 0.4 |
| Other information | PD | (µsec) | 0.43 | | | | | |
| | PRF | (Hz) | 2250 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.76 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | - | |
| | Focal Length | $FL_x$ (cm) | | 5 | - | - | | 5 |
| | | $FL_y$ (cm) | | 2.5 | - | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 470.5 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 12 MHz / On | 7 MHz / Off | | | | 7 MHz / Off |
| | Control 2: Color Frequency | | 6.15 MHz | 8 MHz | | | | 8 MHz |
| | Control 3: Color Box Size | | Narrow | Narrow | | | | Narrow |
| | Control 4: Color PRF | | 5000 Hz | 7042 Hz | | | | 7042 Hz |
| | Control 5: | | | | | | | |

**Table 10-17: Transducer model: HFL50xp** **Operating mode: PW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | - | 0.9 | - | 1.5 | 1.2 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.70 | | | | | |
| | $W_0$ | (mW) | | - | 30.0 | | 24.7 | 30.0 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.7 | |
| | $z@PII_{.3max}$ | (cm) | 1.7 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.18 | |
| | $F_c$ | (MHz) | 6.01 | - | 6.00 | - | 6.07 | 6.08 |
| | Dim of $A_{aprt}$ | X (cm) | | - | 0.8 | - | 0.6 | 0.8 |
| | | Y (cm) | | - | 0.4 | - | 0.4 | 0.4 |
| Other information | PD | (µsec) | 0.48 | | | | | |
| | PRF | (Hz) | 5000 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.27 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.17 | |
| | Focal Length | $FL_x$ (cm) | | - | 6 | - | | 6 |
| | | $FL_y$ (cm) | | - | 2.5 | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 145.7 | | | | | |
| Operating control conditions | Control 1: Frequency | | 6.15 MHz | | 6.15 MHz | | 6.15 MHz | 6.15 MHz |
| | Control 2: PRF | | 5000 Hz | | 8064 Hz | | 13514 Hz | 8064 Hz |
| | Control 3: Sample Volume Position | | 3.0 cm | | 6.0 cm | | 3.0 cm | 6.0 cm |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-18: Transducer model: HFL50xp** **Operating mode: 2D (B)/PW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.5 | 0.7 | - | 1.1 | 1.1 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 2.18 | | | | | |
| | $W_0$ | (mW) | | 16.3 | 24.0 | | 18.7 | 32.8 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.7 | |
| | $z@PII_{.3max}$ | (cm) | 1.7 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.19 | |
| | $F_c$ | (MHz) | 5.50 | 6.82 | 6.08 | - | 6.04 | 6.00 |
| | Dim of $A_{aprt}$ | X (cm) | | 4.2 | 0.8 | - | 0.6 | 0.8 |
| | | Y (cm) | | 0.4 | 0.4 | - | 0.4 | 0.4 |
| Other information | PD | (µsec) | 0.25 | | | | | |
| | PRF | (Hz) | 1080 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.83 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.18 | |
| | Focal Length | $FL_x$ (cm) | | 8 | 6 | - | | 6 |
| | | $FL_y$ (cm) | | 2.5 | 2.5 | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 250.0 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 12 MHz / On | 7 MHz / Off | 7 MHz / Off | | 7 MHz / Off | 10 MHz / On |
| | Control 2: PW Frequency | | 6.15 MHz | 6.15 MHz | 6.15 MHz | | 6.15 MHz | 6.15 MHz |
| | Control 3: PW PRF | | 5000 Hz | 3125 Hz | 8064 Hz | | 8064 Hz | 8064 Hz |
| | Control 4: PW Sample Volume Position | | 2.5 cm | 8.0 cm | 6.0 cm | | 3.0 cm | 6.0 cm |
| | Control 5: | | | | | | | |

**Table 10-19: Transducer model: HFL50xp Operating mode: 2D (B)/Color/PW Doppler (Triplex)**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.3 | 0.7 | - | 1.0 | 1.2 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 2.18 | | | | | |
| | $W_0$ | (mW) | | 8.6 | 24.0 | | 24.0 | 35.3 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.3 | |
| | $z@PII_{.3max}$ | (cm) | 1.7 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.31 | |
| | $F_c$ | (MHz) | 5.50 | 6.82 | 6.08 | - | 6.08 | 6.08 |
| | Dim of $A_{aprt}$ | X (cm) | | 4.2 | 0.8 | - | 0.8 | 0.8 |
| | | Y (cm) | | 0.4 | 0.4 | - | 0.4 | 0.4 |
| Other information | PD | (µsec) | 0.25 | | | | | |
| | PRF | (Hz) | 540 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.83 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.29 | |
| | Focal Length | $FL_x$ (cm) | | 8 | 6 | - | | 6 |
| | | $FL_y$ (cm) | | 2.5 | 2.5 | - | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 250.0 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 12 MHz / On | 7 MHz / Off | 7 MHz / Off | | 10 MHz / On | 10 MHz / On |
| | Control 2: Color Frequency | | 6.15 MHz | 6.15 MHz | 6.15 MHz | | 6.15 MHz | 6.15 MHz |
| | Control 3: PW Frequency | | 6.15 MHz | 6.15 MHz | 6.15 MHz | | 6.15 MHz | 6.15 MHz |
| | Control 4: PW PRF | | 5000 Hz | 3125 Hz | 5000 Hz | | 5000 Hz | 8064 Hz |
| | Control 5: PW Sample Volume Position | | 2.5 cm | 8.0 cm | 6.0 cm | | 6.0 cm | 6.0 cm |

**Table 10-20: Transducer model: L25xp** **Operating mode: 2D (B)**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | 0.3 | - | - | - | 0.5 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.90 | | | | | |
| | $W_0$ | (mW) | | 9.9 | - | | - | 18.9 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | - | |
| | $z@PII_{.3max}$ | (cm) | 1.2 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | - | |
| | $F_c$ | (MHz) | 6.86 | 6.15 | - | - | - | 6.15 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.6 | - | - | - | 2.6 |
| | | Y (cm) | | 0.3 | - | - | - | 0.3 |
| Other information | PD | (µsec) | 0.21 | | | | | |
| | PRF | (Hz) | 5882 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.36 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | - | |
| | Focal Length | $FL_x$ (cm) | | 5 | - | - | | 5 |
| | | $FL_y$ (cm) | | 2.7 | - | - | | 2.7 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 352.9 | | | | | |
| Operating control conditions | Control 1: Frequency | | 8 MHz | 12 MHz | | | | 12 MHz |
| | Control 2: THI | | Off | On | | | | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-21: Transducer model: L25xp** **Operating mode: 2D (B)/M**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | 0.3 | ≤0.1 | - | 0.1 | 0.5 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.90 | | | | | |
| | $W_0$ | (mW) | | 9.5 | 1.1 | | 0.8 | 19.4 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.2 | |
| | $z@PII_{.3max}$ | (cm) | 1.2 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.17 | |
| | $F_c$ | (MHz) | 6.86 | 6.15 | 6.15 | - | 6.18 | 6.15 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.6 | 0.8 | - | 0.5 | 2.6 |
| | | Y (cm) | | 0.3 | 0.3 | - | 0.3 | 0.3 |
| Other information | PD | (µsec) | 0.21 | | | | | |
| | PRF | (Hz) | 250 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.36 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.16 | |
| | Focal Length | $FL_x$ (cm) | | 5 | 5 | - | | 5 |
| | | $FL_y$ (cm) | | 2.7 | 2.7 | - | | 2.7 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 352.9 | | | | | |
| Operating control conditions | Control 1: Frequency | | 8 MHz | 12 MHz | 12 MHz | | 12 MHz | 12 MHz |
| | Control 2: THI | | Off | On | On | | On | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-22: Transducer model: L25xp** **Operating mode: 2D (B)/Color**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | 0.4 | - | - | - | 0.5 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.90 | | | | | |
| | $W_0$ | (mW) | | 11.8 | - | | - | 13.9 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | - | |
| | $z@PII_{.3max}$ | (cm) | 1.2 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | - | |
| | $F_c$ | (MHz) | 6.86 | 7.17 | - | - | - | 7.17 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.2 | - | - | - | 1.2 |
| | | Y (cm) | | 0.3 | - | - | - | 0.3 |
| Other information | PD | (µsec) | 0.21 | | | | | |
| | PRF | (Hz) | 961 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.36 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | - | |
| | Focal Length | $FL_x$ (cm) | | 5 | - | - | | 5 |
| | | $FL_y$ (cm) | | 2.7 | - | - | | 2.7 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 352.9 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 8 MHz / Off | 12 MHz / On | | | | 12 MHz / On |
| | Control 2: Color Frequency | | 7.27 MHz | 7.27 MHz | | | | 7.27 MHz |
| | Control 3: Color Box Size | | Narrow | Narrow | | | | Narrow |
| | Control 4: Color PRF | | 4000 Hz | 4000 Hz | | | | 4000 Hz |
| | Control 5: | | | | | | | |

**Table 10-23: Transducer model: L25xp** **Operating mode: PW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | - | 0.4 | - | 0.7 | 0.6 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.90 | | | | | |
| | $W_0$ | (mW) | | - | 11.9 | | 8.0 | 11.9 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.2 | |
| | $z@PII_{.3max}$ | (cm) | 1.2 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.15 | |
| | $F_c$ | (MHz) | 7.16 | - | 7.22 | - | 7.27 | 7.16 |
| | Dim of $A_{aprt}$ | X (cm) | | - | 0.6 | - | 0.4 | 0.6 |
| | | Y (cm) | | - | 0.3 | - | 0.3 | 0.3 |
| Other information | PD | (µsec) | 0.40 | | | | | |
| | PRF | (Hz) | 3125 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.32 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.14 | |
| | Focal Length | $FL_x$ (cm) | | - | 6 | - | | 6 |
| | | $FL_y$ (cm) | | - | 2.7 | - | | 2.7 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 177.3 | | | | | |
| Operating control conditions | Control 1: Frequency | | 7.27 MHz | | 7.27 MHz | | 7.27 MHz | 7.27 MHz |
| | Control 2: PRF | | 3125 Hz | | 7042 Hz | | 11111 Hz | 7042 Hz |
| | Control 3: Sample Volume Position | | 2.0 cm | | 6.0 cm | | 2.0 cm | 6.0 cm |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-24: Transducer model: L25xp** **Operating mode: 2D (B)/PW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.8 | 0.3 | 0.4 | - | 0.6 | 0.6 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 2.04 | | | | | |
| | $W_0$ | (mW) | | 9.8 | 11.0 | | 7.4 | 13.0 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.1 | |
| | $z@PII_{.3max}$ | (cm) | 1.0 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.16 | |
| | $F_c$ | (MHz) | 6.50 | 6.30 | 7.14 | - | 7.16 | 7.22 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.5 | 0.6 | - | 0.4 | 0.6 |
| | | Y (cm) | | 0.3 | 0.3 | - | 0.3 | 0.3 |
| Other information | PD | (µsec) | 0.21 | | | | | |
| | PRF | (Hz) | 920 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.32 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.15 | |
| | Focal Length | $FL_x$ (cm) | | 8 | 6 | - | | 6 |
| | | $FL_y$ (cm) | | 2.7 | 2.7 | - | | 2.7 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 177.4 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 13 MHz / On | 12 MHz / On | 12 MHz / On | | 12 MHz / On | 12 MHz / On |
| | Control 2: PW Frequency | | 7.27 MHz | 8.8 MHz | 7.27 MHz | | 7.27 MHz | 7.27 MHz |
| | Control 3: PW PRF | | 3125 Hz | 2000 Hz | 3125 Hz | | 3125 Hz | 7042 Hz |
| | Control 4: PW Sample Volume Position | | 1.5 cm | 8.0 cm | 6.0 cm | | 2.0 cm | 6.0 cm |
| | Control 5: | | | | | | | |

