Technical Publications

Vivid T8/Vivid T8 Pro

Version R1.x.x

CE 0197

User Manual

5487003-100 — English

Rev. 04

Operating Documentation

Regulatory requirement

This product complies with regulatory requirements of the following European Directive 93/42/EEC concerning medical devices.

CE 0197

This manual is a reference for the Vivid T8/Vivid T8 Pro. It applies to all versions of the R1.x.x software for the Vivid T8/Vivid T8 Pro ultrasound system.

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Revision History

Reason for Change

REV	DATE(YYYY/MM/DD)	REASON FOR CHANGE
Rev. 01	2013/07/10	Initial release
Rev. 02	2014/03/20	Update software functions
Rev. 03	2014/04/15	Update the system applications
Rev. 04	2014/06/12	Update rating plate label and add cTUVus label

List of Effective Pages

SECTION NUMBER	REVISION NUMBER	SECTION NUMBER	REVISION NUMBER
Title Page	Rev. 04	Chapter 7	Rev. 04
Revision History	Rev. 04	Chapter 8	Rev. 04
Regulatory Requirements	Rev. 04	Chapter 9	Rev. 04
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Chapter 1	Rev. 04	Chapter 11	Rev. 04
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Chapter 6	Rev. 04	Index	Rev. 04

Please verify that you are using the latest revision of this document. Information pertaining to this document is maintained on MyWorkshop/ePDM (GE electronic Product Data Management). If you need to know the latest revision, contact your distributor, local GE Sales Representative or in the USA call the GE Ultrasound Clinical Answer Center at 1 800 682 5327 or 1 262 524 5698.

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Regulatory Requirements

Conformance Standards

The following classifications are in accordance with the IEC/EN 60601-1:

- According to 93/42/EEC Medical Device Directive, this is Class IIa Medical Device.
- According to IEC/EN 60601-1,
  - Equipment is Class I, Type BF or CF Applied Parts.
  - Continuous Operation
- According to CISPR 11,
  - Equipment is Group 1, Class A ISM Equipment.
- According to IEC 60529,
  - The footswitch rate IPx8 is suitable for use in surgical rooms.
  - Probe head (immersible portion) is IPX7

    Probe connector is not waterproof.

    System is Ordinary Equipment (IPX0).

This product complies with the regulatory requirement of the following:

- Council Directive 93/42/EEC concerning medical devices: the CE label affixed to the product testifies compliance to the Directive.

  The location of the CE marking is shown in the Safety chapter of this manual.

  Authorized EU Representative

EC REP

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Conformance Standards (continued)

- International Electrotechnical Commission (IEC).
  - IEC/EN 60601-1 Medical Electrical Equipment, Part 1 General Requirements for Safety.
  - IEC/EN 60601-1-2 Electromagnetic compatibility - Requirements and tests.
  - IEC/EN 60601-1-6 (Usability), EN 1041 (Information supplied with medical devices)
  - IEC/EN 60601-2-37 Particular requirements for the safety of ultrasonic medical diagnostic and monitoring equipment.
- International Organization of Standards (ISO)
  - ISO 10993-1 Biological evaluation of medical devices.
- ANSI/AAMI ES60601-1 Medical Electrical Equipment, Part 1 General Requirements for Safety .
- Canadian Standards Association (CSA).
  - CSA 22.2, 601.1 Medical Electrical Equipment, Part 1 General Requirements for Safety.
- NEMA/AIUM Acoustic Output Display Standard (NEMA UD3).
- Medical Device Good Manufacturing Practice Manual issued by the FDA (Food and Drug Administration, Department of Health, USA).

Certifications

- General Electric Medical Systems is ISO 9001 and ISO 13485 certified.

Original Documentation

- The original document was written in English.

Country Specific Approvals

- JAPAN

  MHLW Approved Number:

Importer Information

Turkey

İTHALATÇI
PENTA ELEKTRONİK MEDİKAL
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HOŞDERE CAD. FUAR SOK. 5 / 3
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Table of Contents

Chapter 1

Introduction

The Vivid T8/Vivid T8 Pro ultrasound unit is a high performance digital ultrasound imaging system with total data management.

The system provides image generation in 2D (B) Mode, Color Doppler, Power Doppler (Angio), M-Mode, Color M-Mode, PW and CW Doppler spectral, Tissue Velocity imaging, advanced Strain and Contrast applications.

The fully digital architecture of the Vivid T8/Vivid T8 Pro unit allows optimal usage of all scanning modes and probe types, throughout the full spectrum of operating frequencies.

Overview

Attention

Read and understand all instructions in the User's Manual before attempting to use the ultrasound unit. Keep the manual with the equipment at all time. Periodically review the procedures for operation and safety precautions.

For USA only:

United States law restricts this device to sale or use by, or on the order of a physician.

Safety

All information in Chapter 'Safety' on *page 14-1*, should be read and understood before operating the ultrasound unit.

Interference caution

Use of devices that transmit radio waves near the unit could cause it to malfunction.

Devices which intrinsically transmit radio waves such as cellular phones, radio transceivers, mobile radio transmitters, radio-controlled toys, and so on, should preferably not be operated near the unit. See 'Minimum Distance' on *page 14-19* about the recommended minimum separation distances between portable and mobile RF communications equipment and the ultrasound unit.

Medical staff in charge of the unit are required to instruct technicians, patients, and other people who may be around the unit, to fully comply with the above recommendations.

Documentation

Safety instructions must be reviewed before operating the unit.

Vivid T8/Vivid T8 Pro documentation consists of various manuals:

- The User Manual (TRANSLATED) and User Guide (ENGLISH ONLY) provide information needed by the operator to operate the system safely. They describe the basic functions of the system, safety features, operating modes, measurements/calculations, probes, user care and maintenance.
- The Release Notes (TRANSLATED) provide precautions and instructions that supplement the Basic User Manual.
- The Advanced Reference Manual (TRANSLATED) contains data tables, such as Obstetrics (OB) and Acoustic Output tables.
- The Service Manual (ENGLISH ONLY) supplies block diagrams, lists of spare parts, descriptions, adjustment instructions or similar information which helps qualified technical personnel in repairing those parts of the system which have been defined as repairable.
- AIUM Booklet (USA only)

NOTE: The Electronic Documentation CD includes English and all translations.

The Vivid T8/Vivid T8 Pro manuals are written for operators who are familiar with basic ultrasound principles and techniques. They do not include sonographic training or detailed clinical procedures.

NOTE: The screen graphics in this manual are only for illustrational purposes. Actual screen output may differ.

NOTE: Probe information displayed on screen examples does not necessarily reflect the probes available on your ultrasound system. Please refer to the Probes chapter for a listing of available probes and features.

Principles of Operation

Medical ultrasound images are created by computer and digital memory from the transmission and reception of mechanical high-frequency waves applied through a transducer. The mechanical ultrasound waves spread through the body, producing an echo where density changes occur. For example, in the case of human tissue, an echo is created where a signal passes from an adipose tissue (fat) region to a muscular tissue region. The echoes return to the transducer where they are converted back into electrical signals.

These echo signals are highly amplified and processed by several analog and digital circuits having filters with many frequency and time response options, transforming the high-frequency electrical signals into a series of digital image signals which are stored in memory. Once in memory, the image can be displayed in real-time on the image monitor. All signal transmission, reception and processing characteristics are controlled by the main computer. By selection from the system control panel, the operator can alter the characteristics and features of the system, allowing a wide range of uses, from obstetrics to peripheral vascular examinations.

Transducers are accurate, solid-state devices, providing multiple image formats. The digital design and use of solid-state components provides highly stable and consistent imaging performance with minimal required maintenance. Sophisticated design with computer control offers a system with extensive features and functions which is user-friendly and easy to use.

Indications for use

The Vivid T8/Vivid T8 Pro is intended for use by a qualified physician or sonographer for ultrasound evaluation.

The Vivid T8/Vivid T8 Pro is intended for ultrasound imaging, measurement and analysis of the human body for multiple clinical applications including: Fetal/OB, Abdominal, Pediatric, Small Organ, Cardiac, Peripheral Vascular, Adult Cephalic, Neonatal Cephalic, Musculoskeletal Superficial/Conventional, Transcranial, Transrectal, Transvaginal and Transesophageal.

This machine should be used in compliance with law. Some jurisdictions restrict certain uses, such as gender determination.

Operator Profile

- Qualified and trained physicians or sonographers with at least basic ultrasound knowledge.
- The operator must have read and understood the user manual.

Contraindications

The ultrasound unit is not intended for ophthalmic use or any use causing the acoustic beam to pass through the eye.

Prescription Device

CAUTION: United States law restricts this device to sale or use by, or on the order of a physician.

Manual contents

The User's Manual is organized to provide the information needed to start scanning immediately.

The safety instruction must be reviewed before operation of the unit.

NOTE: Not all features, products, probes or peripherals described in this document may be available or cleared for sale in all markets. Please contact your local GE Ultrasound representative to get the latest information.

Finding information

Table of Contents, lists the main topics and their location.

Headers and Footers, give the chapter name and page number.

Index, provides an alphabetical and contextual list of topics.

Conventions used in this manual

Buttons and other controls on the Touch panel or on the monitor screen are indicated by bold type.

Program windows, *screens* and *Dialogue boxes* are indicated by italic type.

The following icons, highlight safety issues as follow:


DANGER

Indicates that a specific hazard exists that, given inappropriate conditions or actions, will cause severe or fatal personal injury with or without substantial property damage.


WARNING

Indicates that a specific hazard exists that, given inappropriate conditions or actions, can cause severe or fatal personal injury with or without substantial property damage.


CAUTION

Indicates that a potential hazard may exist that, given inappropriate conditions or actions, can cause minor injury or property damage.

Contact Information

Contacting GE Ultrasound

For additional information or assistance, please contact your local distributor or the appropriate support resource listed on the following pages:

INTERNET

http://www.gehealthcare.com

http://www.gehealthcare.com/usen/ultrasound/products/probe_care.html

Clinical Questions

For information in the United States, Canada, Mexico and parts of the Caribbean, call the Customer Answer Center.
TEL: (1) 800-682-5327 or (1) 262-524-5698

In other locations, contact your local Applications, Sales, or Service Representative.

Service Questions

For service in the United States, call GE CARES.

TEL: (1) 800-437-1171

In other locations, contact your local Service Representative.

Information Requests

To request technical product information in the United States, call GE.

TEL: (1) 800-643-6439

In other locations, contact your local Applications, Sales, or Service Representative.

Placing an Order

To order accessories, supplies, or service parts in the United States, call the GE Technologies Contact Center.

TEL: (1) 800-558-5102

In other locations, contact your local Applications, Sales, or Service Representative.

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Chapter 2

Getting started

This chapter describes:

Introduction

Only qualified physicians or ultrasound sonographers should perform scans of patients for medical diagnostic reasons. Request training, if needed. Ensure that unauthorized personnel do not tamper with the unit.

Service representatives authorized by GE Ultrasound will unpack and install the unit. Do not attempt to install the unit alone.

All the warnings in Chapter **'Safety' on *page 14-1***, should be read and understood before operating the unit.

Never set liquids on the unit in order to avoid spillage into the unit or the control panel. Maintain a clean environment. Turn off the circuit breaker before cleaning the unit. Refer to 'System Care and Maintenance' on *page 13-9* for cleaning instructions.

To carry out regular preventative maintenance refer to 'System Care and Maintenance' on *page 13-9*.

Preparing the unit for use

The ultrasound unit must operate within the proper environment and in accordance with the requirements described in this section. Before using the system, ensure that the requirements are met.

Site requirements

Optimal operation of the unit can be obtained by implementing the following requirements:

Power requirements

The ultrasound unit uses a separate power outlet for 100– 240 VAC, 50/60 Hz.

Operating Environment

Ensure that there is sufficient air flow around the ultrasound unit when installed in a fixed location.

Environmental requirements

The ultrasound unit requires constant maintenance of its operational environment. Different temperature and humidity requirements are specified for operation, storage and transportation.

Requirement	Temperature	Humidity	Air Pressure
Operational	3–40 ºC	30–80%	700–1060 hPa
Storage	-5–50 ºC	10–90%	700–1060 hPa
Transport	-5–50 ºC	10–90%	700–1060 hPa

Electromagnetic interferences

The ultrasound unit is approved for use in hospitals, clinics and other environmentally qualified facilities, in terms of the prevention of radio wave interference. Operation of the unit in an inappropriate environment can cause electronic interference to radios and television sets situated near the medical equipment.

Ensure that the unit is protected from electromagnetic interferences as follows:

- Operate the unit at least 4.5 meters (15 feet) away from equipment that emits strong electromagnetic radiation.
- Shield the unit when operating it in the vicinity of radio broadcasting equipment, if necessary.

Connecting the unit

A GE-qualified person should perform the initial system installation.

Connecting the ultrasound unit involves preliminary checks of the power cord, voltage level and compliance with electrical safety requirements.

Use only power supply cords, cables and plugs provided by or designated by GE.

Ensure that the power cord and plug are intact and that the power plug is the proper hospital-grade type (where required).

The unit should be connected to a fixed power socket which has the protective grounding connector. Never use an extension cord or adapter plug.


WARNING

Failure to provide an adequate earth circuit can cause electrical shock, resulting in serious injury.


WARNING

Connection of additional protective earth conductors or potential equalization conductors is not necessary in most cases and is only recommended for situations involving multiple equipment in a high-risk patient environment to provide assurance that all equipment is at the same potential and operates within acceptable leakage current limits. An example of a high-risk patient would be a special procedure where the patient has an accessible conductive path to the heart such as exposed cardiac pacing leads

Voltage level check

Check the rating label on the rear side of the system.

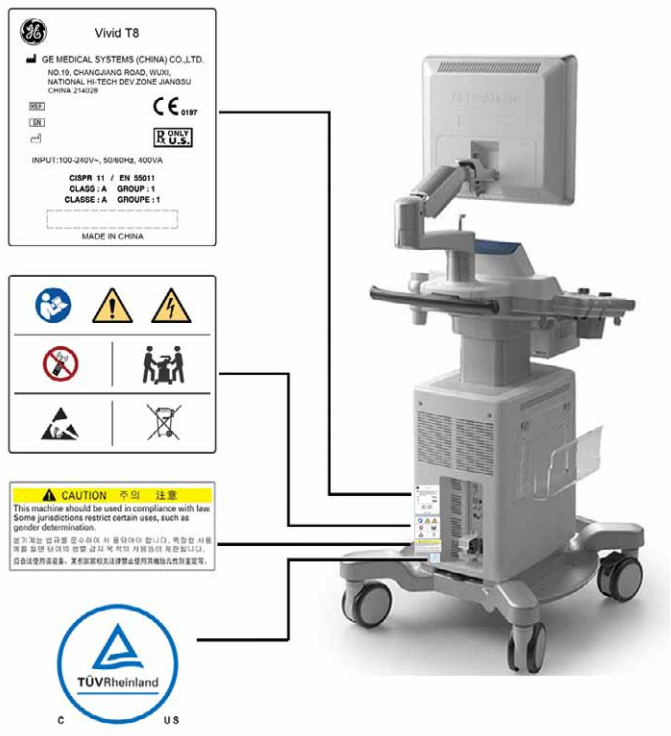


Figure 2-1. The rating label for Vivid T8

Voltage level check (continued)

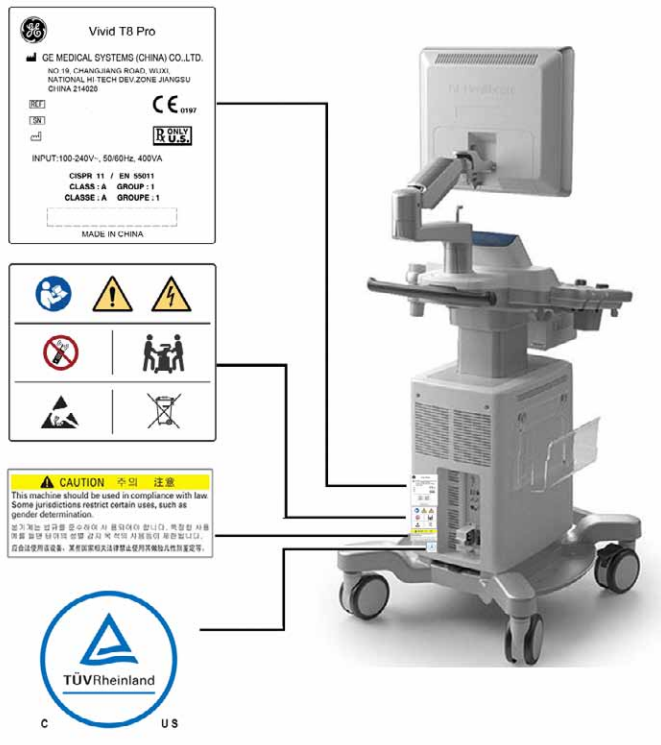


Figure 2-2. The rating label for Vivid T8 Pro

Check the voltage range indicated on the label:

- 100–240 VAC, 50/60 Hz, 400VA

Connecting to the electrical outlet


WARNING

POWER OUTAGE MAY OCCUR. The ultrasound unit requires a dedicated single branch circuit. To avoid circuit overload and possible loss of critical care equipment, make sure you DO NOT have other equipment operating on the same circuit.

The unit's power must be supplied from a separate, properly rated outlet to avoid risk of fire. Refer to 'Power requirements' on *page 2-3* for rating information.

The power cord should not, under any circumstances, be altered to a configuration rated less than that specified for the current.

Do not use an extension cord or adapter plug.

1. Ensure that the wall outlet is of appropriate type, and that the power switch is turned off.
2. Uncoil the power cable, allowing sufficient slack so that the unit can be moved slightly.
3. Attach the power plug to the system and secure it in place by using the retaining clamp.
4. Secure the power plug in the wall outlet.

Switching On/Off

To switch on the unit

1. Switch on the circuit breaker on the rear of the unit (see Figure 2-3).
2. Press the **On/Off** button on the top left of the control panel (see Figure 2-3).

   After initialization the default scanning screen is displayed.

Figure 2-3. The Circuit breaker and On/Off button

To switch off the unit

When the ultrasound unit is switched off, the system performs an automatic shutdown sequence.

Shutdown

NOTE: After switching off the system, wait at least ten seconds before turning it on again.

1. Press the **On/Off** button on the top left of the control panel.

   The *Exit dialogue* window is displayed.

Figure 2-4. The Exit dialogue window

NOTE: In case of total lockup of the system, hold the on/off button down a few seconds to turn the system off.

2. Select **Shutdown**.

   The shutdown process takes a few seconds and is completed when the control panel illumination is turned off.

To switch off before moving the unit, follow the additional steps below:

1. Set the circuit breaker to **OFF**.
2. Remove the plug from the mains power socket.
3. Wind the power cable around the rear handle.

LCD monitor adjustment

Related Hazards - LCD Monitor

- **DO NOT** place a finger, hand or any object on the joint of the monitor or monitor arm to avoid injury when moving the monitor and monitor arm.
- To avoid result of injury or system damage, **NEVER** place any object or liquid on the monitor, whether in the home or flip down/transport position.

  If an object or liquid falls/spills into the monitor or the cabinet, unplug the system immediately. Call the Service Representative for information.
- **DO NOT** scratch or press on the panel with any sharp objects, such as a pencil or pen, as this may result in damage to the panel.
- To avoid injury or damage, make sure nothing is within the range of motion before moving the monitor and monitor arm. This includes both objects and people.
- Before moving the system to another location, be sure to lock the LCD arm in the transport position if it is a flexible arm.
- The LCD screen may have defective pixels. These pixels may appear as a slightly light or dark area on the screen. This is due to the characteristics of the panel itself, and not the product.
- The backlight of the LCD panel has fixed life span. When the screen becomes dark or begins to flicker, contact a qualified Service Representative for information.

NOTE: Bright light could impact readability of screen.

To adjust the LCD Monitor Brightness/Contrast

The LCD monitor brightness and contrast can be adjusted to the normal viewing of a good gray scale image. The operator may press the middle button under the lower right corner of the LCD to switch between Brightness and Contrast. Press the left and right button to adjust the LCD monitor brightness and contrast.

To adjust the LCD Monitor Position

The LCD monitor can be swiveled and tilted.

CAUTION

To avoid injury or damage, make sure nothing is within the range of motion before moving the monitor and monitor arm. This includes both objects and people.

To unlock/lock the LCD monitor (Option)

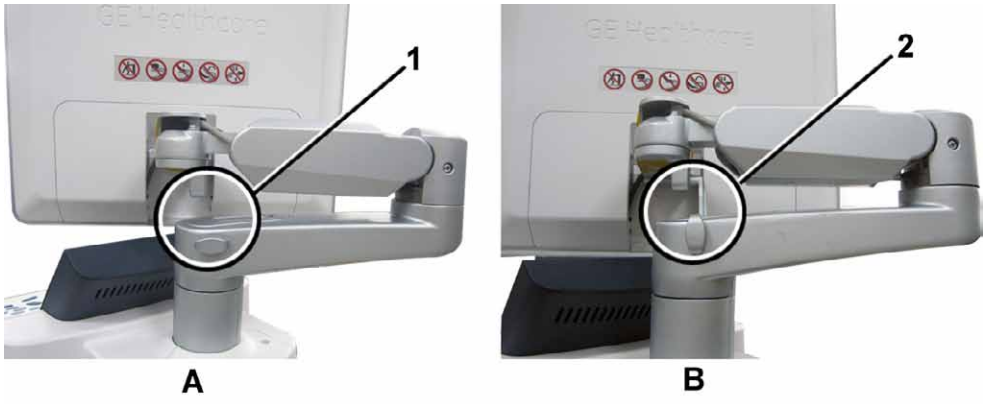
To unlock the LCD monitor

1. Turn the release knob clockwise to unlock the LCD monitor (Figure 2-5-B).

   The LCD monitor can be moved freely in all directions.

To lock the LCD monitor

1. Turn the release knob counter clockwise to raise the lock and move the LCD monitor into the parked position (Figure 2-5-A).



1. Unlocked LCD monitor
2. Locked LCD monitor

Figure 2-5. LCD monitor locking mechanism

Connecting and disconnecting probes

See ‘Probe Integration’ on *page 11-10*.

Moving and transporting the unit

Wheels

All the four wheels have independent brake pedals.

Examine the wheels frequently for defects to avoid breaking or jamming.

1. Unlocked Wheels
2. Locked Wheels

Figure 2-6. Wheels

CAUTION

Avoid ramp steeper than 10 degrees.

Moving the unit

To prepare the unit to be moved

1. If not locked, move the LCD monitor to the park position (see ‘LCD monitor adjustment’ on *page 2-11*).
2. Turn the system off, including the circuit breaker (see ‘Switching On/Off’ on *page 2-9*), and remove the plug from the wall.
3. Disconnect all cables linking the unit to any off-board peripheral devices and network.
4. Secure the unit’s power cable around the rear handle.
5. Place all probes in the probe holder. Ensure that the probe cables do not protrude from the unit or interfere with the wheels.
6. Ensure that no loose items are left on the unit
7. Fold down the monitor.
8. Unlock the brake.

To ensure safety while moving the unit

1. Ensure that the LCD monitor are in locked position (see ‘LCD monitor adjustment’ on *page 2-11*). Flip down the LCD monitor so that the display is face down.

Do not move the unit if the LCD Monitor are in free position.

2. Proceed cautiously when crossing door or elevator thresholds. Grasp the front handle grips or the back handle bar and push or pull. Do not attempt to move the unit using cables or probe connectors. Take extra care while moving the unit on inclines.
3. Ensure that the unit does not strike the walls or door frames.
4. Ensure that the pathway is clear.
5. Move the unit slowly and carefully.

Avoid ramps that are steeper than 10 degrees.

6. Use two or more persons to move the unit over long distances or on inclines.

Transporting the unit

Take extra care when transporting the unit by vehicle. In addition to the moving precautions listed on ‘Moving the unit’ on *page 2-14*, follow the procedure described below.

1. If not locked, move the LCD monitor to the park position (see ‘LCD monitor adjustment’ on *page 2-11*).

Do not move/lift the unit if the LCD monitor are in free (unlocked) position.

2. Disconnect all probes and secure them in their boxes.
3. Ensure that the transporting vehicle is appropriate for the unit’s weight. The recommended load capacity is a minimum of 65 kg (144 lbs).
4. Park the vehicle on a level surface for loading and unloading.
5. Secure the unit while it is on the lift, to prevent rolling. Do not attempt to hold it in place by hand. Cushion the unit and strap the lower part so that it does not break loose.
6. Ensure that the unit is secured inside the vehicle. Secure it with straps to prevent movement while in transit.
7. Drive cautiously to prevent vibration damage.

Reinstalling at a new location

1. When the unit is in place at a new location, lock the wheel brakes.
2. Follow the installation procedure described in ‘Connecting the unit’ on *page 2-5*.

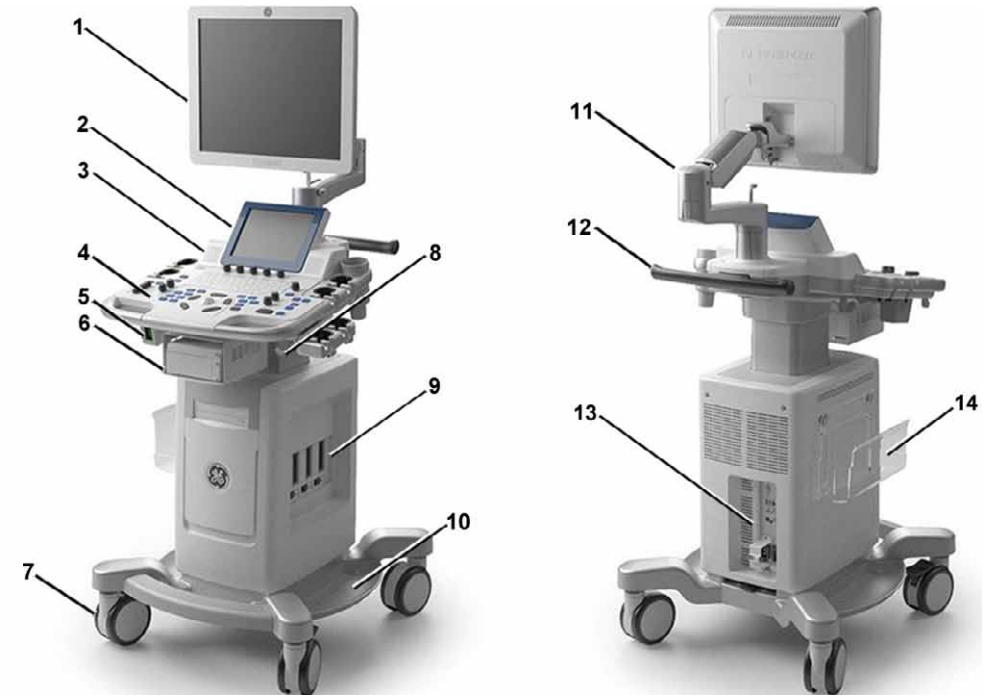
Unit acclimation time

Following transport the unit may be very cold or hot. Allow the unit to acclimate before being switched on. Acclimation will take one hour for each 2.5 ^{o}C increment when the unit's temperature is below 3 ^{o}C or above 40 ^{o}C.