**Table 10-25: Transducer model: L25xp Operating mode: 2D (B)/Color/PW Doppler (Triplex)**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.8 | 0.1 | 0.3 | - | 0.6 | 0.6 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 2.04 | | | | | |
| | $W_0$ | (mW) | | 3.3 | 9.5 | | 6.4 | 13.4 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | 1.2 | |
| | $z@PII_{.3max}$ | (cm) | 1.0 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.15 | |
| | $F_c$ | (MHz) | 6.50 | 8.45 | 7.22 | - | 7.27 | 7.22 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.3 | 0.6 | - | 0.4 | 0.6 |
| | | Y (cm) | | 0.3 | 0.3 | - | 0.3 | 0.3 |
| Other information | PD | (µsec) | 0.21 | | | | | |
| | PRF | (Hz) | 460 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.32 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.14 | |
| | Focal Length | $FL_x$ (cm) | | 8 | 6 | - | | 6 |
| | | $FL_y$ (cm) | | 2.7 | 2.7 | - | | 2.7 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 177.4 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 13 MHz / On | 12 MHz / On | 12 MHz / On | | 12 MHz / On | 12 MHz / On |
| | Control 2: Color Frequency | | 7.27 MHz | 8.8 MHz | 7.27 MHz | | 7.27 MHz | 7.27 MHz |
| | Control 3: PW Frequency | | 7.27 MHz | 7.27 MHz | 7.27 MHz | | 7.27 MHz | 7.27 MHz |
| | Control 4: PW PRF | | 3125 Hz | 7042 Hz | 5000 Hz | | 5000 Hz | 7042 Hz |
| | Control 5: PW Sample Volume Position | | 1.5 cm | 8.0 cm | 6.0 cm | | 2.0 cm | 6.0 cm |

**Table 10-26: Transducer model: P21xp** **Operating mode: 2D (B)**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.9 | - | - | - | 2.4 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.37 | | | | | |
| | $W_0$ | (mW) | | 75.8 | - | | - | 181.5 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | - | |
| | $z@PII_{.3max}$ | (cm) | 4.5 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | - | |
| | $F_c$ | (MHz) | 2.12 | 2.49 | - | - | - | 2.08 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.1 | - | - | - | 2.1 |
| | | Y (cm) | | 1.3 | - | - | - | 1.3 |
| Other information | PD | (µsec) | 0.82 | | | | | |
| | PRF | (Hz) | 4311 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.82 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | - | |
| | Focal Length | $FL_x$ (cm) | | 13 | - | - | | 13 |
| | | $FL_y$ (cm) | | 9 | - | - | | 9 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 154.6 | | | | | |
| Operating control conditions | Control 1: Frequency | | 2.0 MHz | 3.0 MHz | | | | 2.0 MHz |
| | Control 2: THI | | Off | On | | | | Off |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-27: Transducer model: P21xp** **Operating mode: 2D (B)/M**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.9 | - | 0.1 | 0.3 | 2.5 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.37 | | | | | |
| | $W_0$ | (mW) | | 74.7 | - | | 12.6 | 189.4 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | 9.3 | | |
| | $z_1$ | (cm) | | | | 2.6 | | |
| | $Z_{bp}$ | (cm) | | | | 2.7 | | |
| | $Z_{sp}$ | (cm) | | | | | 5.8 | |
| | $z@PII_{.3max}$ | (cm) | 4.5 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.51 | |
| | $F_c$ | (MHz) | 2.12 | 2.49 | - | 1.69 | 1.69 | 2.08 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.1 | - | 2.0 | 2.0 | 2.1 |
| | | Y (cm) | | 1.3 | - | 1.3 | 1.3 | 1.3 |
| Other Information | PD | (µsec) | 0.82 | | | | | |
| | PRF | (Hz) | 250 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.82 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.48 | |
| | Focal Length | $FL_x$ (cm) | | 13 | - | 10 | | 13 |
| | | $FL_y$ (cm) | | 9 | - | 9 | | 9 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 154.6 | | | | | |
| Operating control conditions | Control 1: Frequency | | 2.0 MHz | 3.0 MHz | | 2.0 MHz | 2.0 MHz | 2.0 MHz |
| | Control 2: THI | | Off | Off | | Off | Off | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-28: Transducer model: P21xp** **Operating mode: 2D (B)/Color**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 1.1 | - | - | - | 2.4 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.37 | | | | | |
| | $W_0$ | (mW) | | 107.6 | - | | - | 150.2 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | - | | |
| | $z_1$ | (cm) | | | | - | | |
| | $Z_{bp}$ | (cm) | | | | - | | |
| | $Z_{sp}$ | (cm) | | | | | - | |
| | $z@PII_{.3max}$ | (cm) | 4.5 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | - | |
| | $F_c$ | (MHz) | 2.12 | 1.99 | - | - | - | 1.99 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.2 | - | - | - | 1.2 |
| | | Y (cm) | | 1.3 | - | - | - | 1.3 |
| Other information | PD | (µsec) | 0.82 | | | | | |
| | PRF | (Hz) | 646 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.82 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | - | |
| | Focal Length | $FL_x$ (cm) | | 6 | - | - | | 6 |
| | | $FL_y$ (cm) | | 9 | - | - | | 9 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 154.6 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 2.0 MHz / Off | 3.0 MHz / Off | | | | 3.0 MHz / Off |
| | Control 2: Color Frequency | | 2.0 MHz | 2.0 MHz | | | | 2.0 MHz |
| | Control 3: Color Box Size | | Narrow | Narrow | | | | Narrow |
| | Control 4: Color PRF | | 4808 Hz | 13158 Hz | | | | 13158 Hz |
| | Control 5: | | | | | | | |

**Table 10-29: Transducer model: P21xp** **Operating mode: PW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | - | - | 0.7 | 2.4 | 1.8 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.05 | | | | | |
| | $W_0$ | (mW) | | - | - | | 82.2 | 82.2 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | 53.0 | | |
| | $z_1$ | (cm) | | | | 1.6 | | |
| | $Z_{bp}$ | (cm) | | | | 1.7 | | |
| | $Z_{sp}$ | (cm) | | | | | 1.4 | |
| | $z@PII_{.3max}$ | (cm) | 4.2 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.62 | |
| | $F_c$ | (MHz) | 2.00 | - | - | 2.83 | 1.99 | 1.99 |
| | Dim of $A_{aprt}$ | X (cm) | | - | - | 0.8 | 0.8 | 0.8 |
| | | Y (cm) | | - | - | 1.3 | 1.3 | 1.3 |
| Other information | PD | (µsec) | 1.30 | | | | | |
| | PRF | (Hz) | 3125 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.41 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.47 | |
| | Focal Length | $FL_x$ (cm) | | - | - | 4 | | 4 |
| | | $FL_y$ (cm) | | - | - | 9 | | 9 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 64.7 | | | | | |
| Operating control conditions | Control 1: Frequency | | 2.0 MHz | | | 2.96 MHz | 2.0 MHz | 2.0 MHz |
| | Control 2: PRF | | 3125 Hz | | | 11111 Hz | 11111 Hz | 11111 Hz |
| | Control 3: Sample Volume Position | | 6.0 cm | | | 4.0 cm | 4.0 cm | 4.0 cm |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-30: Transducer model: P21xp** **Operating mode: 2D (B)/PW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.9 | - | 0.6 | 2.2 | 2.7 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.27 | | | | | |
| | $W_0$ | (mW) | | 72.6 | - | | 79.0 | 204.5 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | 63.5 | | |
| | $z_1$ | (cm) | | | | 3.4 | | |
| | $Z_{bp}$ | (cm) | | | | 2.8 | | |
| | $Z_{sp}$ | (cm) | | | | | 5.0 | |
| | $z@PII_{.3max}$ | (cm) | 5.4 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.41 | |
| | $F_c$ | (MHz) | 2.14 | 2.49 | - | 1.99 | 2.01 | 2.10 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.1 | - | 2.1 | 1.6 | 2.1 |
| | | Y (cm) | | 1.3 | - | 1.3 | 1.3 | 1.3 |
| Other information | PD | (µsec) | 0.81 | | | | | |
| | PRF | (Hz) | 860 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.90 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.38 | |
| | Focal Length | $FL_x$ (cm) | | 16 | - | 20 | | 20 |
| | | $FL_y$ (cm) | | 9 | - | 9 | | 9 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 151.7 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 2.0 MHz / Off | 3.0 MHz / Off | | 3.0 MHz / Off | 3.0 MHz / Off | 2.0 MHz / Off |
| | Control 2: PW Frequency | | 2.0 MHz | 2.96 MHz | | 2.0 MHz | 2.0 MHz | 2.0 MHz |
| | Control 3: PW PRF | | 3125 Hz | 1000 Hz | | 3125 Hz | 2000 Hz | 1000 Hz |
| | Control 4: PW Sample Volume Position | | 8.0 cm | 16 cm | | 20 cm | 8.0 cm | 20 cm |
| | Control 5: | | | | | | | |

**Table 10-31: Transducer model: P21xp Operating mode: 2D (B)/Color/PW Doppler (Triplex)**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.6 | - | 0.5 | 1.9 | 1.9 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 1.27 | | | | | |
| | $W_0$ | (mW) | | 55.1 | - | | 59.8 | 132.3 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | 40.1 | | |
| | $z_1$ | (cm) | | | | 1.8 | | |
| | $Z_{bp}$ | (cm) | | | | 2.5 | | |
| | $Z_{sp}$ | (cm) | | | | | 3.8 | |
| | $z@PII_{.3max}$ | (cm) | 5.4 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.41 | |
| | $F_c$ | (MHz) | 2.14 | 2.10 | - | 2.82 | 2.00 | 2.82 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.1 | - | 1.6 | 1.2 | 1.6 |
| | | Y (cm) | | 1.3 | - | 1.3 | 1.3 | 1.3 |
| Other information | PD | (µsec) | 0.81 | | | | | |
| | PRF | (Hz) | 430 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.90 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.38 | |
| | Focal Length | $FL_x$ (cm) | | 20 | - | 8 | | 8 |
| | | $FL_y$ (cm) | | 9 | - | 9 | | 9 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 151.7 | | | | | |
| Operating control conditions | Control 1: 2D Frequency / THI | | 2.0 MHz / Off | 2.0 MHz / Off | | 3.0 MHz / On | 2.0 MHz / Off | 3.0 MHz / On |
| | Control 2: Color Frequency | | 2.0 MHz | 2.96 MHz | | 2.0 MHz | 2.0 MHz | 2.0 MHz |
| | Control 3: PW Frequency | | 2.0 MHz | 2.0 MHz | | 2.96 MHz | 2.0 MHz | 2.96 MHz |
| | Control 4: PW PRF | | 3125 Hz | 1000 Hz | | 6250 Hz | 3125 Hz | 6250 Hz |
| | Control 5: PW Sample Volume Position | | 8.0 cm | 20 cm | | 8.0 cm | 6.0 cm | 8.0 cm |

**Table 10-32: Transducer model: P21xp** **Operating mode: CW Doppler**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Nonscan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.1 | - | 1.1 | | 3.1 | 2.5 |
| Associated acoustic parameter | $p_{r.3}$ | (MPa) | 0.10 | | | | | |
| | $W_0$ | (mW) | | - | 110.4 | | 111.6 | 112.8 |
| | min of $[W_{.3(z_1)}, I_{TA.3(z_1)}]$ | (mW) | | | | | | |
| | $z_1$ | (cm) | | | | | | |
| | $Z_{bp}$ | (cm) | | | | | | |
| | $Z_{sp}$ | (cm) | | | | | 3.4 | |
| | $z@PII_{.3max}$ | (cm) | 3.6 | | | | | |
| | $d_{eq}(Z_{sp})$ | (cm) | | | | | 0.50 | |
| | $F_c$ | (MHz) | 2.00 | - | 2.00 | | 2.00 | 2.00 |
| | Dim of $A_{aprt}$ | X (cm) | | - | 0.8 | | 0.8 | 0.8 |
| | | Y (cm) | | - | 1.3 | | 1.3 | 1.3 |
| Other information | PD | (µsec) | N/A | | | | | |
| | PRF | (Hz) | N/A | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 0.13 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.48 | |
| | Focal Length | $FL_x$ (cm) | | - | 10 | | | 10 |
| | | $FL_y$ (cm) | | - | 9 | | | 9 |
| | $I_{PA.3}@MI_{max}$ | ($W/cm^2$) | 0.4 | | | | | |
| Operating control conditions | Control 1: Sample Volume Position | | 6 cm | | 10 cm | | 6 cm | 16 cm |
| | Control 2: | | | | | | | |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-33: Transducer Model: L38xp** **Operating Mode: 2D**

| Index label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.1 | 0.7 | — | — | — | 1.8 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 2.44 | | | | | |
| | $W_0$ | (mW) | | 29.9 | — | | — | 101.2 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | — | |
| | $z@PII_{.3max}$ | | 1.1 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | — | |
| | $f_c$ | (MHz) | 4.62 | 5.15 | — | — | — | 5.15 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.8 | — | — | — | 3.8 |
| | | Y (cm) | | 0.4 | — | — | — | 0.4 |
| Other Information | PD | (µsec) | 0.30 | | | | | |
| | PRF | (Hz) | 9950 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.63 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | — | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | — | | 8 |
| | | $FL_y$ (cm) | | 2.5 | — | — | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 265.4 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 9 MHz | 6.5 MHz | | | | 9 MHz |
| | Control 2: THI | | On | Off | | | | On |
| | Control 3: Depth | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: Needle Vision | | | | | | | |

**Table 10-34: Transducer Model: L38xp** **Operating Mode: 2D/M**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.1 | 0.5 | — | 0.1 | 0.1 | 1.2 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 2.44 | | | | | |
| | $W_0$ | (mW) | | 18.2 | — | | 3.6 | 64.7 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 2.6 | | |
| | $z_1$ | (cm) | | | | 1.0 | | |
| | $z_{bp}$ | (cm) | | | | 1.3 | | |
| | $z_{sp}$ | (cm) | | | | | 1.0 | |
| | $z@PII_{.3max}$ | | 1.1 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.47 | |
| | $f_c$ | (MHz) | 4.62 | 6.03 | | 4.64 | 4.64 | 4.64 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.8 | — | 1.4 | 1.4 | 3.8 |
| | | Y (cm) | | 0.4 | — | 0.4 | 0.4 | 0.4 |
| Other Information | PD | (µsec) | 0.30 | | | | | |
| | PRF | (Hz) | 9084 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.63 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.46 | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | 8 | | 8 |
| | | $FL_y$ (cm) | | 2.5 | — | 2.5 | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 265.4 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 9 MHz | 6.5 MHz | | 9 MHz | 9 MHz | 9 MHz |
| | Control 2: THI | | On | Off | | On | On | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-35: Transducer Model: L38xp** **Operating Mode: 2D/color**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.1 | 0.6 | — | — | — | 1.0 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 2.44 | | | | | |
| | $W_0$ | (mW) | | 20.7 | — | | — | 50.6 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | — | |
| | $z@PII_{.3max}$ | | 1.1 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | — | |
| | $f_c$ | (MHz) | 4.62 | 6.29 | — | — | — | 4.56 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.9 | — | — | — | 2.9 |
| | | Y (cm) | | 0.4 | — | — | — | 0.4 |
| Other Information | PD | (µsec) | 0.30 | | | | | |
| | PRF | (Hz) | 2554 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.63 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | — | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | — | | 8 |
| | | $FL_y$ (cm) | | 2.5 | — | — | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 265.4 | | | | | |
| Operating Control Conditions | Control 1: 2D Frequency /THI | | 9 MHz / On | 6.5 MHz / Off | | | | 5 MHz / Off |
| | Control 2: Color Frequency | | 4.45 MHz | 6.67 MHz | | | | 4.45 MHz |
| | Control 3: Color Box Size | | Narrow | Narrow | | | | Narrow |
| | Control 4: Color PRF | | 3226 Hz | 3226 Hz | | | | 8064 Hz |
| | Control 5: | | | | | | | |

**Table 10-36: Transducer Model: L38xp** **Operating Mode: PW Doppler**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.8 | — | — | 0.6 | 1.1 | 1.0 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.62 | | | | | |
| | $W_0$ | (mW) | | — | — | | 14.5 | 34.3 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 20.2 | | |
| | $z_1$ | (cm) | | | | 1.2 | | |
| | $z_{bp}$ | (cm) | | | | 1.3 | | |
| | $z_{sp}$ | (cm) | | | | | 1.5 | |
| | $z@PII_{.3max}$ | | 1.1 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.15 | |
| | $f_c$ | (MHz) | 4.57 | — | — | 6.40 | 6.41 | 6.40 |
| | Dim of $A_{aprt}$ | X (cm) | | — | — | 1.4 | 0.5 | 1.4 |
| | | Y (cm) | | — | — | 0.4 | 0.4 | 0.4 |
| Other Information | PD | (µsec) | 0.64 | | | | | |
| | PRF | (Hz) | 4000 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.84 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.15 | |
| | Focal Length | $FL_x$ (cm) | | — | — | 8 | | 8 |
| | | $FL_y$ (cm) | | — | — | 2.5 | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 117.6 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 4.45 MHz | | | 6.67 MHz | 6.67 MHz | 4.45 MHz |
| | Control 2: PRF | | 4000 Hz | | | 5000 Hz | 9091 Hz | 9091 Hz |
| | Control 3: Sample Volume Position | | 2.0 cm | | | 8.0 cm | 2.5 cm | 8.0 cm |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-37: Transducer Model: L38xp** **Operating Mode: 2D/PW Doppler**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.1 | 0.6 | — | 0.5 | 0.9 | 1.9 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 2.37 | | | | | |
| | $W_0$ | (mW) | | 19.7 | — | | 11.6 | 94.8 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 16.1 | | |
| | $z_1$ | (cm) | | | | 1.2 | | |
| | $z_{bp}$ | (cm) | | | | 1.3 | | |
| | $z_{sp}$ | (cm) | | | | | 1.5 | |
| | $z@PII_{.3max}$ | | 1.1 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.15 | |
| | $f_c$ | (MHz) | 4.61 | 6.13 | — | 6.40 | 6.41 | 5.12 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.8 | — | 1.4 | 0.5 | 3.8 |
| | | Y (cm) | | 0.4 | — | 0.4 | 0.4 | 0.4 |
| Other Information | PD | (µsec) | 0.30 | | | | | |
| | PRF | (Hz) | 1000 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.60 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.15 | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | 8 | | 8 |
| | | $FL_y$ (cm) | | 2.5 | — | 2.5 | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 231.5 | | | | | |
| Operating Control Conditions | Control 1: 2D Frequency/THI | | 9 MHz / On | 6.5 MHz / Off | | 9 MHz / On | 9 MHz / On | 5 MHz / Off |
| | Control 2: PW Frequency | | 4.45 MHz | 6.67 MHz | | 6.67 MHz | 6.67 MHz | 4.45 MHz |
| | Control 3: PW PRF | | 4000 Hz | 3125 Hz | | 5000 Hz | 9091 Hz | 3125 Hz |
| | Control 4: PW Sample Volume Position | | 2.0 cm | 8.0 cm | | 8.0 cm | 2.5 cm | 8.0 cm |
| | Control 5: Needle Vision | | | | | | | |