^{o}C	-4.5	-2	0.5	3	40	42.5	45	47.5	50	55	60
^{o}F	23.9	28.4	32.9	37.4	104	108.5	113	117.5	122	131	140
Hours	3	2	1	0	0	1	2	3	4	6	8

System description

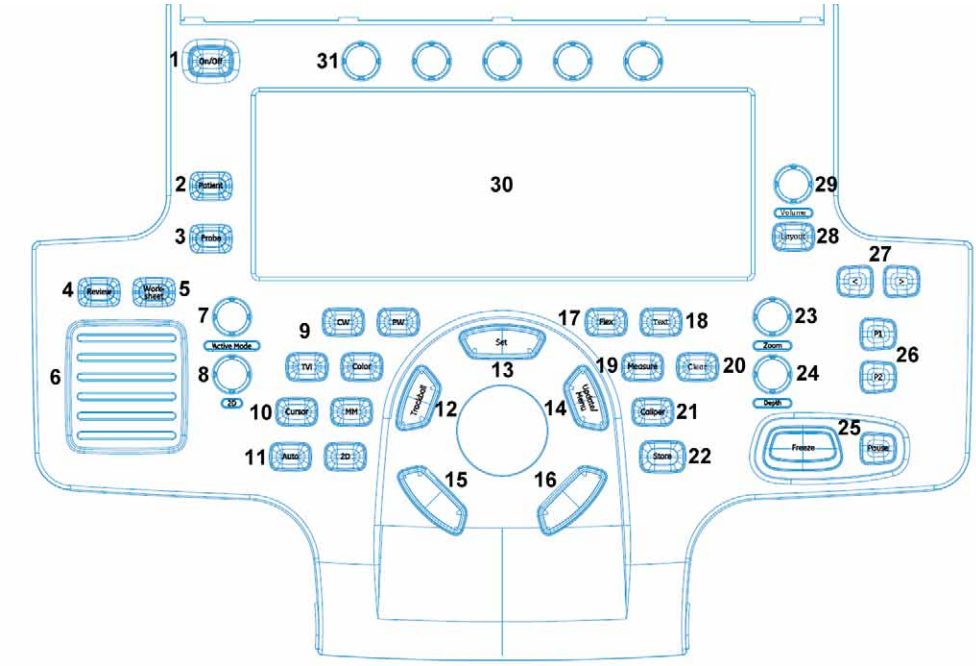
System overview



1. Display Monitor
2. Touch Panel
3. Speakers
4. Control Panel
5. ECG Port and USB Port
6. Printer Box
7. Wheels
8. Cable Hook
9. Probe Ports
10. Cable Tray (Option)
11. Flexible Arm (Option)
12. Rear Handle
13. Rear Panel
14. Paper Tray (Option)

Figure 2-7. Vivid T8/Vivid T8 Pro (front, back)

Control panel



1. On/Off button (see page 2-9)
2. Patient
3. Probe
4. Image Review
5. Worksheet
6. TGC sliders
7. Active mode gain
8. 2D Gain
9. Scan mode selection
10. Cursor
11. Auto
12. Trackball (see page 3-2)
13. Upper Set Key
14. Update/Menu Key
15. Left Set Key
16. Right Set Key
17. Flex Key
18. Text
19. Measurement
20. Clear
21. Caliper
22. Store
23. Zoom
24. Depth
25. Freeze, Pause
26. Print
27. Display controls
28. Layout
29. Loudspeaker volume control
30. Alphanumeric Keyboard
31. Touch panel with adjustment rotaries (see page 3-3)

Figure 2-8. The control panel

Key illumination

The keys on the control panel are illuminated according to their availability:

- **Illumination in green**: the key function is currently active.
- **Illumination in white**: the key function is available (but not active) in the current state of the scanner.
- **No illumination**: The key is not available in the current state of the scanner.

Alphanumeric Keyboard

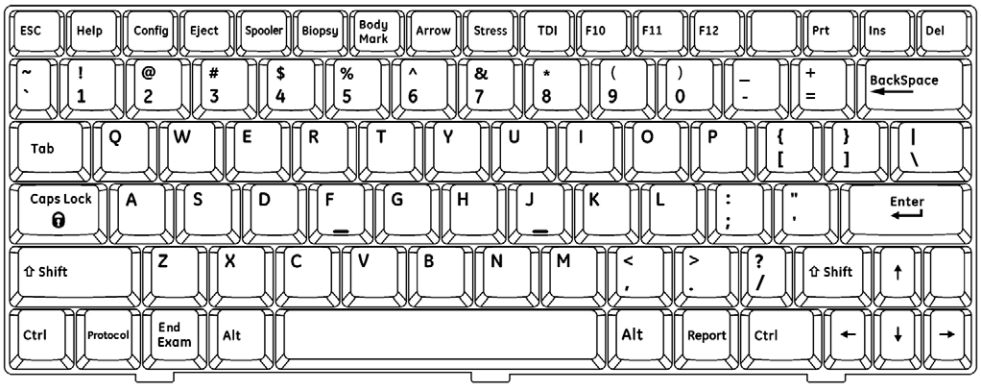


Figure 2-9. Alphanumeric Keyboard

Key	Description
ESC	Exit current display screen.
Help	Displays the on-line version of the user manual.
Config	Displays the configuration dialog box, allowing user configuration of various settings on the scanner. Some settings are configured for each application, press **Application.** to access to application-specific settings.
Eject	Eject media.
Spooler	Displays the DICOM spooler window. The DICOM spooler is used for checking the current job's status when a job is saved or when the total spooler status on the right of the Archive windows displays an error.
Biopsy	Displays the biopsy screen.
Body Mark	Displays the bodymark icons.
Arrow	Displays the arrow icons.
Stress	Access to the Stress echo window.
TDI	Access to the TDI mode.

Peripheral/accessory connector panel

The Peripheral/accessory connector panel is situated on the rear side of the unit (see Figure 2-10).

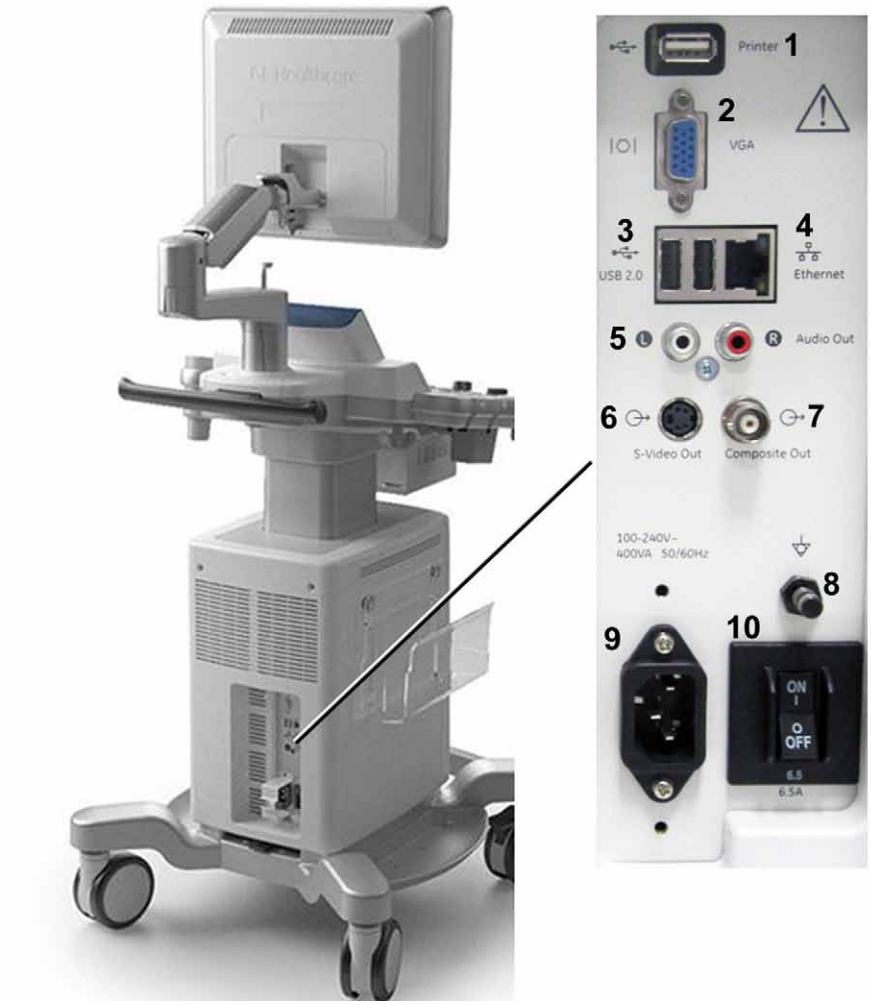


Figure 2-10. Peripheral/accessory connector panel

1. USB Printer port: For AC Printer ONLY.
2. VGA Video out port
3. USB 2.0 ports
4. Ethernet
5. Audio Out port
6. S-Video out port
7. Composite out port
8. Equipotentiality
9. AC Inlet
10. Circuit breaker

Peripheral/accessory connector panel (continued)

WARNING

Accessory equipment connected to the analogue and digital interfaces must be certified according to the respective IEC standards (e.g. IEC 60950 for data processing equipment and IEC 60601-1 for medical equipment). Any person connecting additional equipment to the signal input part or output part is configuring the medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601-1. If in doubt, consult the technical service department or your local representative.

Do not touch the conducting parts of the USB or Ethernet cables when connecting equipment to the unit.

WARNING

Any devices or cables, other than those sold with the ultrasound unit, connected to the Peripheral /accessory connector panel or to an USB port on the unit may result in an increase of the electromagnetic emission from the unit, or a decrease of the electromagnetic immunity of the unit.

Wired Footswitch (Option)

You can attach this Footswitch to the system by connecting it to one of the USB port on the rear of the system.

CAUTION

To avoid damage of the cable, keep the cable away from the wheels. Disconnect the Footswitch before moving the system.

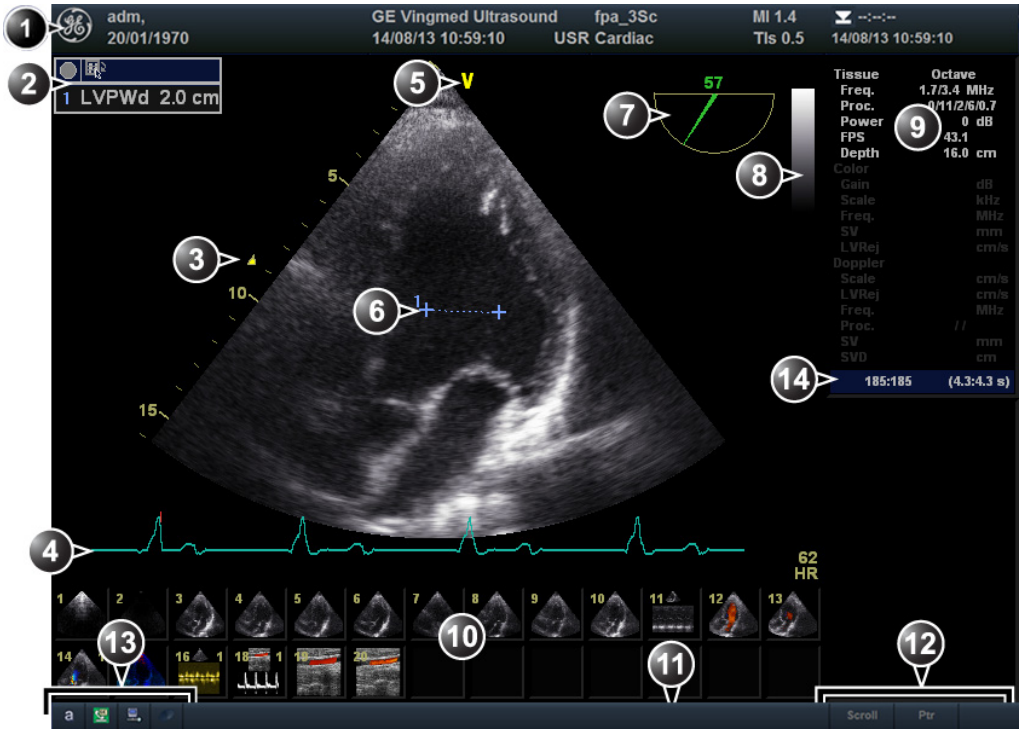
Figure 2-11. 3-pedal Footswitch and USB Cable

You can configure 3-pedal Footswitch its functionality from the **Config**/**Imaging**/**Application** (see page 4-49).

CAUTION

When using the Footswitch, DO NOT hold down the footswitch pedal. Press and release the Footswitch pedal. Pushing and holding down the pedal behaves the same way as pushing and holding down a key on the keyboard.

The Scanning screen



1. Title bar
   - Current patient data
   - Institution
   - Date & time
   - Operator ID
   - Probe
   - Application
   - Mechanical & Thermal Index
2. Measurement result table
3. Focal zone and depth scale
4. ECG trace and Heart rate
5. Probe orientation marker
6. Measurement
7. Scanplane indicator (TEE probe)
8. Grayscale/Color bar
9. Parameter window
10. Clipboard
11. Prompt/Status information
12. Trackball assignment
13. - Caps lock on/off
    - Contact GE
    - Network status
    - CD status
14. Frame counter and timer

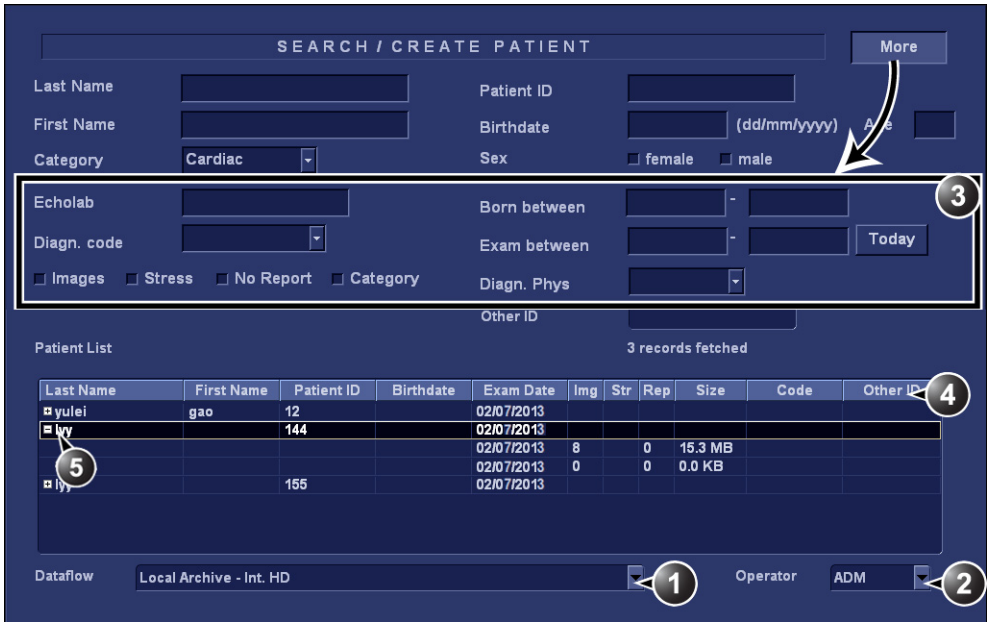
Figure 2-12. The scanning screen (composite)

Starting an examination

Creating a new patient record

1. Press **Patient** on the Control panel.
   If required, log on by typing the user ID and password.
   The *Search/Create patient* window is displayed.

Creating a new patient record (continued)



1. Select archive and other pre-defined services.
2. Change user.
3. Advanced search filters, the system can be configured to display the advanced search filters as default (see ‘Patient management presets’ on *page 9-77*).
4. Press one of the headings to sort the list accordingly (ascending/descending).
5. Expanded Patient record displaying belonging examinations

The Search/Create patient window may be slightly different depending on the Dataflow selected

Figure 2-13. The Search/Create Patient window

Creating a new patient record (continued)

2. In the *Search/Create patient* window select the desired dataflow.
3. Type the patient **Last Name**, and/or **ID**.

NOTE: The unit can be configured to automatically generate a patient ID.

NOTE: The patient ID MUST be unique. The system does not support patient ID repetition.

Figure 2-14. The Formats sheet

When default configured, the system automatically searches to see if the patient is already in the archive. The result of this search is displayed in the *Patient list* field.

4. To create a new patient record, press **Create Patient**.

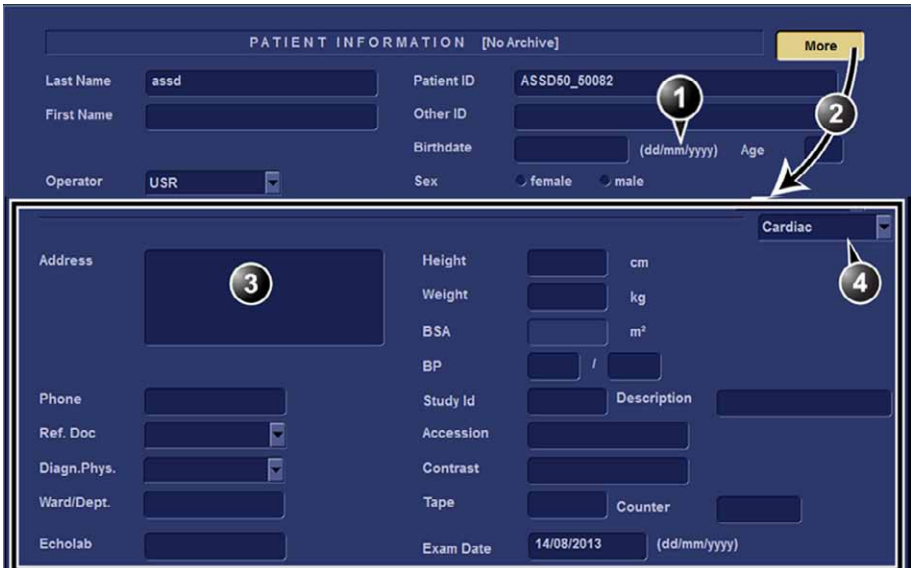
The unit is ready for scanning or the *Patient information* window is displayed, depending on system configuration (See Figure 2-14).

Creating a new patient record (continued)

If the unit is configured to display the *Patient information* window, follow the steps below:

1. Enter additional patient information if required.

   Select between **Cardiac**, **Obstetric**, **Gynecology**... etc. to enter application specific patient info (Displayed when the button **More** is depressed).



1. The date format is configurable (see page 3-27).
2. The window can be configured to display the expanded patient info as default (see Figure 2-14).
3. The Address field is configurable (see Figure 2-14).
4. Select patient information category.

Figure 2-15. The Patient information window (cardiac)

2. Press **Patient** or any active scanning key to start the examination.

Selecting an existing patient record

1. Press **Patient** on the Control panel.

   If required, log on by typing the user ID and password.

   The *Search/Create patient* window is displayed.
2. In the *Search/Create patient* window select the desired dataflow.
3. Type the patient **Last Name**, and/or **ID** or another query that identifies a patient.

   When default configured, the system automatically searches to see if the patient is already in the archive. The result of this search is displayed in the *Patient list* field.
4. Highlight a patient record in the *Patient list* filed.

*NOTE: You can select **[+]** in front of the actual patient record to display the examinations belonging to the patient record.*

5. Press **Open Exam**.

   The *Examination List* window for the actual patient is displayed.
6. To start a new examination, press **Add Exam**.

Ending an examination

1. Press **Patient** on the Control panel.
2. Press **End Exam** on the Touch Panel or the Keyboard.

   If the images on the clipboard were not previously stored, a prompt window is displayed where the user can choose to store all, none or a selection of the images saved to the clipboard.
3. Select:

   - **All**: to store all images and end the exam
   - **None**: to end the exam without storing any images
   - **Select**: to select the images to store from the Review screen and end the exam.

Chapter 3

Basic operations

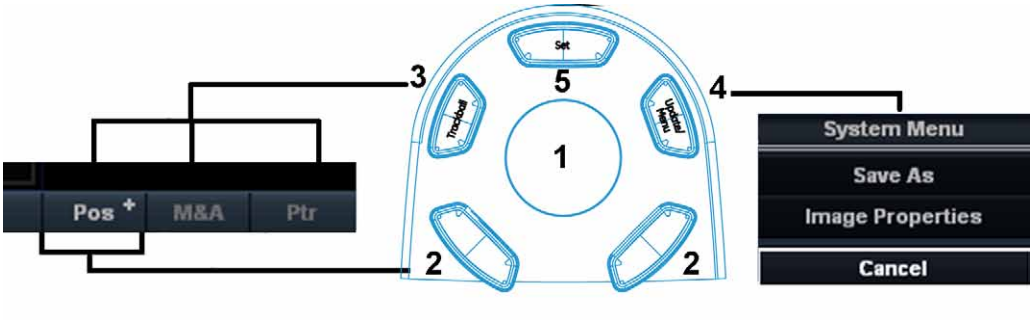
This chapter describes:

Trackball area

Different functions can be assigned to the trackball.

The trackball functions are organized in functional groups which are displayed in the lower right corner of the screen. The **Trackball** key (Figure 3-1, [3]) is used to toggle between the functional groups.

Each functional group can have one or more functions. The Left/Right Set Key (Figure 3-1, [2]) is used to toggle between the functions within the active group.



1. Trackball
   - Adjusts the selected control
   - Moves the pointer
   - When ROI is active, use the Trackball to adjust the ROI size or position.
2. Left/Right Set Keys:
   - Configured to be specific function key. (See ‘Imaging Settings’ on *page 4-48 for more information.*)
3. Trackball key:
   - Toggles between trackball functional groups. In active mode, press Trackball key to switch among Pos/Size, M&A and Ptr. In frozen mode, press Trackball key to switch between Scroll and Ptr.
     Pos/Size: adjust the ROI position/size.
     M&A: activate the cursor
     Ptr: mouse left key
     Scroll: scroll through the progress bar to watch the cine loop frame by frame.
4. Update/Menu key:
   - In Freeze: displays a pop-up System menu.
   - In Live duplex mode (Doppler or M-mode): toggles Live/Freeze between the 2D image and the spectrum image.
5. Upper Set key:
   - A select key which functions like the mouse left key
   - When Pos/Size is selected, press the Set key to switch between Pos and Size.

Figure 3-1. The Trackball area

Touch panel

The Touch panel enables the access of modality driven controls. The mode/function controls are organized in tabbed folders. Several pages may be accessed within each folder.

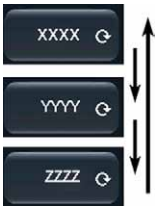
At the bottom of the Touch panel, there are five rotary/push buttons. The functionality of these buttons changes, based on the active mode/function.

1. Select a folder. The yellow dot on the tab indicates the active mode.
2. Each folder may have multiple pages.
3. Rotary/Push buttons with mode/function specific controls.
   - : rotate the button to adjust the active control
   - : press the button to apply the active control

Note: If two controls are adjusted by rotating the same button, press the button to toggle between the two controls.

Figure 3-2. Touch panel

There are different types of control buttons.

Button	Function
 Off  On	Push button: toggles the control between on and off states. • Gray = Off • Blue = On
	Opens a menu on screen. The selection in the menu is done using the trackball and the **Set** Key. The current selection from the menu is displayed inside the button.
	Control with variable adjustment
	Dual button: combines two controls that exclude each other mutually (e.g. toggling between Dual and Quad screen display)
	Disable key (Color: brown). If the software option is not available, this button is disable.
	Toggle button: toggles a control between two or three different states (e.g. switch between Lower/Upper/Mid annotation texts.)

Removable media

Intended use

Removable media can be used for the following purposes:

- Long-term image storage: the final destination of the images, after they are moved out of the system harddisk by using the Disk Management feature (see page 9-59).
- Backup of patient database and system configuration presets (see page 9-68)
- Patient archive sneaker-net: copy a set of patient records between a scanner and EchoPAC PC using the Import/ Export feature (see page 9-49) with a removable media.
- DICOM export to copy a set of patient records to a third party DICOM review station.
- MPEGVue export: review exported images on a Windows computer (see page 9-10).
- Excel export: exports demographics, measurements and reporting data from the unit to a third party reporting application using a removable media (see page 9-49).
- Copy of system configuration presets between to units using the Backup/Restore feature (see page 9-68).
- Save images as JPEG, MPEG or AVI for review on a regular computer.

Supported removable media

The following removable media are supported:

- CD/DVD-R (Option)
- USB HDD (Option)
- USB Stick

USB Stick:

- Use only shielded USB Sticks that are verified for EMC performance according to EN55011/EN55022. The use of other USB Sticks may cause interference on the system itself or on other electronic devices.

Media/Purposes compatibility

	USB HD	CD-R	DVD-R	USB Flash card
Long-term image storage	+[1]	+	+	
Backup of patient database and system configuration presets	+	+	+	+
Patient archive sneaker-net	+	+	+	+
DICOM export	+	+	+	+
MPEGVue export	+	+	+	+
Excel export	+	+	+	+
System configuration presets	+	+	+	+
Save images as JPEG, MPEG or AVI	+	+	+	+
[1] Recommended media				

About removable media and long-term image storage

We recommend to run the Disk management feature with Mobile USB HDD for long-term image storage, because of the longevity and reliability of this media. It is not recommended to use CD or DVD for long-term storage, because of weaker performance in general when it comes to longevity and reliability. However, Disk management does not prevent the use of CD/DVD for long-term image storage. If CD/DVD is used it is recommended to use Archival Grade or Medical Grade CD/DVD.

No matter which media is used, it is always highly recommended to take a backup of the media, which is the responsibility of the customer. The unit does not offer functionality for taking backup of images saved on long-term storage media.

Recommendation concerning CD and DVD handling

To avoid data loss, never touch the recordable surface of a disk. Handle the disk only by the outer edge. Do not place it face down on a hard surface. Fingerprints or scratches will make the disk unusable. Before usage, verify that the disk surface has no visible scratches. If there are any scratches, do NOT use the disk.

Formatting removable media

CD-R and DVD-R have to be formatted.

CAUTION

The formatting process will erase any data present on the disk.

To format a removable media:

1. Insert the media in the drive.
2. Press **Utility**/**Config** on the Touch panel.
3. If required, log on to the system.
   The Configuration package is opened.
4. Select the category **Connectivity** and select the sheet **Tools** (Figure 3-3).

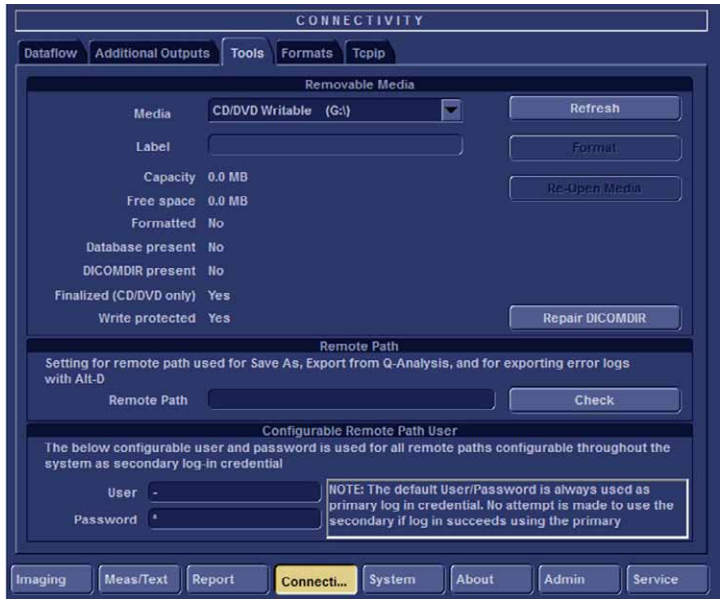


Figure 3-3. The Tools sheet

Formatting removable media (continued)

5. Select the removable media from the *Media* drop-down menu.
6. Enter a name for the removable media in the *Label* field.