**Table 10-38: Transducer Model: L38xp** **Operating Mode: 2D/color/PW Doppler (Triplex)**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.1 | 0.3 | — | 0.5 | 0.9 | 1.2 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 2.37 | | | | | |
| | $W_0$ | (mW) | | 11.6 | — | | 11.6 | 48.0 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 16.1 | | |
| | $z_1$ | (cm) | | | | 1.2 | | |
| | $z_{bp}$ | (cm) | | | | 1.3 | | |
| | $z_{sp}$ | (cm) | | | | | 1.5 | |
| | $z@PII_{.3max}$ | | 1.1 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.15 | |
| | $f_c$ | (MHz) | 4.61 | 5.12 | — | 6.40 | 6.41 | 6.40 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.8 | — | 1.4 | 0.5 | 1.4 |
| | | Y (cm) | | 0.4 | — | 0.4 | 0.4 | 0.4 |
| Other Information | PD | (µsec) | 0.30 | | | | | |
| | PRF | (Hz) | 500 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.60 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.15 | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | 8 | | 8 |
| | | $FL_y$ (cm) | | 2.5 | — | 2.5 | | 2.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 231.5 | | | | | |
| Operating Control Conditions | Control 1: 2D Frequency/THI | | 9 MHz/ On | 5 MHz/ Off | | 9 MHz/ On | 9 MHz/ On | 5 MHz/ Off |
| | Control 2: Color Frequency | | 4.45 MHz | 4.45 MHz | | 4.45 MHz | 4.45 MHz | 4.45 MHz |
| | Control 3: PW Frequency | | 4.45 MHz | 4.45 MHz | | 4.45 MHz | 4.45 MHz | 6.67 MHz |
| | Control 4: PW PRF | | 4000 Hz | 3125 Hz | | 5000 Hz | 9091 Hz | 5000 Hz |
| | Control 5: PW Sample Volume Position | | 2.0 cm | 8.0 cm | | 8.0 cm | 2.5 cm | 8.0 cm |

**Table 10-39: Transducer Model: C11xp** **Operating Mode: 2D**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.8 | 0.4 | — | — | — | 0.6 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.68 | | | | | |
| | $W_0$ | (mW) | | 17.6 | — | | — | 22.6 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | — | |
| | $z@PII_{.3max}$ | | 1.6 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | — | |
| | $f_c$ | (MHz) | 4.49 | 5.08 | — | — | — | 5.08 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.6 | — | — | — | 1.6 |
| | | Y (cm) | | 0.5 | — | — | — | 0.5 |
| Other Information | PD | (µsec) | 0.29 | | | | | |
| | PRF | (Hz) | 5398 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.83 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | — | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | — | | 8 |
| | | $FL_y$ (cm) | | 4.5 | — | — | | 4.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 118.4 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 9 MHz | 5 MHz | | | | 5 MHz |
| | Control 2: THI | | On | Off | | | | Off |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-40: Transducer Model: C11xp** **Operating Mode: 2D/M**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.8 | 0.4 | — | 0.2 | 0.1 | 0.5 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.61 | | | | | |
| | $W_0$ | (mW) | | 14.5 | — | | 0.8 | 19.7 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 1.1 | | |
| | $z_1$ | (cm) | | | | 1.3 | | |
| | $z_{bp}$ | (cm) | | | | 1.4 | | |
| | $z_{sp}$ | (cm) | | | | | 1.6 | |
| | $z@PII_{.3max}$ | | 1.7 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.20 | |
| | $f_c$ | (MHz) | 4.49 | 5.12 | — | 4.71 | 4.63 | 5.12 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.6 | — | 1.3 | 0.6 | 1.6 |
| | | Y (cm) | | 0.5 | — | 0.5 | 0.5 | 0.5 |
| Other Information | PD | (µsec) | 0.29 | | | | | |
| | PRF | (Hz) | 5334 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.89 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.20 | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | 8 | | 8 |
| | | $FL_y$ (cm) | | 4.5 | — | 4.5 | | 4.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 121.0 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 9 MHz | 9 MHz | | 9 MHz | 9 MHz | 5 MHz |
| | Control 2: THI | | On | On | | On | On | Off |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-41: Transducer Model: C11xp** **Operating Mode: 2D/Color**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | 0.3 | — | — | — | 0.4 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.58 | | | | | |
| | $W_0$ | (mW) | | 14.0 | — | | — | 16.0 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | — | |
| | $z@PII_{.3max}$ | | 1.7 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | — | |
| | $f_c$ | (MHz) | 4.48 | 4.29 | — | — | — | 4.29 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.1 | — | — | — | 1.1 |
| | | Y (cm) | | 0.5 | — | — | — | 0.5 |
| Other Information | PD | (µsec) | 0.29 | | | | | |
| | PRF | (Hz) | 6024 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.87 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | — | |
| | Focal Length | $FL_x$ (cm) | | 5 | — | — | | 5 |
| | | $FL_y$ (cm) | | 4.5 | — | — | | 4.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 119.5 | | | | | |
| Operating Control Conditions | Control 1: 2D Frequency/THI | | 9 MHz / On | 9 MHz / On | | | | 9 MHz / On |
| | Control 2: Color Frequency | | 4.2 MHz | 4.2 MHz | | | | 4.2 MHz |
| | Control 3: Color Box Size | | Narrow | Narrow | | | | Narrow |
| | Control 4: Color PRF | | 6024 Hz | 6024 Hz | | | | 6024 Hz |
| | Control 5: | | | | | | | |

**Table 10-42: Transducer Model: C11xp** **Operating Mode: PW Doppler**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.4 | — | — | 0.4 | 1.0 | 0.8 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 0.92 | | | | | |
| | $W_0$ | (mW) | | — | — | | 13.9 | 28.4 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 19.5 | | |
| | $z_1$ | (cm) | | | | 1.3 | | |
| | $z_{bp}$ | (cm) | | | | 1.4 | | |
| | $z_{sp}$ | (cm) | | | | | 1.5 | |
| | $z@PII_{.3max}$ | | 1.6 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.19 | |
| | $f_c$ | (MHz) | 4.24 | — | — | 4.22 | 4.24 | 4.22 |
| | Dim of $A_{aprt}$ | X (cm) | | — | — | 1.3 | 0.6 | 1.3 |
| | | Y (cm) | | — | — | 0.5 | 0.5 | 0.5 |
| Other Information | PD | (µsec) | 1.06 | | | | | |
| | PRF | (Hz) | 7042 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.15 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.19 | |
| | Focal Length | $FL_x$ (cm) | | — | — | 8 | | 8 |
| | | $FL_y$ (cm) | | — | — | 4.5 | | 4.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 39.6 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 4.2 MHz | | | 4.2 MHz | 4.2 MHz | 4.2 MHz |
| | Control 2: PRF | | 7042 Hz | | | 7042 Hz | 7042 Hz | 7042 Hz |
| | Control 3: Sample Volume Position | | 2.0 cm | | | 8.0 cm | 2.0 cm | 8.0 cm |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-43: Transducer Model: C11xp** **Operating Mode: 2D/PW Doppler**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | 0.1 | — | 0.3 | 0.8 | 0.7 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.56 | | | | | |
| | $W_0$ | (mW) | | 5.7 | — | | 11.1 | 27.0 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 15.6 | | |
| | $z_1$ | (cm) | | | | 1.3 | | |
| | $z_{bp}$ | (cm) | | | | 1.4 | | |
| | $z_{sp}$ | (cm) | | | | | 1.5 | |
| | $z@PII_{.3max}$ | | 1.7 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.19 | |
| | $f_c$ | (MHz) | 4.5 | 5.11 | — | 4.22 | 4.24 | 4.25 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.6 | — | 1.3 | 0.6 | 1.3 |
| | | Y (cm) | | 0.5 | — | 0.5 | 0.5 | 0.5 |
| Other Information | PD | (µsec) | 0.29 | | | | | |
| | PRF | (Hz) | 530 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.86 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.19 | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | 8 | | 8 |
| | | $FL_y$ (cm) | | 4.5 | — | 4.5 | | 4.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 105.5 | | | | | |
| Operating Control Conditions | Control 1: Frequency/THI | | 9 MHZ/ On | 5 MHz / Off | | 5 MHz / Off | 9 MHZ/ On | 5 MHz / Off |
| | Control 2: PW Frequency | | 4.2 MHz | 4.2 MHz | | 4.2 MHz | 4.2 MHz | 4.2 MHz |
| | Control 3: PW PRF | | 7042 Hz | 2000 Hz | | 7042 Hz | 7042 Hz | 7042 Hz |
| | Control 4: PW Sample Volume Position | | 2.0 cm | 8.0 cm | | 8.0 cm | 2.0 cm | 8.0 cm |
| | Control 5: | | | | | | | |

**Table 10-44: Transducer Model: C11xp Operating Mode: 2D/Color/PW Doppler (Triplex)**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | 0.1 | — | 0.3 | 0.8 | 0.8 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.56 | | | | | |
| | $W_0$ | (mW) | | 4.4 | — | | 11.1 | 27.8 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 15.6 | | |
| | $z_1$ | (cm) | | | | 1.3 | | |
| | $z_{bp}$ | (cm) | | | | 1.4 | | |
| | $z_{sp}$ | (cm) | | | | | 1.5 | |
| | $z@PII_{.3max}$ | | 1.7 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.19 | |
| | $f_c$ | (MHz) | 4.50 | 5.11 | — | 4.25 | 4.24 | 4.25 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.6 | — | 1.3 | 0.6 | 1.3 |
| | | Y (cm) | | 0.5 | — | 0.5 | 0.5 | 0.5 |
| Other Information | PD | (µsec) | 0.29 | | | | | |
| | PRF | (Hz) | 260 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.86 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.19 | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | 8 | | 8 |
| | | $FL_y$ (cm) | | 4.5 | — | 4.5 | | 4.5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 101.5 | | | | | |
| Operating Control Conditions | Control 1: 2D Frequency / THI | | 9 MHz / On | 5 MHz / Off | | 5 MHz / Off | 9 MHz / On | 5 MHz / Off |
| | Control 2: Color Frequency | | 4.2 MHz | 6.1 MHz | | 6.1 MHz | 4.2 MHz | 6.1 MHz |
| | Control 3: PW Frequency | | 4.2 MHz | 4.2 MHz | | 6.1 MHz | 4.2 MHz | 4.2 MHz |
| | Control 4: PW PRF | | 7042 Hz | 2000 Hz | | 7042 Hz | 7042 Hz | 7042 Hz |
| | Control 5: PW Sample Volume Position | | 2.0 cm | 8.0 cm | | 8.0 cm | 2.0 cm | 8.0 cm |

**Table 10-45: Transducer Model: ICTxp** **Operating Mode: 2D**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | 0.3 | — | — | — | 0.5 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.43 | | | | | |
| | $W_0$ | (mW) | | 15.9 | — | | — | 16.3 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | — | |
| | $z@PII_{.3max}$ | | 1.7 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | — | |
| | $f_c$ | (MHz) | 4.63 | 4.56 | — | — | — | 4.56 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.1 | — | — | — | 1.1 |
| | | Y (cm) | | 0.5 | — | — | — | 0.5 |
| Other Information | PD | (µsec) | 0.29 | | | | | |
| | PRF | (Hz) | 8000 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.70 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | — | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | — | | 8 |
| | | $FL_y$ (cm) | | 4.4 | — | — | | 4.4 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 88.8 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 9 MHz | 9 MHz | | | | 9 MHz |
| | Control 2: THI | | On | On | | | | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-46: Transducer Model: ICTxp** **Operating Mode: 2D/M**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | 0.3 | ≤0.1 | — | 0.1 | 0.5 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.43 | | | | | |
| | $W_0$ | (mW) | | 15.8 | 1.0 | | 0.8 | 17.3 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | 1.9 | |
| | $z@PII_{.3max}$ | | 1.7 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.21 | |
| | $f_c$ | (MHz) | 4.63 | 4.56 | 4.56 | — | 4.65 | 4.56 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.1 | 0.9 | — | 0.7 | 1.1 |
| | | Y (cm) | | 0.5 | 0.5 | — | 0.5 | 0.5 |
| Other Information | PD | (µsec) | 0.29 | | | | | |
| | PRF | (Hz) | 7986 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.70 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.20 | |
| | Focal Length | $FL_x$ (cm) | | 8 | 8 | — | | 8 |
| | | $FL_y$ (cm) | | 4.4 | 4.4 | — | | 4.4 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 88.8 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 9 MHz | 9 MHz | 9 MHz | | 9 MHz | 9 MHz |
| | Control 2: THI | | On | On | On | | On | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-47: Transducer Model: ICTxp** **Operating Mode: 2D/Color**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | 0.3 | — | — | — | 0.4 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.43 | | | | | |
| | $W_0$ | (mW) | | 13.4 | — | | — | 13.5 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | — | |
| | $z@PII_{.3max}$ | | 1.7 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | — | |
| | $f_c$ | (MHz) | 4.63 | 5.85 | — | — | — | 5.85 |
| | Dim of $A_{aprt}$ | X (cm) | | 0.9 | — | — | — | 0.9 |
| | | Y (cm) | | 0.5 | — | — | — | 0.5 |
| Other Information | PD | (µsec) | 0.29 | | | | | |
| | PRF | (Hz) | 2222 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.70 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | — | |
| | Focal Length | $FL_x$ (cm) | | 8 | — | — | | 8 |
| | | $FL_y$ (cm) | | 4.4 | — | — | | 4.4 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 88.8 | | | | | |
| Operating Control Conditions | Control 1: Frequency / THI | | 9 MHz / On | 9 MHz / On | | | | 9 MHz / On |
| | Control 2: Color Frequency | | 6.15 MHz | 6.15 MHz | | | | 6.15 MHz |
| | Control 3: Color Box Size | | Narrow | Narrow | | | | Narrow |
| | Control 4: Color PRF | | 4000 Hz | 4000 Hz | | | | 4000 Hz |
| | Control 5: | | | | | | | |

**Table 10-48: Transducer Model: ICTxp** **Operating Mode: PW Doppler**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.5 | — | 0.3 | — | 0.8 | 0.5 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.24 | | | | | |
| | $W_0$ | (mW) | | — | 15.2 | | 13.0 | 15.2 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | 1.9 | |
| | $z@PII_{.3max}$ | | 1.2 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.20 | |
| | $f_c$ | (MHz) | 5.93 | — | 4.48 | — | 4.47 | 4.48 |
| | Dim of $A_{aprt}$ | X (cm) | | — | 0.9 | — | 0.7 | 0.9 |
| | | Y (cm) | | — | 0.5 | — | 0.5 | 0.5 |
| Other Information | PD | (µsec) | 0.45 | | | | | |
| | PRF | (Hz) | 4000 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.94 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.19 | |
| | Focal Length | $FL_x$ (cm) | | — | 8 | — | | 8 |
| | | $FL_y$ (cm) | | — | 4.4 | — | | 4.4 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 89.4 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 6.15 MHz | | 4.45 MHz | | 4.45 MHz | 4.45 MHz |
| | Control 2: PRF | | 4000 Hz | | 7042 Hz | | 7042 Hz | 7042 Hz |
| | Control 3: Sample Volume Position | | 4.0 cm | | 8.0 cm | | 4.0 cm | 8.0 cm |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-49: Transducer Model: ICTxp** **Operating Mode: 2D/PW Doppler**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.6 | 0.2 | 0.3 | — | 0.7 | 0.5 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.39 | | | | | |
| | $W_0$ | (mW) | | 7.7 | 12.1 | | 10.4 | 15.0 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | 1.9 | |
| | $z@PII_{.3max}$ | | 1.6 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.20 | |
| | $f_c$ | (MHz) | 4.65 | 5.41 | 4.48 | — | 4.48 | 4.48 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.4 | 0.9 | — | 0.7 | 0.9 |
| | | Y (cm) | | 0.5 | 0.5 | — | 0.5 | 0.5 |
| Other Information | PD | (µsec) | 0.29 | | | | | |
| | PRF | (Hz) | 800 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.77 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.19 | |
| | Focal Length | $FL_x$ (cm) | | 5.0 | 8 | — | | 8 |
| | | $FL_y$ (cm) | | 4.4 | 4.4 | — | | 4.4 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 82.1 | | | | | |
| Operating Control Conditions | Control 1: 2D Frequency/THI | | 9 MHz/ On | 5.5 MHz / Off | 9 MHz / On | | 9 MHz/ On | 9 MHz / On |
| | Control 2: PW Frequency | | 6.15 MHz | 6.15 MHz | 4.45 MHz | | 4.45 MHz | 4.45 MHz |
| | Control 3: PW PRF | | 4000 Hz | 2000 Hz | 7042 Hz | | 7042 Hz | 7042 Hz |
| | Control 4: PW Sample Volume Position | | 3.0 cm | 5.0 cm | 8.0 cm | | 4.0 cm | 8.0 cm |
| | Control 5: | | | | | | | |

**Table 10-50: Transducer Model: ICTxp** **Operating Mode: 2D/Color/PW Doppler (Triplex)**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.6 | 0.3 | 0.3 | — | 0.7 | 0.5 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.39 | | | | | |
| | $W_0$ | (mW) | | 9.6 | 12.1 | | 10.4 | 15.1 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | 1.9 | |
| | $z@PII_{.3max}$ | | 1.6 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.20 | |
| | $f_c$ | (MHz) | 4.65 | 5.89 | 4.48 | — | 4.48 | 4.48 |
| | Dim of $A_{aprt}$ | X (cm) | | 1.4 | 0.9 | — | 0.7 | 0.9 |
| | | Y (cm) | | 0.5 | 0.5 | — | 0.5 | 0.5 |
| Other Information | PD | (µsec) | 0.29 | | | | | |
| | PRF | (Hz) | 400 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.77 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.19 | |
| | Focal Length | $FL_x$ (cm) | | 8 | 8 | — | | 8 |
| | | $FL_y$ (cm) | | 4.4 | 4.4 | — | | 4.4 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 82.1 | | | | | |
| Operating Control Conditions | Control 1: 2D Frequency / THI | | 9 MHz / On | 5.5 MHz / Off | 9 MHz / On | | 9 MHz / On | 9 MHz / On |
| | Control 2: Color Frequency | | 6.15 MHz | 4.45 MHz | 6.15 MHz | | 4.45 MHz | 6.15 MHz |
| | Control 3: PW Frequency | | 6.15 MHz | 6.15 MHz | 4.45 MHz | | 4.45 MHz | 4.45 MHz |
| | Control 4: PW PRF | | 4000 Hz | 2000 Hz | 7042 Hz | | 4032 Hz | 7042 Hz |
| | Control 5: PW Sample Volume Position | | 3.0 cm | 8.0 m | 8.0 cm | | 4.0 cm | 8.0 cm |

**Table 10-51: Transducer Model: C35xp** **Operating Mode: 2D**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.0 | 0.8 | — | — | — | 1.0 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.89 | | | | | |
| | $W_0$ | (mW) | | 33.9 | — | | — | 84.0 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | — | |
| | $z@PII_{.3max}$ | | 3.3 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | — | |
| | $f_c$ | (MHz) | 3.54 | 5.10 | — | — | — | 3.37 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.8 | — | — | — | 4.1 |
| | | Y (cm) | | 0.8 | — | — | — | 0.8 |
| Other Information | PD | (µsec) | 0.37 | | | | | |
| | PRF | (Hz) | 5730 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.67 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | — | |
| | Focal Length | $FL_x$ (cm) | | 10 | — | — | | 10 |
| | | $FL_y$ (cm) | | 5 | — | — | | 5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 242.7 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 8 MHz | 6 MHz | | | | 8 MHz |
| | Control 2: THI | | On | Off | | | | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-52: Transducer Model: C35xp** **Operating Mode: 2D/M**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.0 | 0.6 | — | 0.1 | 0.2 | 1.1 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.89 | | | | | |
| | $W_0$ | (mW) | | 25.3 | — | | 3.9 | 85.0 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 4.3 | | |
| | $z_1$ | (cm) | | | | 2.1 | | |
| | $z_{bp}$ | (cm) | | | | 2.2 | | |
| | $z_{sp}$ | (cm) | | | | | 3.1 | |
| | $z@PII_{.3max}$ | | 3.3 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.25 | |
| | $f_c$ | (MHz) | 3.57 | 5.39 | — | 3.42 | 3.57 | 3.38 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.7 | — | 2.0 | 1.0 | 4.1 |
| | | Y (cm) | | 0.8 | — | 0.8 | 0.8 | 0.8 |
| Other Information | PD | (µsec) | 0.37 | | | | | |
| | PRF | (Hz) | 250 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.64 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.24 | |
| | Focal Length | $FL_x$ (cm) | | 10 | — | 10 | | 10 |
| | | $FL_y$ (cm) | | 5 | — | 5 | | 5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 239.3 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 8 MHz | 8 MHz | | 8 MHz | 8 MHz | 8 MHz |
| | Control 2: THI | | On | Off | | On | On | On |
| | Control 3: | | | | | | | |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-53: Transducer Model: C35xp** **Operating Mode: 2D/Color**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 1.0 | 0.9 | — | — | — | 1.4 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.82 | | | | | |
| | $W_0$ | (mW) | | 45.2 | — | | — | 100.6 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | — | | |
| | $z_1$ | (cm) | | | | — | | |
| | $z_{bp}$ | (cm) | | | | — | | |
| | $z_{sp}$ | (cm) | | | | | — | |
| | $z@PII_{.3max}$ | | 3.3 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | — | |
| | $f_c$ | (MHz) | 3.58 | 4.56 | — | — | — | 4.56 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.7 | — | — | — | 2.7 |
| | | Y (cm) | | 0.8 | — | — | — | 0.8 |
| Other Information | PD | (µsec) | 0.37 | | | | | |
| | PRF | (Hz) | 2500 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.68 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | — | |
| | Focal Length | $FL_x$ (cm) | | 10 | — | — | | 10 |
| | | $FL_y$ (cm) | | 5 | — | — | | 5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 234.7 | | | | | |
| Operating Control Conditions | Control 1: 2D Frequency/THI | | 8 MHz / On | 8 MHz / On | | | | 8 MHz / On |
| | Control 2: Color Frequency | | 3.64 MHz | 4.71 MHz | | | | 4.71 MHz |
| | Control 3: Color Box Size | | Narrow | Narrow | | | | Narrow |
| | Control 4: Color PRF | | 2500 Hz | 13158 Hz | | | | 13158 Hz |
| | Control 5: | | | | | | | |