NOTE: Only the following characters and signs can be used when labelling a media: A - Z, a - z, 0 - 9, "_" and "-". Do not use more than 11 characters or signs. Do not use space.

7. Select **Format**.

   A confirmation window is displayed.
8. Select **OK** to continue.
9. Wait for the display of the *Information* window indicating that the formatting process is completed.
10. Select **OK**.
11. Eject the media as described below.

NOTE: Removable media used during Disk space management, Backup, Export or Save as do not need to be formatted in advance as the formatting process is part of these procedures if required.

Ejecting removable media

1. Press **Utility**/**Eject**.

NOTE: Do not eject CD/DVD using the button on the CD/DVD drive.

The *Eject device* menu is displayed (Figure 3-4).

Figure 3-4. The Eject device menu

2. Select the relevant media.

   The selected media is ejected.

Physiological ECG traces

The system contains a physiological module capable of displaying the patient's ECG trace. The ECG trace is generated by monitoring the patient, using 3 ECG electrodes, or by interfacing to an external monitor.


CAUTION

Use only GE accessories

Conductive parts of electrodes and associated connectors for applied parts, including neutral electrodes should not contact other conductive parts, including earth.

Simultaneous use of two or more applied parts will cause summation of patient leakage currents.


CAUTION

The heart-rate may be adversely affected by the operation of cardiac pacemaker pulses or by cardiac arrhythmias.

ECG Connection Panel

Figure 3-5. The patient (I/O) connection panel

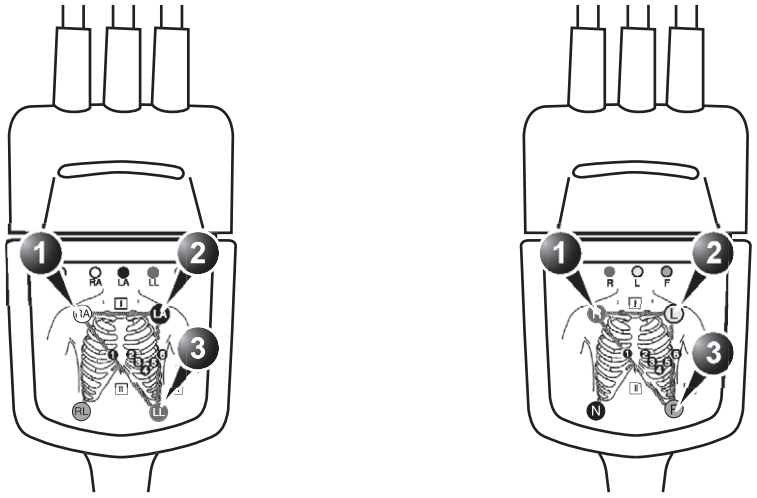
ECG

The ECG cable is a modular cable consisting of two different cables parts:

- **The Trunk**: a single cable connecting to the system at one end, and providing a cable splitter device at the other end (see Figure 3-6).
- **The triple color-coded electrode cable**: to be inserted in the splitter device. Each electrode cable hooks up to the appropriate stick-on electrode by a color-coded clip type connector.

ECG (continued)

The color-coding of the electrodes follows one of two standards that are common in different parts of the world. The cable splitter device has a drawing defining the color codes, names and body location for the two standard color codes (see Figure 3-6).



AHA (USA)

1. RA: White
2. LA: Black
3. LL: Red

IEC (Europe, Asia, ROW)

1. R: Red
2. L: Yellow
3. F: Green

Figure 3-6. The cable splitter device with electrode placement conventions

To connect the internal ECG

1. Connect the ECG trunk cable into the rectangular-shaped socket marked ECG on the patient trace (I/O) panel. The patient trace (I/O) panel is located in the front left of the ultrasound unit (see Figure 3-5).
2. Hook up the electrode cables to the electrodes, following the appropriate convention (see Figure 3-6).

Using Physios

Display ECG trace

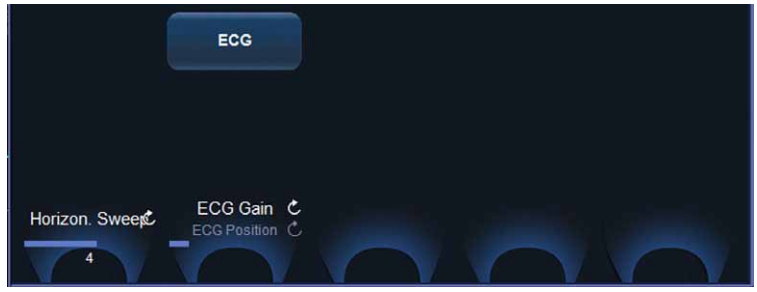


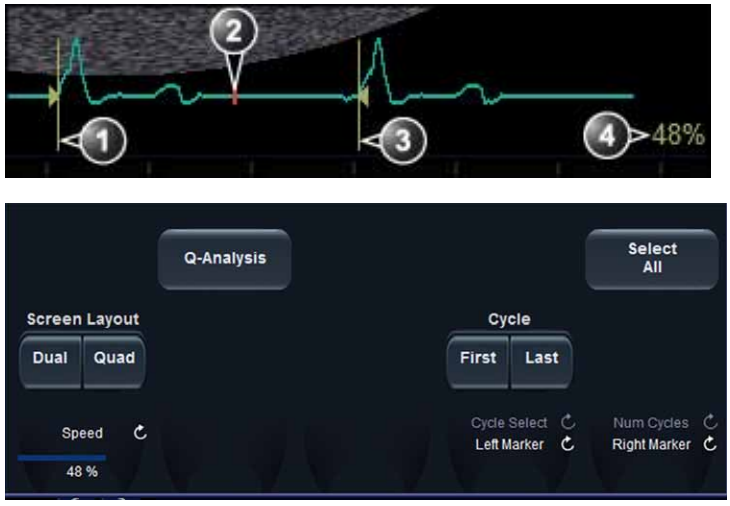
Figure 3-7. ECG controls

1. The ECG is turned on by default in all cardiac applications. For all other applications, press the tab **Physio** on the Touch panel and press **ECG** (Figure 3-7).
2. The following controls can be adjusted:
   - **Horiz. Sweep**: adjusts the sweep speed stepwise (1, 2, 3, 4, 6, 8, 12 and 16 sec., 4 sec. is default).
   - **Gain**: adjusts the trace amplitude.
   - **Position**: moves the trace vertically.

Cineloop

When the scan mode is frozen, the unit automatically displays cineloop boundary markers on either side of the last detected heart cycles. The cineloop boundaries can be adjusted using the cineloop controls on the Touch panel to cover one or more heart cycles.

Cineloop overview



1. Left marker (cineloop start)
2. Current frame
3. Right marker (cineloop end)
4. Cine speed

Figure 3-8. Cineloop display

Using cineloop

Selection of a cineloop

1. Press **Freeze**.

   The left and right markers are displayed on either side of the last detected heart cycle on the ECG trace.
2. Press **Pause**.

   The selected heart beat is played back.
3. Press **Pause** to freeze the cineloop.
4. Use the trackball to scroll through the acquisition and find the sequence of interest.
5. Adjust **Cycle select** to move from heart beat to heart beat and select the heart cycle of interest.
6. Adjust **Num cycles** to increase or decrease the number of heart beats to be played back.
7. In Freeze, press **Set left** or **Set right** to set the corresponding cineloop boundary to the current frame.
8. Adjust **Left marker** and **Right marker** to trim or expand the cineloop boundaries.
9. Press **Store** to store the cineloop (see ‘Storing a cineloop’ on *page 9-7*) or **Freeze** to return to live scanning.

NOTE: Cineloop storage can be configured to store heart cycles with additional time before and after the R-wave and to display a preview before storage (see ‘Global imaging settings’ on page 4-47).

Adjustment of cineloop playback

1. Use the trackball or adjust **Speed** to increase or decrease the speed of the cineloop playback.

   The speed factor (%) is displayed on the right side of the ECG.

To view a cineloop frame by frame

1. In freeze, use the trackball or adjust **Frame** to scroll through the cineloop frame by frame.

To synchronize playback of several cineloops

1. Press **Sync** to phase synchronize playback of several cineloops running on the screen.

Storage of a cineloop

See ‘Storing a cineloop’ on *page 9-7*.

Zoom

The unit supports two types of zoom:

- Display zoom: magnifies the image display of a selected area.
- High resolution (HR) zoom: concentrates the image processing to a selected area of the image, resulting in an improved image quality and a higher frame rate in the chosen ROI.

Display zoom

1. Rotate the **Zoom** knob clockwise.

   The resulting magnified image appears in the acquisition window. An un-magnified image is displayed in the right corner showing the outlined zoomed region.
2. Use the trackball to position the zoom area over the desired portion of the image.
3. To turn off the Display zoom, rotate the **Zoom** knob counter clockwise.

HR zoom (Option for Vivid T8 Pro)

1. Press the **Zoom** knob.
2. Use the trackball to position the zoom area over the desired portion of the image.
3. Increase size as desired by turning the **Zoom** knob clockwise.
4. Press **Zoom** one more time to turn off the HR zoom.

Annotations

Text annotations may be inserted anywhere on the image area. The annotation can be free text or a pre-defined text from an application-specific annotation library displayed on the Touch panel.

Annotations can be done on two separate layers to enable selective display of annotations.

Annotations (text, arrow or bodymark) are created on separate layers. When viewing annotated images on a different system or when zooming the image, the position of the annotations on the image may be slightly changed.

To insert an annotation

Free text

1. Type the required text using the alphanumeric keyboard.
   To change/add line press **Enter**.
2. Trackball the text entered to the insertion position.
3. Press **Set** to fix the text and add an annotation.

Pre-defined text

1. Press **Text** on the Control panel.

   The *Text* folder with annotations specific to the current application is displayed on the Touch panel.

*NOTE: To select annotations from another application, press **Library** and select the desired application library.*

2. On the Touch panel, press the pre-defined text to insert.

   The word is displayed on the screen.

*NOTE: Some buttons toggle between two or three related annotation texts (i.e pressing the annotation **Left** will insert the text "Left" and toggle the button to the annotation **Right**). Annotation buttons with toggle functionality are marked with a circular arrow.*

3. Position the text on the screen with the trackball.
4. Press **Set** to fix the text and add an annotation.

1. Selects application specific library
2. Displays Bodymarks
3. Inserts Arrow
4. Creates layered annotations
5. Adjustment tools
6. Button with toggle function

Figure 3-9. Annotation Touch panel (Example)

Layered annotations

Annotations can be entered on two different layers (called Text 1 and Text 2). This function enables the operator to show/hide different annotations on the same image.

1. Press **Text 1** on the Touch panel.

   The Text 1 layer is displayed. Enter an annotation.
2. Press **Text 2**.

   The Text 2 layer is displayed (the Text 1 layer is hidden). Enter an annotation.

To edit annotations

To move annotations

1. Move the text marker over the annotation to move and press **Set**.
2. Move the selected annotation with the trackball to a new location and press **Set**.

To edit annotations

Replacing text

1. Press **Highlight** on the Touch panel to browse through the annotations entered word by word until the word to edit is selected.

   *NOTE: To browse backward, press and hold down **Shift** while pressing **Highlight**.*
2. To select several words, rotate **Grab Word** on the Touch panel.
3. Type a new text to replace the selected text or press **Delete word** on the Touch panel (or **Backspace**) to delete the selection.

Adding text

1. Move the text marker over the annotation to move and press **Set**.
2. The text in the selected annotation can be edited using the following alphanumeric keys:
   - **Right arrow**: moves the text cursor forward.
   - **Left arrow**: moves the text cursor backward.
   - **Tab**: moves the text cursor by word forward.
   - **Shift** + **Tab**: moves the text cursor by word backward.
   - **Enter**: move the cursor to the next line.
   - **Backspace**: deletes backward.
   - **Delete**: deletes forward.
   - **Insert**: toggles the text entry state from overwrite to insert mode.

To erase annotations

To erase all annotations:

1. Press **Page erase** on the Touch panel.

   If using layered annotations, all texts from both layers are deleted.

Bodymark

Bodymarks are small graphic images that represent the anatomy being examined. Using bodymarks, the user can indicate the position that the probe was in during the examination.

Inserting a bodymark

1. Press **Text**.

   The *Text* folder is displayed on the Touch panel.
2. Press **Bodymark**.

   The bodymarks specific to the current application are displayed.

*NOTE: To select bodymarks from another application, press **Library** and select the desired application library.*

3. Press the bodymark to insert.

   The selected bodymark with a probe marker is displayed on the scanning screen.
4. Using the trackball, adjust the position of the probe marker.
5. Adjust **Rotate probe marker** to set the probe marker orientation.
6. To move the bodymark:
   - Press **Move pattern**.
   - Move the bodymark to a new location with the trackball.
   - Press **Move pattern** to anchor the bodymark to the new location.
7. Press **Set**.

Annotation and bodymark configuration

Annotation and bodymark configuration enable the operator to:

- Create new application specific text and bodymark libraries
- Edit existing application specific text and bodymark libraries
- Delete user-defined libraries

A library is a list of up to 30 text inputs that are accessed from the Touch panel (two pages).

To access to the Annotation and bodymark configuration screen:

1. Press **Utility**/**Config** on the Touch panel and log on as administrator if required.
2. Select the **Meas/Text** category and **Text** or **Bodymark** subgroup.

   The corresponding screen is displayed (Figure 3-10).

Annotation and bodymark configuration (continued)

Figure 3-10. The Text and Bodymark sheets

To edit an existing library

1. In the *Library* field, select the library to edit.
2. To change or add a pre-defined text, select the text entry or a blank location and do one of the following.