**Table 10-54: Transducer Model: C35xp** **Operating Mode: PW Doppler**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.7 | — | — | 0.7 | 1.5 | 1.4 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.52 | | | | | |
| | $W_0$ | (mW) | | — | — | | 41.7 | 80.0 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 34.3 | | |
| | $z_1$ | (cm) | | | | 1.9 | | |
| | $z_{bp}$ | (cm) | | | | 1.8 | | |
| | $z_{sp}$ | (cm) | | | | | 3.1 | |
| | $z@PII_{.3max}$ | | 3.0 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.23 | |
| | $f_c$ | (MHz) | 4.58 | — | — | 4.52 | 4.66 | 4.61 |
| | Dim of $A_{aprt}$ | X (cm) | | — | — | 1.5 | 0.8 | 2.0 |
| | | Y (cm) | | — | — | 0.8 | 0.8 | 0.8 |
| Other Information | PD | (µsec) | 0.64 | | | | | |
| | PRF | (Hz) | 3125 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 2.30 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.22 | |
| | Focal Length | $FL_x$ (cm) | | — | — | 7 | | 10 |
| | | $FL_y$ (cm) | | — | — | 5 | | 5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 132.9 | | | | | |
| Operating Control Conditions | Control 1: Frequency | | 4.71 MHz | | | 4.71 MHz | 4.71 MHz | 4.71 MHz |
| | Control 2: PRF | | 3125 Hz | | | 5000 Hz | 9091 Hz | 5000 Hz |
| | Control 3: Sample Volume Position | | 4.0 cm | | | 7.0 cm | 4.0 cm | 10 cm |
| | Control 4: | | | | | | | |
| | Control 5: | | | | | | | |

**Table 10-55: Transducer Model: C35xp** **Operating Mode: 2D/PW Doppler**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.7 | — | 0.6 | 1.5 | 1.3 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.75 | | | | | |
| | $W_0$ | (mW) | | 27.2 | — | | 40.4 | 75.9 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 27.5 | | |
| | $z_1$ | (cm) | | | | 1.9 | | |
| | $z_{bp}$ | (cm) | | | | 1.8 | | |
| | $z_{sp}$ | (cm) | | | | | 3.4 | |
| | $z@PII_{.3max}$ | | 3.3 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.25 | |
| | $f_c$ | (MHz) | 3.65 | 5.43 | — | 4.52 | 3.63 | 4.61 |
| | Dim of $A_{aprt}$ | X (cm) | | 3.6 | — | 1.5 | 1.1 | 2.0 |
| | | Y (cm) | | 0.8 | — | 0.8 | 0.8 | 0.8 |
| Other Information | PD | (µsec) | 0.38 | | | | | |
| | PRF | (Hz) | 474 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.93 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.24 | |
| | Focal Length | $FL_x$ (cm) | | 9 | — | 7 | | 10 |
| | | $FL_y$ (cm) | | 5 | — | 5 | | 5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 193.4 | | | | | |
| Operating Control Conditions | Control 1: 2D Frequency / THI | | 8 MHz / On | 6 MHZ / Off | | 6 MHz / Off | 8 MHz / On | 8 MHz / Off |
| | Control 2: PW Frequency | | 4.71 MHz | 3.64 MHz | | 4.71 MHz | 3.64 MHz | 4.71 MHz |
| | Control 3: PW PRF | | 3125 Hz | 2000 Hz | | 5000 Hz | 3125 Hz | 5000 Hz |
| | Control 4: PW Sample Volume Position | | 4.0 cm | 9.0 cm | | 7.0 cm | 5.0 cm | 10 cm |
| | Control 5: | | | | | | | |

**Table 10-56: Transducer Model: C35xp** **Operating Mode: 2D/Color/PW Doppler (Triplex)**

| Index Label | | | M.I. | TIS | | | TIB | TIC |
|---|---|---|---|---|---|---|---|---|
| | | | | Scan | Non-scan | | Non-scan | |
| | | | | | $A_{aprt} \leq 1$ | $A_{aprt} > 1$ | | |
| Global Maximum Index Value | | | 0.9 | 0.3 | — | 0.6 | 1.2 | 1.5 |
| Associated Acoustic Parameter | $p_{r.3}$ | (MPa) | 1.75 | | | | | |
| | $W_0$ | (mW) | | 12.6 | — | | 32.6 | 90.3 |
| | min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ | (mW) | | | | 27.5 | | |
| | $z_1$ | (cm) | | | | 1.9 | | |
| | $z_{bp}$ | (cm) | | | | 1.8 | | |
| | $z_{sp}$ | (cm) | | | | | 3.1 | |
| | $z@PII_{.3max}$ | | 3.3 | | | | | |
| | $d_{eq}(z_{sp})$ | (cm) | | | | | 0.23 | |
| | $f_c$ | (MHz) | 3.65 | 4.59 | — | 4.52 | 4.66 | 4.61 |
| | Dim of $A_{aprt}$ | X (cm) | | 2.7 | — | 1.5 | 0.8 | 2.0 |
| | | Y (cm) | | 0.8 | — | 0.8 | 0.8 | 0.8 |
| Other Information | PD | (µsec) | 0.38 | | | | | |
| | PRF | (Hz) | 290 | | | | | |
| | $p_r@PII_{max}$ | (MPa) | 1.93 | | | | | |
| | $d_{eq}@PII_{max}$ | (cm) | | | | | 0.22 | |
| | Focal Length | $FL_x$ (cm) | | 10 | — | 7 | | 10 |
| | | $FL_y$ (cm) | | 5 | — | 5 | | 5 |
| | $I_{PA.3}@MI_{max}$ | (W/cm²) | 193.4 | | | | | |
| Operating Control Conditions | Control 1: 2D Frequency / THI | | 8 MHZ / On | 8 MHz / Off | | 6 MHz / Off | 8 MHz / On | 8 MHz / Off |
| | Control 2: Color Frequency | | 3.64 MHz | 4.71 MHz | | 3.64 MHz | 3.64 MHz | 4.71 MHz |
| | Control 3: PW Frequency | | 4.71 MHz | 4.71 MHz | | 3.64 MHz | 3.64 MHz | 4.71 MHz |
| | Control 4: PW PRF | | 3125 Hz | 5000 Hz | | 5000 Hz | 9091 Hz | 5000 Hz |
| | Control 5: PW Sample Volume Position | | 4.0 cm | 10 cm | | 7.0 cm | 4.0 cm | 10 cm |

# Terms used in the acoustic output tables

**Table 10-57: Acoustic output terms and definitions**

| Term | Definition |
|---|---|
| $I_{spta.3}$ | Derated spatial peak, temporal average intensity in units of milliwatts/cm². |
| TI type | Applicable thermal index for the transducer, imaging mode, and exam type. |
| TI value | Thermal index value for the transducer, imaging mode, and exam type. |
| MI | Mechanical index. |
| $I_{pa.3}$@MImax | Derated pulse average intensity at the maximum MI in units of W/cm². |
| TIS | (Soft-tissue thermal index) is a thermal index related to soft tissues. TIS scan is the soft-tissue thermal index in an auto-scanning mode. TIS non-scan is the soft-tissue thermal index in the non-autoscanning mode. |
| TIB | (Bone thermal index) is a thermal index for applications in which the ultrasound beam passes through soft tissue, and a focal region is in the immediate vicinity of bone. TIB non-scan is the bone thermal index in the non-autoscanning mode. |
| TIC | (Cranial bone thermal index) is the thermal index for applications in which the ultrasound beam passes through bone near the beam entrance into the body. |
| $A_{aprt}$ | Area of the active aperture measured in cm². |
| $P_{r.3}$ | Derated peak rarefactional pressure associated with the transmit pattern, giving rise to the value reported under MI (megapascals). |
| Wo | Ultrasonic power, except for TISscan, in which case it is the ultrasonic power passing through a one-centimeter window in units of milliwatts. |
| $W_{.3}(z_1)$ | Derated ultrasonic power at axial distance z1 in units of milliwatts. |
| $I_{SPTA.3}(z_1)$ | Derated spatial-peak temporal-average intensity at axial distance z1 (milliwatts per square centimeter). |
| z1 | Axial distance corresponding to the location of maximum [min(W.3(z), ITA.3(z) x 1 cm²)], where z > zbp in centimeters. |
| zbp | 1.69 $\sqrt{(A_{aprt})}$ in centimeters. |
| $z_{sp}$ | For MI, the axial distance at which pr.3 is measured. For TIB, the axial distance at which TIB is a global maximum (for example, zsp = zb.3) in centimeters. |

**Table 10-57: Acoustic output terms and definitions**

| Term | Definition |
|---|---|
| $d_{eq}(z)$ | Equivalent beam diameter as a function of axial distance z, and equal to $\sqrt{(4/(\pi))((Wo)/(I_{TA}(z)))}$, where ITA(z) is the temporal-average intensity as a function of z in centimeters. |
| fc | Center frequency in MHz. |
| Dim. of $A_{aprt}$ | Active aperture dimensions for the azimuthal (x) and elevational (y) planes in centimeters. |
| PD | Pulse duration (microseconds) associated with the transmit pattern, giving rise to the reported value of MI. |
| PRF | Pulse repetition frequency associated with the transmit pattern, giving rise to the reported value of MI in Hertz. |
| $pr@PII_{max}$ | Peak rarefactional pressure at the point where the free-field, spatial-peak pulse intensity integral is a maximum in megapascals. |
| $d_{eq}@PII_{max}$ | Equivalent beam diameter at the point where the free-field, spatial-peak pulse intensity integral is a maximum in centimeters. |
| FL | Focal length, or azimuthal (x) and elevational (y) lengths; if different, measured in centimeters. |

# Acoustic measurement precision and uncertainty

All table entries have been obtained at the same operating conditions that give rise to the maximum index value in the first column of the table. Measurement precision and uncertainty for power, pressure, intensity, and other quantities that are used to derive the values in the acoustic output table are shown in the table below. In accordance with Section 6.4 of the Output Display Standard, the following measurement precision and uncertainty values are determined by making repeated measurements and stating the standard deviation as a percentage.

**Table 10-58: Acoustic measurement precision and uncertainty**

| Quantity | Precision (% of standard deviation) | Uncertainty (95% confidence) |
|---|---|---|
| Pr | 1.9% | +11.2% |
| $Pr_{.3}$ | 1.9% | +12.2% |
| Wo | 3.4% | +10% |
| fc | 0.1% | +4.7% |

**Table 10-58: Acoustic measurement precision and uncertainty**

| Quantity | Precision (% of standard deviation) | Uncertainty (95% confidence) |
|---|---|---|
| PII | 3.2% | +12.5 to -16.8% |
| $PII_{.3}$ | 3.2% | +13.47 to -17.5% |

# Terms

For ultrasound terms not included in this glossary, see *Recommended ultrasound terminology*, Third Edition, published in 2011 by the American Institute of Ultrasound in Medicine (AIUM).

**Table 10-59: Terms and definitions**

| Terms | Definitions |
|---|---|
| **as low as reasonably achievable (ALARA)** | The guiding principle of ultrasound use, which states that you should keep patient exposure to ultrasound energy as low as is reasonably achievable for diagnostic results. |
| **caliper** | One of the points used to define a measurement. |
| **curved array transducer** | Identified by the letter C (curved or curvilinear) and a number (60). The number corresponds to the radius of curvature of the array expressed in millimeters. The transducer elements are electrically configured to control the characteristics and direction of the acoustic beam. For example, C60xf. |
| **depth** | Refers to the depth of the display. A constant speed of sound of 1530 meters/second is assumed in the calculation of echo position in the image. |
| **in situ** | In the natural or original position. |
| **LCD** | Liquid crystal display. |
| **linear array transducer** | Identified by the letter L (linear) and a number (38). The number corresponds to the radius of width of the array, expressed in millimeters. The transducer elements are electrically configured to control the characteristics and direction of the acoustic beam. For example, L38xp. |
| **mechanical index (MI)** | An indication of the likelihood of mechanical bioeffects occurring: the higher the MI, the greater the likelihood of mechanical bioeffects. |
| **MI/TI** | See mechanical index (MI) above and Thermal index (TI) below in this list. |
| **NTSC** | National Television Standards Committee. A video format setting. See also PAL below in this list. |

**Table 10-59: Terms and definitions**

| Terms | Definitions |
|---|---|
| **PAL** | Phase Alternating Line. A video format setting. See also NTSC above in this list. |
| **phased array** | A transducer designed primarily for cardiac scanning. Forms a sector image by electronically steering the beam direction and focus. |
| **skinline** | A depth on the display that corresponds to the skin/transducer interface. |
| **Tissue Doppler Imaging** | A pulsed-wave Doppler technique used to detect myocardial motion. |
| **thermal index (TI)** | The ratio of total acoustic power to the acoustic power required to raise tissue temperature by 1°C under defined assumptions. |
| **TIB (bone thermal index)** | A thermal index for applications in which the ultrasound beam passes through soft tissue and a focal region is in the immediate vicinity of bone. |
| **TIC (cranial bone thermal index)** | A thermal index for applications in which the ultrasound beam passes through bone near the beam entrance into the body. |
| **TIS (soft tissue thermal index)** | A thermal index related to soft tissues. |
| **Tissue Harmonic Imaging** | Transmits at one frequency and receives at a higher harmonic frequency to reduce noise and clutter and improve resolution. |
| **transducer** | A device that transforms one form of energy into another form of energy. Ultrasound transducers contain piezoelectric elements, which when excited electrically, emit acoustic energy. When the acoustic energy is transmitted into the body, it travels until it encounters an interface, or change in tissue properties. At the interface, an echo is formed that returns to the transducer, where this acoustic energy is transformed into electrical energy, processed, and displayed as anatomical information. |
| **variance** | Displays a variation in Color Doppler flow imaging within a given sample. Variance is mapped to the color green and is used to detect turbulence. |

# Abbreviations

**Table 10-60: Abbreviations in user interface**

| Abbreviation | Definition |
|---|---|
| +/× | "+" Caliper/"×" Caliper Ratio |
| A | "A" Wave Peak Velocity |
| A PG | "A" Wave Peak Pressure Gradient |
| A2Cd | Apical 2 Chamber diastolic |
| A2Cs | Apical 2 Chamber systolic |
| A4Cd | Apical 4 Chamber diastolic |
| A4Cs | Apical 4 Chamber systolic |
| AAA | Abdominal Aortic Aneurysm |
| AAo | Ascending Aorta |
| Abd | Abdomen |
| abs | absolute value |
| AC | Abdominal Circumference |
| ACA | Anterior Cerebral Artery |
| ACC | Acceleration Index |
| ACO | Automatic Cardiac Output |
| ACoA | Anterior Communicating Artery |
| Adur | "A" wave duration |
| AFI | Amniotic Fluid Index |
| AI | Aortic Insufficiency |
| AI PHT | Aortic Insufficiency Pressure Half Time |
| AL | Atlas Loop |
| Ann D | Annulus Diameter |
| ANT F | Anterior Far |
| ANT N | Anterior Near |

**Table 10-60: Abbreviations in user interface**

| Abbreviation | Definition |
|---|---|
| Ao | Aorta |
| AoD | Aortic Root Diameter |
| Apical | Apical View |
| APTD | Anteroposterior Trunk Diameter |
| AT | Acceleration (Deceleration) Time |
| AUA | Average Ultrasound Age<br>Calculated by averaging the individual ultrasound ages for the fetal biometry measurements performed during the exam. The measurements used to determine the AUA are based on the selected OB calculation authors. |
| AV | Aortic Valve |
| AV Area | Aortic Valve Area |
| AVA | Aortic Valve Area |
| BA | Basilar Artery |
| Bifur | Bifurcation |
| BP | Blood Pressure |
| BPD | Biparietal Diameter |
| BPM | Beats per Minute |
| Bre | Breast |
| BSA | Body Surface Area |
| CCA | Common Carotid Artery |
| CI | Cardiac Index |
| CM | Cisterna Magna |
| CO | Cardiac Output |
| CPD | Color Power Doppler |
| Crd | Cardiac |
| CRL | Crown Rump Length |

**Table 10-60: Abbreviations in user interface**

| Abbreviation | Definition |
|---|---|
| CW | Continuous Wave Doppler |
| CxLen | Cervix Length |
| D | Diameter |
| DCCA | Distal Common Carotid Artery |
| DECA | Distal External Carotid Artery |
| DICA | Distal Internal Carotid Artery |
| Dist | Distal |
| dP/dt | Delta Pressure: Delta Time |
| E | "E" Wave Peak Velocity |
| E PG | "E" Wave Peak Pressure Gradient |
| E/A | E:A Ratio |
| E/e' | E velocity = Mitral Valve E velocity divided by the annular e' velocity |
| ECA | External Carotid Artery |
| ECG | Electrocardiogram |
| ECICA | Extracranial Internal Carotid Artery |
| ECVA | Extracranial Vertebral Artery |
| EDD | Estimated Date of Delivery |
| EDD by AUA | Estimated Date of Delivery by Average Ultrasound Age<br>The estimated date of delivery calculated from the measurements performed during the exam. |
| EDD by LMP | Estimated Date of Delivery by Last Menstrual Period<br>The due date calculated from the user-entered LMP. |
| EDV | End Diastolic Velocity |
| EF | Ejection Fraction |
| EF slope | E-F Slope |

**Table 10-60: Abbreviations in user interface**

| Abbreviation | Definition |
|---|---|
| EFW | Estimated Fetal Weight<br>Calculated from the measurements performed during the exam. The measurements used to determine EFW are defined by the currently selected EFW calculation author. |
| Endo | Endocardial |
| Epi | Epicardial |
| EPSS | "E" Point Septal Separation |
| Estab. DD | Established Due Date<br>A user-entered due date based on previous exam data or other available information. The LMP is derived from the Established Due Date and is listed in the patient report as LMPd. |
| ET | Elapsed Time |
| FH | Femoral Head |
| FHR | Fetal Heart Rate |
| FL | Femur Length |
| FM (Right and Left) | Foramen Magnum (same as SO) |
| FTA | Fetal Trunk Area |
| GA | Gestational Age |
| GA by LMP | Gestational Age by Last Menstrual Period<br>The fetal age calculated using the date of the Last Menstrual Period (LMP). |
| GA by LMPd | Gestational Age by derived Last Menstrual Period<br>The fetal age calculated using the Last Menstrual Period (LMPd) derived from the Estab. DD. |
| Gate | Depth of Doppler Gate |
| GS | Gestational Sac |
| Gyn | Gynecology |
| HC | Head Circumference |
| HL | Humerus Length |

**Table 10-60: Abbreviations in user interface**

| Abbreviation | Definition |
|---|---|
| HR | Heart Rate |
| ICA | Internal Carotid Artery |
| IMT | Intima Media Thickness |
| IVRT | Iso Volumic Relaxation Time |
| IVS | Interventricular Septum |
| IVSd | Interventricular Septum Thickness, End Diastole |
| IVSFT | Interventricular Septum Fractional Thickening |
| IVSs | Interventricular Septum Thickness, End Systole |
| LA | Left Atrium |
| LA/Ao | Left Atrium/Aorta Ratio |
| LAT F | Lateral Far |
| LAT N | Lateral Near |
| Lat V | Lateral Ventricle |
| LMP | Last Menstrual Period<br>The first day of the last menstrual period. Used to calculate gestational age and EDD. |
| LMPd | derived Last Menstrual Period<br>Calculated from the user-entered Estab. DD. |
| LV | Left Ventricular |
| LV Area | Left Ventricular Area |
| LV mass | Left Ventricular mass |
| LV Volume | Left Ventricular Volume |
| LVd | Left Ventricular diastolic |
| LVD | Left Ventricular Dimension |
| LVDd | Left Ventricular Dimension, End Diastole |
| LVDFS | Left Ventricular Dimension Fractional Shortening |
| LVDs | Left Ventricular Dimension, End Systole |