   Annotation library:

   - Type a text
   - Select a text from the *Copy from existing* list.

   Bodymark library:

   - Select a bodymark form the *Bodymark available* field.
3. Press **Save Library**.

*NOTE: If a factory library is edited, the original library can be restored by pressing **Reload default**.*

Toggling pre-defined annotations

It is possible to assign up to three related texts to one location enabling the operator to toggle between the text entries when pressing the button on the Touch panel (i.e pressing the toggling annotation **Left** will insert the text “Left” and toggle the button to the annotation **Right**). Annotation buttons with toggle functionality are marked with a circular arrow.

To create a toggling annotation:

1. Enter up to three text entries separated by a colon in the desired location (i.e “Left:Right”).

To create a library

1. In the *User defined library* field, type a name for the library to create, then select **Create**.
2. Enter pre-defined texts as described in step 2 above.
3. Press **Save Library**.

General options

Text, Bodymark and arrow default options can be specified from the *Option* category.

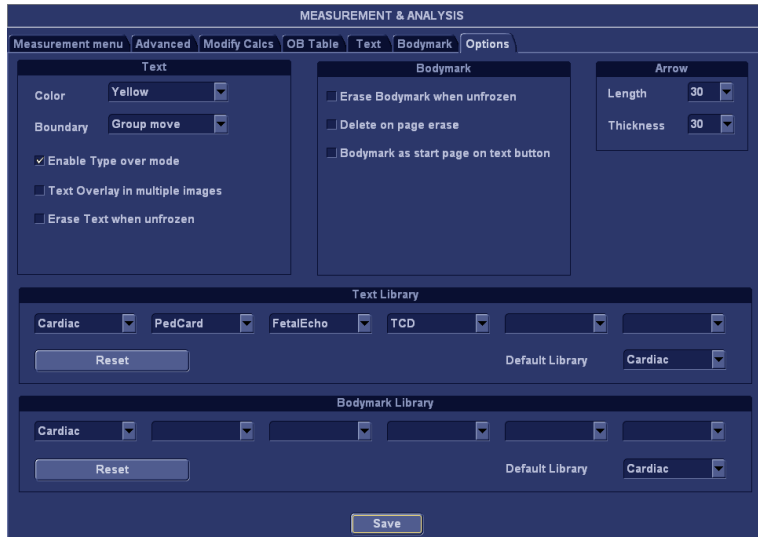


Figure 3-11. The Options sheet

Parameter	Description
Text color	Select the color for annotation text.
Text boundary	Select Group Move or Word Wrapping
Enable type over mode	When selected, the user can place the cursor in an existing annotation and start typing to insert new text.
Text overlay in multiple images	When selected, if in dual mode, hides annotations in both images when toggling **Text 1**/**Text 2**. If unchecked, hides annotations in the active image only.
Erase text when unfrozen	Deletes annotations when unfreezing the image.
Erase Bodymark when unfrozen	Deletes bodymark when unfreezing the image.
Delete Bodymark on page erase	The Bodymark inserted is deleted when applying **Page erase**.
Bodymark as start page on text button	Sets the Bodymark Touch panel as default page when pressing **Text** on the Control panel.
Arrow length	Select the default arrow length.
Arrow thickness	Select the default arrow thickness.
Text and bookmark library	Set availability for up to six libraries for the current application and select the default library. Reset reloads the factory default setting.

Configuration – System and presets

About system Configuration

The configuration package enables customizing of the global configuration of the unit, application-specific settings, system connectivity and data management settings.

The configuration management package is divided in different setup categories with subgroups.

Only users with administration rights have access to all the subgroups.

Setup category	Description	Subgroup	Access
Imaging	Global imaging and application configuration	Global	All
		Application	All
		Application menu	All
Meas/Text	Measurements and Annotation configuration	Measurement menu	All
		Advanced	All
		Modify Calcs	All
		OB Tables	All
		Text	All
		Bodymark	All
		Options	All
Report	Report configuration	Template	All
		Diagnostic codes	All
		Comments	All
		Structured findings	All

Setup category	Description	Subgroup	Access
Connectivity	System connectivity	Dataflow	Admin
		Additional outputs	All
		Tools	All
		Formats	All
		TCP/IP	Admin
System	General system settings and system test	Settings	Admin
		Test	Admin
About	System information	System version	All
		Firmware version	All
		HW version	All
		Probes	All
Admin	Data management and user account	Disk Management	All
		Backup	Admin
		Restore	Admin
		Users	Admin
		System Admin	Admin
		Unlock patient	Admin
Service	Service	Service	Admin

General system settings

1. Press **Utility**/**Config** on the Touch panel and log on as administrator if required.
2. Select the **System** category and **Settings** subgroup.

   The *Settings* sheet is displayed.

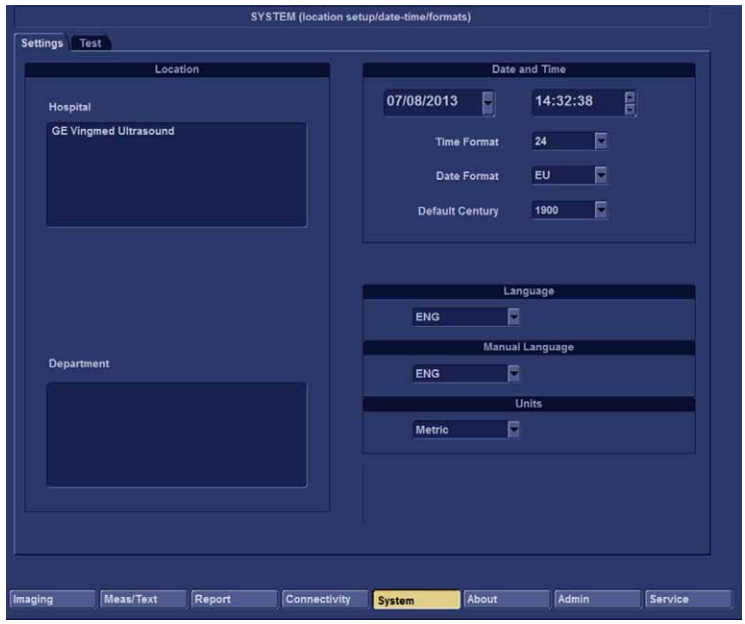


Figure 3-12. The Settings sheet

Location

1. **Hospital**: enter the hospital name (up to 64 characters). This information is displayed on the scanning screen's *Title bar* (up to 24 characters) and on the image properties of all saved images.
2. **Department**: enter the department name (up to 64 characters). This information is displayed on the image properties of all saved images.

Date and time

Changes will be effective only after rebooting the system.

1. **Date**: select the correct date from the pop-up window.
2. **Time**: Press the arrow head buttons to set the time (hour minute and second).
3. **Time Format**: select the desired format (24 or 12 AM/PM) from the pop-up menu.
4. **Date Format**: select the desired format (EU or US) from the pop-up menu.
5. **Default Century**: select the desired format (1900, 2000 or None) from the pop-up menu.

   1900: the number 19 is automatically displayed when entering the year in the patient date of birth (to edit century, press **Backspace** twice).

   2000: the number 20 is automatically displayed when entering the year in the patient date of birth (to edit century, press **Backspace** twice).

   None: the four digits have to be typed when entering the year in the patient date of birth.

Language and Units

Changes will be effective only after rebooting the system.

1. **Language**: select the desired language for the system from the pop-up menu.
2. **Manual Language**: select the desired language for the Online manual. If not available the English manual will be displayed as default.
3. **Units**: select the desired units (Metric or US) from the pop-up menu.

System users

The ultrasound unit requires operator registration.

Users are divided in groups with different rights. There are two types of groups:

- **User groups**: members of these groups are allowed to login on the system when selected together with the group Operator. They have group specific rights (see tables below).
- **Referring groups**: members of these groups (Diagnosing physician and Referring doctors) are not allowed to login on the system. They are registered as references that can be associated to a patient record.

Group	Right (see definition below)				
	Create	Print report	Store report	Admin	Service
Cardiologist	+	+	+		Activated with a Dongle
Physician	+	+			
Sonographer	+	+			
Fellow	+	+			
Sys Admin	+	+		+	
Hosp admin		+			
GE admin	+	+		+	

System users (continued)

The rights associated to the user groups are:

Right	Definition
Create	• Create, update and delete a patient record • Create, update and delete an examination • Create, update and delete an user or a referring member • Import/Export patient records, examinations • Move examinations
Print report	• Print a report
Store report	• Store reports, sign and unsign reports
Admin	• System administration
Service	• Access to the service platform
Diagnose	• Enable the operator to have diagnosis right

1. Press **Utility**/**Config** on the Touch panel and log on as administrator if required.
2. Select the **Admin** category and **Users** subgroup.

   The *Users* sheet is displayed.

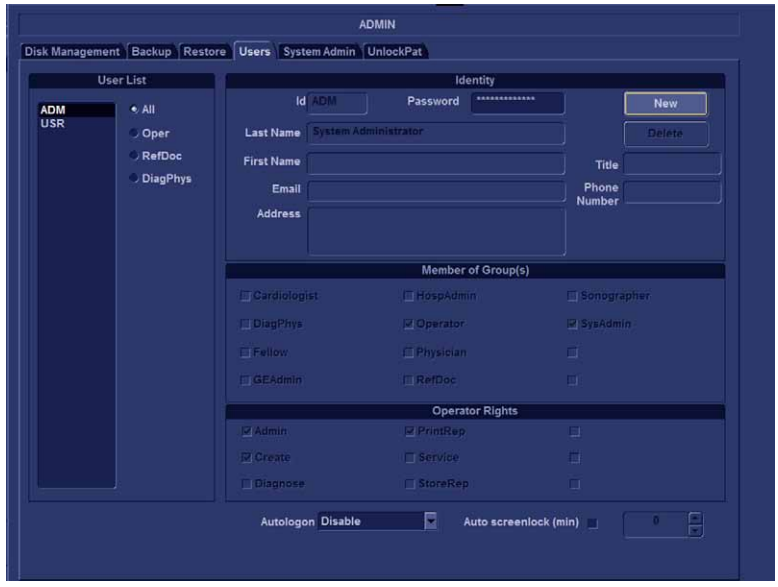


Figure 3-13. The Users sheet

Creating a user or a referring member

1. Press **New**.
2. Enter the user's information.
3. Select the type of user/referring member in *Member of Group(s)*.

To be able to login on the system, the group Operator MUST be selected.

Editing a user configuration

1. Select the actual user in the *User list*.
2. Make the desired changes.
3. Press **Config** or any active scanning key to exit the Configuration management package.

Deleting a user

1. Select the actual user in the *User list*.
2. Press **Delete**.

   The user is removed from the *User list*.

Auto logon and auto screen lock

Auto logon

1. Select the desired logon setup from the pull down menu:
   - **Disabled**: no default user is selected when logging on.
   - **Last user**: the last user is selected automatically when logging on.
   - USR: select one of the users to be the default user when logging on.

Auto screen lock

1. Set the time span (from 10 min.) for the system to automatically get locked when not in use. When the system is locked, the current user may either log on again or the system may be restarted by a different user.

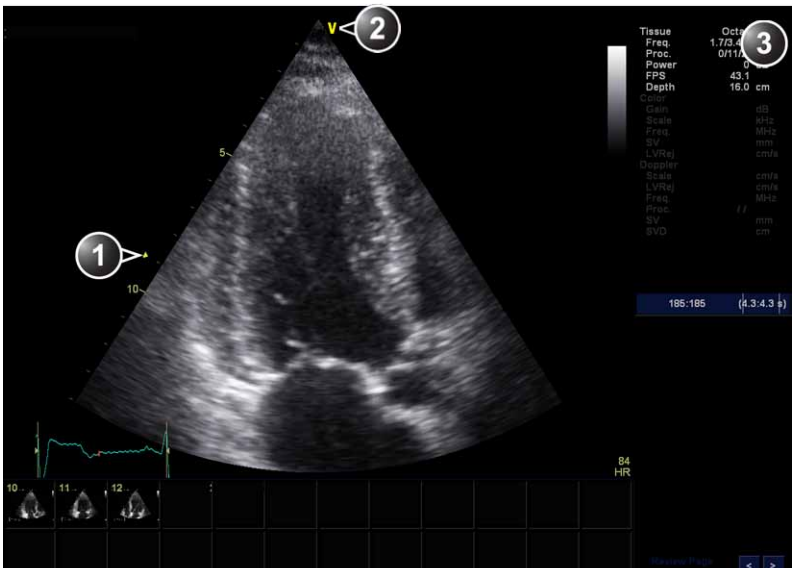
Chapter 4

Scanning Modes

This chapter describes:

2D-Mode

2D-Mode overview



1. Focus marker
2. Probe orientation marker
3. Parameter window

Figure 4-1. The 2D screen (cardiac)

Using 2D-Mode

The 2D-Mode is the system's default mode.

1. Press **2D** on the control panel to access 2D mode.
2. Optimize the image by adjusting the image controls (see below).

   If necessary use preset for optimum performance with minimum adjustment (see ‘Application presets’ on *page 4-49*).

Optimizing 2D

The following controls can be adjusted to optimize the 2D Mode display:

- Press **Auto** on the Control panel to turn on Automatic Tissue Optimization. ATO optimizes the 2D image by adjusting the gray scale curve.
- Use the **Active Gain**, **2D Gain** and **TGC** controls to optimize the overall image.