**Table 10-60: Abbreviations in user interface**

| Abbreviation | Definition |
|---|---|
| LVEDV | Left Ventricular End Diastolic Volume |
| LVESV | Left Ventricular End Systolic Volume |
| LVET | Left Ventricular Ejection Time |
| LVO | Left Ventricular Opacification |
| LVOT | Left Ventricular Outflow Tract |
| LVOT Area | Left Ventricular Outflow Tract Area |
| LVOT D | Left Ventricular Outflow Tract Diameter |
| LVOT VTI | Left Ventricular Outflow Tract Velocity Time Integral |
| LVPW | Left Ventricular Posterior Wall |
| LVPWd | Left Ventricular Posterior Wall Thickness, End Diastole |
| LVPWFT | Left Ventricular Posterior Wall Fractional Thickening |
| LVPWs | Left Ventricular Posterior Wall Thickness, End Systole |
| LVs | Left Ventricular systolic |
| MCA | Middle Cerebral Artery |
| MCCA | Mid Common Carotid Artery |
| MECA | Mid External Carotid Artery |
| MI | Mechanical Index |
| MICA | Mid Internal Carotid Artery |
| Mid | Middle |
| MM | M Mode |
| MR PISA | Mitral Regurgitation Proximal Iso Velocity Surface Area |
| MR/VTI | Mitral Regurgitation/Velocity Time Integral |
| Msk | Musculoskeletal |
| MV | Mitral Valve |
| MV Area | Mitral Valve Area |

**Table 10-60: Abbreviations in user interface**

| Abbreviation | Definition |
|---|---|
| MV Regurgitant Fraction | Mitral Valve Regurgitant Fraction |
| MV Regurgitant Volume | Mitral Valve Regurgitant Volume |
| MV/VTI | Mitral Valve/Velocity Time Integral |
| MVA | Mitral Valve Area |
| MV ERO | Mitral Valve Effective Regurgitant Orifice |
| MV PISA Area | Mitral Valve Proximal Iso Velocity Surface Area |
| MV Rate | Mitral Valve Rate |
| Neo | Neonatal |
| Nrv | Nerve |
| NST | Non-stress test |
| NTSC | National Television Standards Committee |
| OB | Obstetrical |
| OFD | Occipital Frontal Diameter |
| PAL | Phase Alternating Line |
| PCAp | Posterior Cerebral Artery Peak |
| PCCA | Proximal Common Carotid Artery |
| PCoA | Posterior Communicating Artery |
| PECA | Proximal External Carotid Artery |
| PGmax | Maximum Pressure Gradient |
| PGmean | Mean Pressure Gradient |
| PGr | Pressure Gradient |
| PHT | Pressure Half Time |
| PI | Pulsatility Index |
| PICA | Proximal Internal Carotid Artery |

**Table 10-60: Abbreviations in user interface**

| Abbreviation | Definition |
|---|---|
| PISA | Proximal Isovelocity Surface Area |
| Plaq | Plaque |
| POST F | Posterior Far |
| POST N | Posterior Near |
| PRF | Pulse Repetition Frequency |
| Prox | Proximal |
| PSV | Peak Systolic Velocity |
| PV | Pulmonic Valve |
| P. Vein | Pulmonary Vein |
| PW | Pulsed Wave Doppler |
| Qp/Qs | Pulmonary blood flow divided by systemic blood flow |
| RA | Right Atrial (pressure) |
| RI | Resistance Index |
| RVD | Right Ventricular Dimension |
| RVDd | Right Ventricular Diameter, Diastole |
| RVDs | Right Ventricular Diameter, Systole |
| RVOT D | Right Ventricular Outflow Tract Diameter |
| RVOT VTI | Right Ventricular Outflow Tract Velocity Time Integral |
| RVSP | Right Ventricular Systolic Pressure |
| RVW | Right Ventricular Free Wall |
| RVWd | Right Ventricular Free Wall, Diastole |
| RVWs | Right Ventricular Free Wall, Systole |
| S/D | Systolic/Diastolic Ratio |
| SFV | Superficial Femoral Vein |
| SI | Stroke Index |

**Table 10-60: Abbreviations in user interface**

| Abbreviation | Definition |
|---|---|
| Siphon | Siphon (internal carotid artery) |
| SM | Submandibular |
| SmP | Small Parts |
| SO | Suboccipital |
| Sup | Superficial |
| SV | Stroke Volume |
| TAM | Time Average Mean |
| TAP | Time Average Peak |
| TCD | Trans-cerebellum Diameter (OB measurement)<br>Transcranial Doppler (exam type) |
| TDI | Tissue Doppler Imaging |
| THI | Tissue Harmonic Imaging |
| TI | Thermal Index |
| TICA | Terminal Internal Carotid Artery |
| TRmax | Tricuspid Regurgitation (peak velocity) |
| TT | Transtemporal |
| TTD | Transverse Trunk Diameter |
| TV | Tricuspid Valve |
| TVA | Tricuspid Valve Area |
| UA | Ultrasound Age<br>Calculated on the mean measurements taken for a particular fetal biometry |
| Umb A | Umbilical Artery |
| VA | Vertebral Artery |
| Vert A | Vertebral Artery |
| Vas | Vascular |
| Ven | Venous |

**Table 10-60: Abbreviations in user interface**

| Abbreviation | Definition |
|---|---|
| VF | Volume Flow |
| Vmax | Peak Velocity |
| Vmean | Mean Velocity |
| Vol | Volume |
| VTI | Velocity Time Integral |
| YS | Yolk Sac |

CHAPTER 11

# Chapter 11: IT network

## Functions

This device can be connected to an IT network to perform the following functions.

- The examination data (still images, clips) acquired with this device can be stored in PACS (Picture Archiving and Communication System) by DICOM communication.
- This device can receive examination orders from HIS (Hospital Information System)/RIS (Radiology Information System) by DICOM communication and start them.
- The time of this device can be set correctly by checking the NTP server that is based on NTP (Network Time Protocol).

## Network for connecting the device

To ensure safety, use an IT network that is isolated from the external environment by a firewall.

## Specification for the connection

### Hardware specification

- Specification: 100BASE-TX/10BASE-T
- Connector: RJ45
- Connection cable: UTP type, straight LAN cable, Category 5/5e (CAT 5/5E)

### Software specification

- This device is connected to PACS and HIS/RIS by DICOM standard. Refer to the DICOM Conformance Statement of this device for details.
- This device is connected to NTP server by NTP (RFC 5905). The time acquisition from NTP server is done every time at startup of this device.

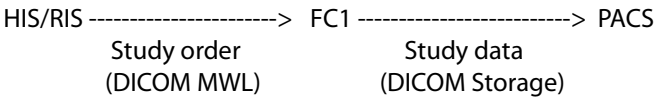
# Security

- This device uses the following ports in the application level (the seventh layer of OSI model). All other ports are closed.
  - Port for DICOM communication
  - It is the port number specified in the system setting by user.
  - Port for the device maintenance
  - TCP/22222, TCP/50100 and TPC/55555. How to use these ports is undisclosed and inadvertent access from the outside is prevented by use of ID/Password/Special-protocol.

This device prevents users from loading software and executing it. Software that is not within the specification of this device, such as Web browser and e-mail is not installed in this device. The anti-virus software is not installed in this device.

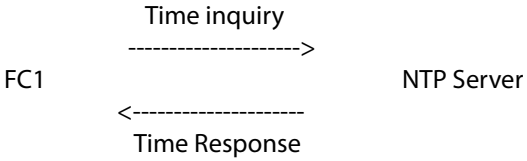
# Data flow

**1** DICOM




*Please refer to the DICOM Conformance Statement for FC1 for details.

**2** NTP



# Measures when failures occur in IT networks

Connection to an IT Network may become at times unreliable, and this may lead to failure to perform the functions described in section 21.1. As a result, the following hazardous situations may occur:

**Table 11-1: Network failure risks and mitigation**

| Failure of the IT-Network | Impact on the equipment | Hazardous Situation | Countermeasures of FC1 (for your reference) |
|---|---|---|---|
| IT-Network has become unstable. | Unable to transmit exam data to a PACS.<br>Delay of transmission of exam data to a PACS. | Delay of diagnosis. | FC1 has internal memory and exam data is stored in it. After IT-Network has returned to stable, FC1 will start to transmit exam data automatically. |
| | Incorrect data to a PACS. | Misdiagnosis | FC1 uses TCP/IP and DICOM Protocol. Integrity of the data is ensured by them. |
| IT-Network has become unstable. | Unable to get order data from a HIS/RIS.<br>Delay of getting order data from a HIS/RIS. | Delay of exam. | FC1 has capability of entering order data by itself. |
| | Incorrect data from a HIS/RIS. | Incorrect exam. | FC1 uses TCP/IP and DICOM Protocol. Integrity of the data is ensured by them. |
| IT-Network has become unstable. | Unable to get the time from an NTP server. | Incorrect exam data | FC1 has capability of entering data and time by itself. |
| | | Incorrect time data. | FC1 always indicates the date and the time on the main screen. |

**Table 11-1: Network failure risks and mitigation**

| Failure of the IT-Network | Impact on the equipment | Hazardous Situation | Countermeasures of FC1 (for your reference) |
|---|---|---|---|
| Firewall has broken down. | Attack via network.<br>Infection by computer viruses. | Manipulation of exam data.<br>Leak of exam data. | FC1 closes unnecessary network ports.<br>FC1 protects network ports for device maintenance purpose by dedicated network protocol, ID and password.<br>FC1 prevent a user from loading software and executing it. |

# Warnings and cautions for IT networks

**WARNING**

Connection of equipment to an IT network that includes other systems, could result in previously unidentified risks to patients, operators or third parties. Before connecting the equipment to an uncontrolled IT Network, make sure that all potential risks resulting from such connections, were identified and evaluated, and suitable countermeasures were put in place. IEC 80001-1:2010 provides guidance for addressing these risks.

**WARNING**

When the setting of the IT network to which this device is connected has been changed, check that the change does not affect this device and take measures if necessary. Changes to the IT network include:

- Changes in network configuration (IP address, router, etc.)
- Connection of additional items
- Disconnection of items
- Update of equipment
- Upgrade of equipment

Any changes to the IT network could introduce new risks requiring additional evaluation to be performed.

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