  Gain increases or decreases the amount of echo information displayed. TGC compensates for depth-related attenuation in the image.
- Use the **Depth** control to adjust the range to be imaged.
- Use the **Focus Pos** control to center the focal point around the region of interest.
- Use the **Frequency** control (move to higher frequencies) or the **Frame Rate** control (move to lower frame rate) to increase resolution in image.
- Use the **Frequency** control (move to lower frequency) to increase penetration.
- Use the **Reject** control to reduce noise in the image.
- Use the **Persistence** control to optimize imaging in the blood flow regions and make a cleaner, less noisy image.
- Use **UD Sp. Red** (in non Cardiac scanning) or Use UD Clarity (in Cardiac scanning) to reduce image speckle. Extra care must be taken to select the optimal Speckle reduction level, as too much filtering of speckle can mask or obscure desired image detail.
- Press **Color Maps** and select a gray map from the menu on screen.
- Press **Octave** to toggle between fundemental and Harmonic mode.
- Press **Virtual Convex** to enable a larger field of view in the far field.

Always use the minimum power required to obtain acceptable images in accordance with applicable guidelines and policies.

M-Mode

M-Mode overview

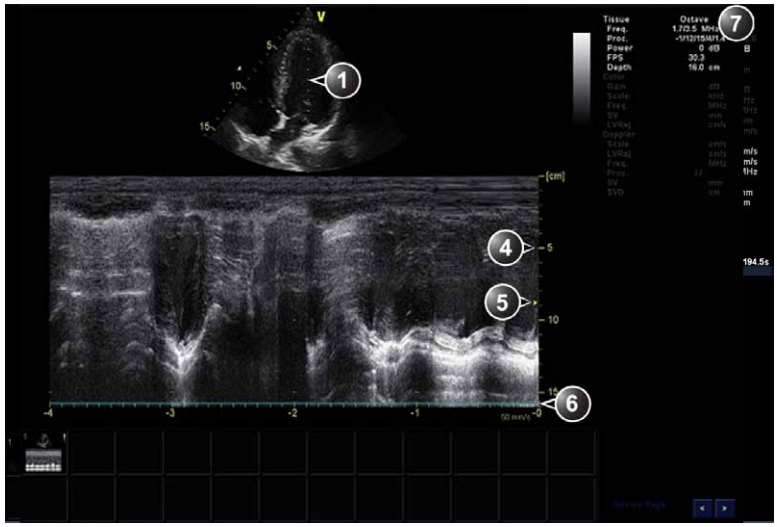


Figure 4-2. M-Mode screen

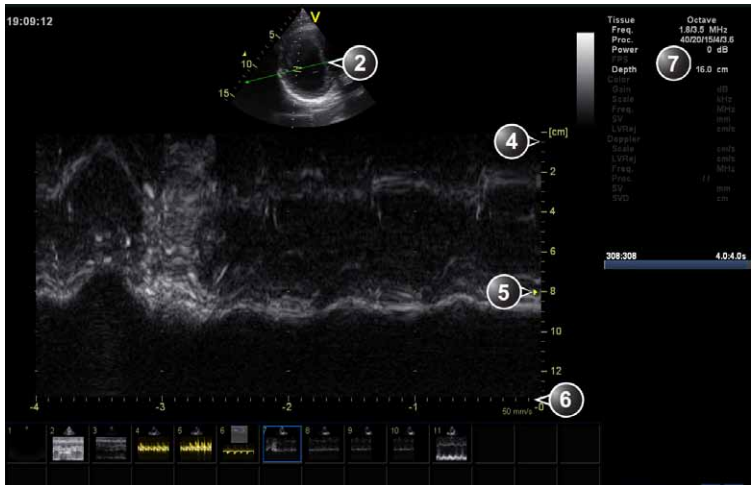


Figure 4-3. AMM Mode Screen

M-Mode overview (continued)

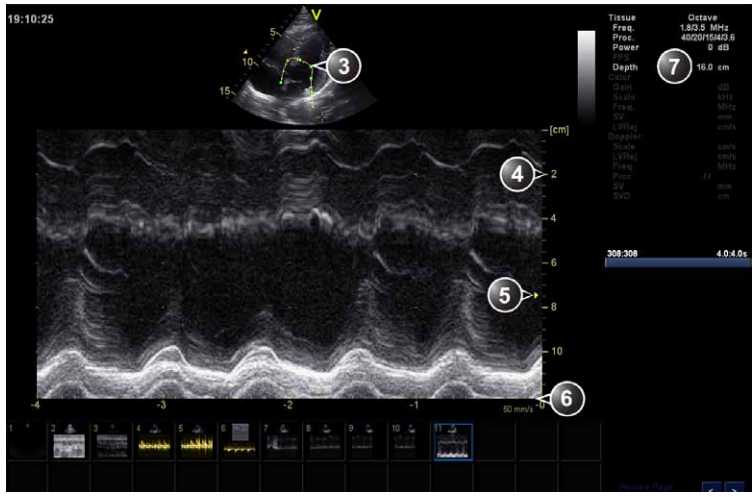


Figure 4-4. Curved AMM Mode Screen

1. Time motion cursor conventional M-Mode
2. Time motion cursor anatomical M-Mode
3. Time motion cursor curved anatomical M-Mode
4. Depth scale
5. Focus marker
6. Time scale
7. Parameter window

NOTE: The sweep speed information displayed in the bottom right corner of the image represents the user selected sweep speed and should be used only as a reference to confirm that the image was acquired at the selected sweep speed. It is not to be used for measurements or analysis. This is not an absolute value, but simply a reference number. Users performing studies using standardized protocols may find this sweep speed information useful for reading studies from other institutions

M-Mode overview (continued)

This unit has three types of M-Mode:

- Conventional M-Mode (MM): displays a distance/time plot of a cursor line in the axial plane of the 2D-image.
- Anatomical M-Mode (AMM): displays a distance/time plot from a cursor line, which is independent from the axial plane. AMM is available in grayscale, color, TVI, Tissue Tracking, Strain rate and Strain modes.
- Curved Anatomical M-Mode (CAMM): displays a distance/time plot from a free-drawn cursor line. CAMM is available in grayscale, color, TVI, Tissue Tracking, Strain rate and Strain modes.

Conventional M-Mode can be combined with Color Mode.

Using M-Mode

Conventional M-Mode

1. To access M-Mode from any other scan mode, press **MM** on the control panel.
2. Use the trackball to position the cursor over the required area of the image.
3. Press **Freeze**.
4. Use the trackball to scroll through the data acquired.

Anatomical M-Mode (Option for Vivid T8 Pro)

1. In M-Mode or 2D-Mode Freeze, press **AMM** on the Touch panel.

NOTE: *Anatomical M-Mode can also be used with previously acquired digitally stored 2D images. More than one heart cycle should be stored if performing M-Mode in post processing.*

2. Use the trackball (assigned function: *Pos*) to position the cursor over the required area of the image.
3. Press **Trackball** to allow free rotation of the solid full-length cursor line throughout the 2D image (trackball assigned function: *Angle*).
4. Rotate the solid cursor line to the desired direction.

Curved Anatomical M-Mode

NOTE: Curved Anatomical M-Mode (Curved AMM) is an option for Vivid T8.

NOTE: Curved Anatomical M-Mode (Curved AMM) is not available for Vivid T8 Pro.

1. In M-Mode, press **Curved AMM**.
2. Use the trackball (assigned function: *Pos*) to position the starting point of the time motion curve.
3. Press **Set** to anchor the starting point of the time motion curve.
4. Use the trackball to position the next point of the time motion curve.
5. Press **Set** to anchor the point of the time motion curve.
6. Repeat step 4 and 5 up to draw a complete time motion curve.

NOTE: The time motion curve can be edited by following the curve back to the desired point and redraw.

7. On the last point, press **Set** twice to terminate the curve.

*NOTE: To edit the time motion curve, select a point, move it to a new position and press **Set**.*

Optimizing M-Mode

The use of preset gives optimum performance with minimum adjustment. If necessary, the following controls can be adjusted to further optimize the M-Mode display:

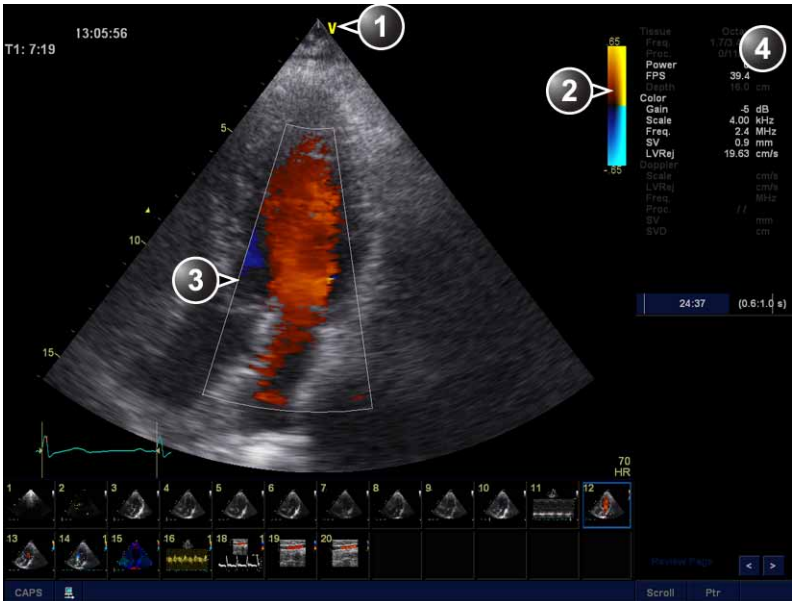
NOTE: Refer to 'Application presets' on page 4-49 about creating presets.

- Adjust **Horizon. Sweep** to optimize the display resolution.
- Adjust **Active Gain**, and **TGC** controls to adjust the range to be imaged.
- Use the **Frequency** (move to higher frequencies) or the **Frame Rate** control (move to lower frame rate) to increase resolution in image.
- Adjust **Dynamic Range** to optimize the useful range of incoming echoes to the available grayscale.
- Adjust **Compress** and **Edge Enhance** to further optimize the display.
- Adjust **Reject** to reduce noise while taking care not to eliminate significant low-level diagnostic information.
- Press **Octave** to toggle between fundemental and Harmonic mode.
- Use the **Focus Pos** control to center the focal point around the region of interest.
- Adjust **Power** to obtain an acceptable image using the lowest setting possible.

NOTE: The Power setting affects all other operating modes.

Color Mode

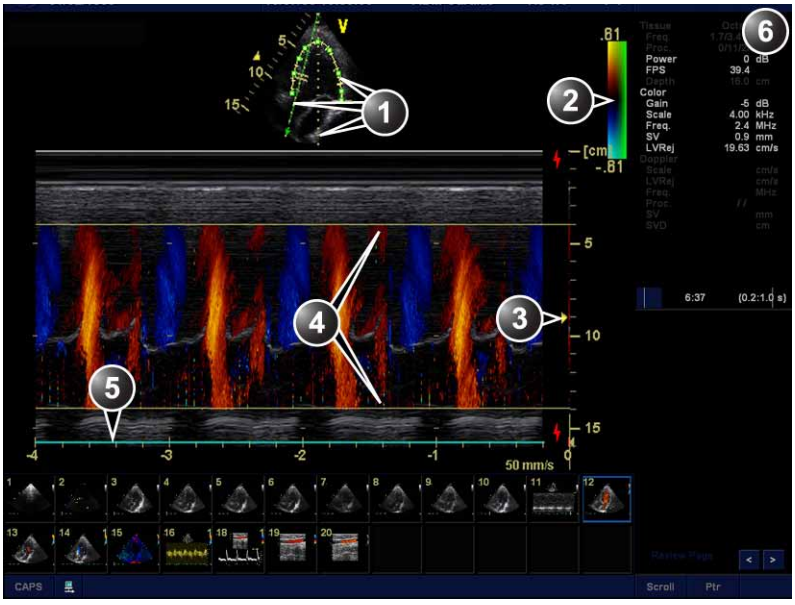
Color 2D Mode overview



1. Probe orientation marker
2. Color bar
3. Color sector marker
4. Parameter window

Figure 4-5. The Color Mode screen

Color M-Mode overview



1. Time motion cursors (M-Mode, AMM and Curved AMM)
2. Color bar
3. Focus marker
4. Flow sector marker
5. Time scale
6. Parameter window

Figure 4-6. The Color M-Mode screen (top/bottom display)

Using Color Mode

Color 2D

1. From an optimized 2D image, press **Color**.
2. Use the trackball (assigned function: *Pos*) to position the ROI frame over the area to be examined.
3. Press **Set**. The instruction *Size* should be highlighted in the trackball status bar.

*NOTE: If the trackball control Pointer is selected, press **Trackball** to be able to select between Position and Size controls.*

4. Use the trackball to adjust the dimension of the ROI.
5. Press **Store**.

Color M-Mode

1. From M-Mode press **Color**.
2. Use the trackball (assigned function: *Pos*) to position the color area in the M-Mode display.
3. Press **Set**. The instruction *Size* should be highlighted in the trackball status bar.

*NOTE: If the trackball control Pointer is selected, press **Set** to be able to select between Position and Size controls.*

4. Use the trackball to adjust the dimension of the color area.
5. Press **Store**.

Optimizing Color Mode

The use of preset gives optimum performance with minimum adjustment. If necessary, the following controls can be adjusted to further optimize the Color Mode display:

NOTE: Refer to 'Application presets' on page 4-49 about creating presets.

- Adjust the **Active Gain** to set the gain in the color flow area.
- Adjust **Scale** to the highest setting that provides adequate flow detection.

NOTE: The scale value may affect FPS, Low Velocity Reject, and Sample Volume.

- Adjust **Low Vel Reject** to remove low velocity blood flow and tissue movement that reduces image quality.
- Adjust **Variance** to detect flow disturbances.
- Adjust **Sample vol.** (SV) to a low setting for better flow resolution, or a higher setting to more easily locate disturbed flows

Optimizing Color Mode (continued)

- Adjust **Frequency** to optimize the color flow display. Higher settings improve resolution. Lower settings improve depth penetration and sensitivity. This does not affect the frequency used for 2D and M-Mode.

NOTE: Frequency setting may affect FPS, SV and Low Velocity Reject.

- Adjust **Power** to obtain an acceptable image using the lowest setting possible.

NOTE: The Power setting affects all other operating modes.

Adjust the following settings to further optimize display of the image:

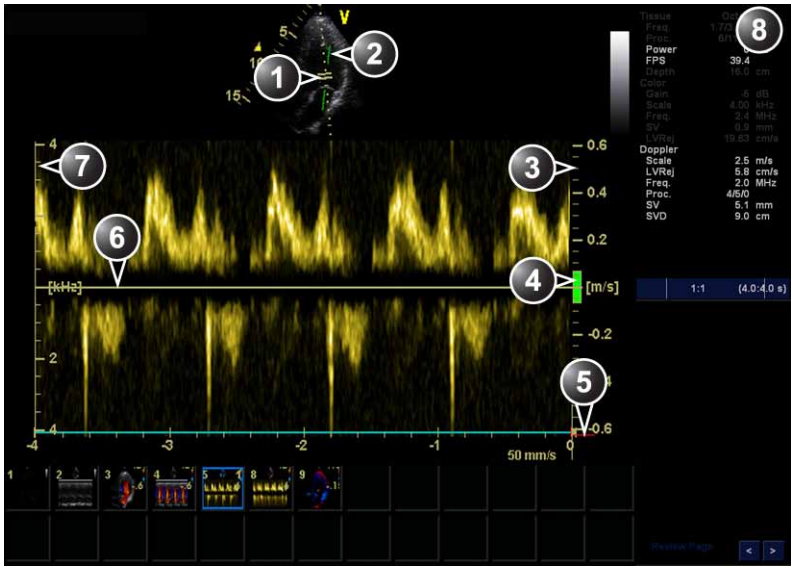
- Use **Invert** to reverse the color assignments in the color flow area of the display.
- Use **Tissue Priority** to emphasize either the color flow overlay, or the underlying grayscale tissue detail.
- Use **Baseline** to emphasize flow either toward or away from the probe.
- Use **Radial avg.** and **Lateral avg.** to reduce noise in the color flow area. Radial and Lateral Averaging smooths the image by averaging collected data along the same horizontal line. An increase of the lateral averaging will reduce noise, but this will also reduce the lateral resolution.


CAUTION

Use all noise reduction controls with care. Excessive application may obscure low level diagnostic information.

PW and CW Doppler

PW and CW Doppler overview



1. Sample volume (PW only)
2. Angle correction marker
3. Velocity scale
4. Low velocity reject
5. Nyquist velocity
6. Doppler baseline
7. Frequency scale (configurable, see page 4-47)
8. Parameter window

Note: the sweep speed information displayed in the bottom right corner of the image represents the user selected sweep speed and should be used only as a reference to confirm that the image was acquired at the selected sweep speed. It is not to be used for measurements or analysis. This is not an absolute value, but simply a reference number. Users performing studies using standardized protocols may find this sweep speed information useful for reading studies from other institutions.

Figure 4-7. The PW/CW Doppler Mode screen

Using PW/CW Doppler modes

Alternative 1

1. Press **PW** or **CW**. A scanning screen is displayed with a Doppler cursor on the 2D mode image and a Doppler spectrum in the lower part of the screen.
2. Use the trackball to position the Doppler cursor line and in PW the sample volume location over the area of interest.
3. In PW, adjust the **Sample Vol.**.

NOTE: Sample Volume adjustment may affect the Scale, Frame rate and LV rej. settings.

Alternative 2

1. Press **Cursor** on the control panel. A cursor line is displayed on the 2D image.
2. Select the cursor type on the Touch panel.
3. With the trackball adjust the position of the cursor line.
4. Press **PW** or **CW**.

Optimizing PW/CW Doppler modes

The use of preset gives optimum performance with minimum adjustment. If necessary, the following controls can be adjusted to further optimize the PW/CW modes display:

NOTE: Refer to 'Application presets' on page 4-49 about creating presets

- Adjust the **Active Gain** to set the gain in the spectral Doppler area.
- Adjust **Low Vel Reject** to reduce unwanted low velocity blood flow and tissue movement.
- In PW mode, adjust **Sample vol.** to low setting for better resolution, or higher setting to more easily locate the disturbed flows.
- Adjust the **Compress** setting to balance the effect of stronger and weaker echoes and obtain the desired intensity display.
- Adjust **Frequency** to optimize flow display. Higher setting will improve resolution and the lower setting will increase the depth penetration.
- Adjust **Frame Rate** to a higher setting to improve motion detection, or to a lower setting to improve resolution.

NOTE: Frequency and Frame rate settings may affect the Low Velocity Reject.

Optimizing PW/CW Doppler modes (continued)

- Adjust **Power** to obtain an acceptable image using the lowest setting possible. This is particularly important in CW mode, as the energy duty cycle is 100% (constant).

NOTE: The Doppler Power setting affects only Doppler operating modes.

Use all noise reduction controls with care. Excessive application may obscure low level diagnostic information.

Adjust the following settings to further optimize the display of the image.

- Use the **Horizon. Sweep** to optimize the sweep speed.
- To view signal detail, adjust **Scale** to enlarge the vertical spectral Doppler trace.
- Use **Invert** to reverse the vertical component of the spectral Doppler area of the display.
- Use **Angle Corr.** to steer the ultrasound beam to the blood flow to be measured (Not typically required during cardiac studies).

Tissue Velocity Imaging (TVI)

TVI overview

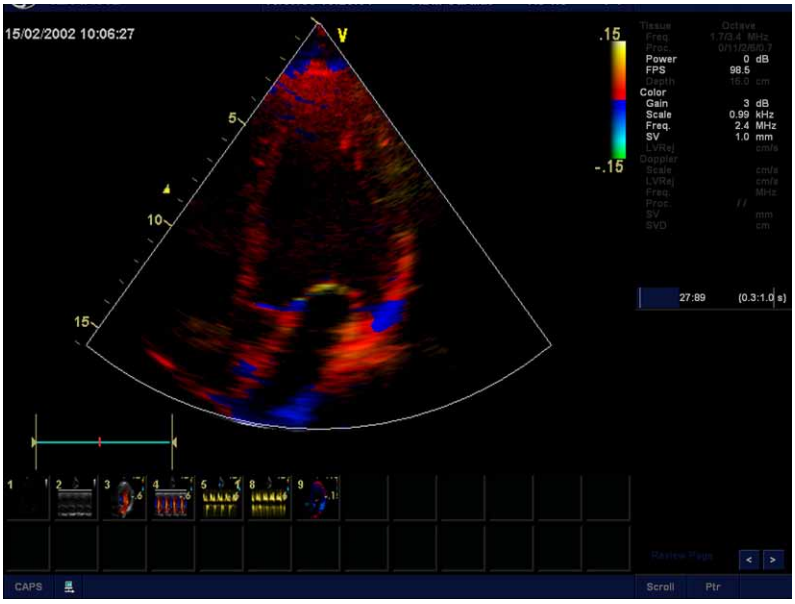


Figure 4-8. The TVI Mode screen

Tissue Velocity Imaging (TVI) calculates and color-codes the velocities in tissue. The tissue velocity information is acquired by sampling of tissue Doppler velocity values at discrete points. The information is stored in a combined format with grayscale imaging during one or several cardiac cycles with high temporal resolution.

Using TVI

1. While in 2D mode press **TVI** on the control panel.
2. Use the trackball (assigned function: *Pos*) to position the ROI frame over the area to be examined.
3. Press **Set**. The instruction *Size* should be highlighted in the trackball status bar.

*NOTE: If the trackball control Pointer is selected, press **Set** to be able to select between Position and Size controls.*

4. Use the trackball to adjust the dimension of the ROI.

Optimizing TVI

The use of preset gives optimum performance with minimum adjustment. If necessary, the following controls can be adjusted to further optimize the TVI display:

NOTE: Refer to 'Application presets' on page 4-49 about creating presets.

- To reduce quantification noise (variance), the Nyquist limit should be as low as possible, without creating aliasing. To reduce the Nyquist limit: Reduce the **Scale** value.

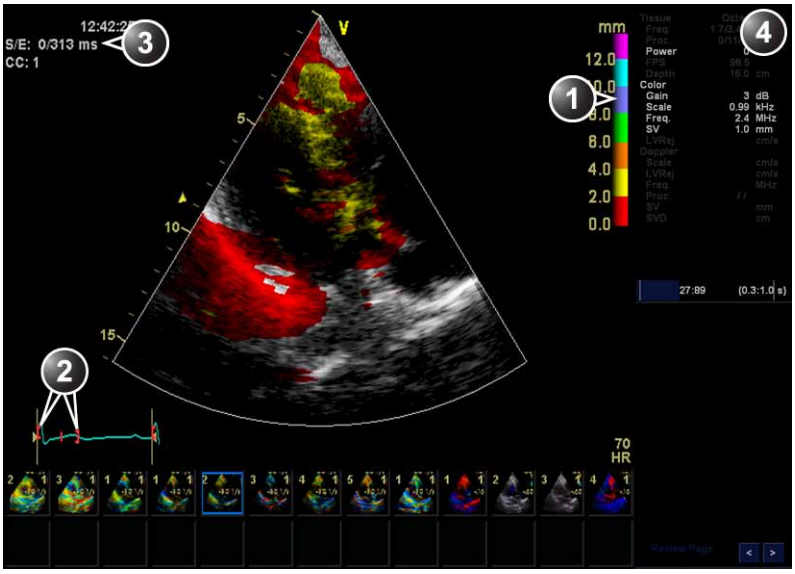
NOTE: The Scale value also affects the frame rate. There is a trade off between the frame rate and quantification noise.

- TVI provides velocity information only in the beam direction. The apical view typically provides the best window since the beams are then approximately aligned to the longitudinal direction of the myocardium (except near the apex). To obtain radial or circumferential tissue velocities, a parasternal view must be used. However, from this window the beam cannot be aligned to the muscle for all the parts of the ventricle.

NOTE: PW will be optimized for Tissue Velocities when activated from inside TVI.

Tissue Tracking (TT)

Tissue Tracking overview



1. Tissue Tracking color bar
2. Track start and track end markers
3. Tracking start and end from detected QRS
4. Parameter window

Figure 4-9. The Tissue Tracking Mode screen

NOTE: TT is an option for Vivid T8.

NOTE: TT is not available for Vivid T8 Pro.

Tissue Tracking calculates and color-codes the displacement in the tissue over a given time interval, typically the systole. The displacement is defined as the distance the tissue moves during this time interval. The displacement is found as the time integral (sum) of the tissue velocities during this interval.

Only displacements in the beam direction are found. Only positive (systolic) displacements are mapped into colors, negative displacements are mapped into grayscale.

Using Tissue Tracking

1. From TVI Mode, press **Tissue Track.**.
2. Adjust **Track Start** close to the R-peak.
3. Adjust **Track End** to end systole.
4. Use the trackball to position the ROI frame over the area to be examined.
5. Press **Set**. The instruction *Size* should be highlighted in the trackball status bar.

*NOTE: If the trackball control Pointer is selected, press **Set** to be able to select between Position and Size controls.*

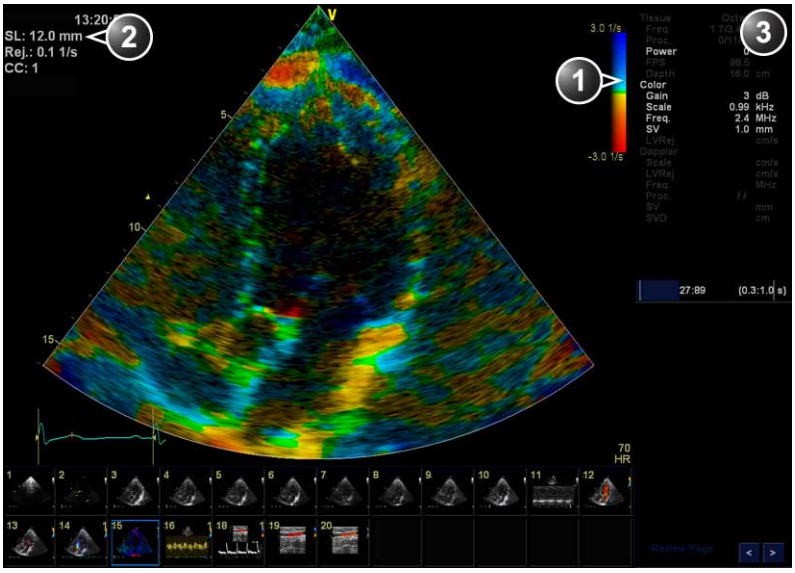
6. Use the trackball to adjust the dimension of the ROI.

Optimizing Tissue Tracking

- To reduce quantification noise (variance), the Nyquist limit should be as low as possible, without creating aliasing. To reduce the Nyquist limit, reduce the scale while in TVI.
- To check for aliasing, freeze the loop and apply velocity trace (Press **Freeze** and **Q-Analysis**), see also 'Quantitative Analysis' on *page 8-1*).
- The main use of Tissue Tracking is to map positive systolic displacements. This means that **Track Start** and **Track End** controls should be adjusted to pick out the systolic phase of the cardiac cycle: Adjust **Track Start** close to the R-Peak. Adjust **Track End** to end systole, typically near the T-wave.
- Negative displacement can be mapped by pressing **Invert**. **Track Start** and **Track End** must then be adjusted to pick out the diastolic phase of the cardiac cycle.
- The maximum displacement that is color-coded can be adjusted using **Track Scale**. If set too low, most of the wall will show the color indicating maximum displacement. If set too high, the maximum displacement color is never reached.
- Tissue Tracking provides velocity information only in the beam direction. The apical view typically provides the best window since the beams are then approximately aligned to the longitudinal direction of the myocardium (except near the apex).

Strain rate

Strain rate overview



1. Strain rate color bar
2. Strain length and Strain rate reject
3. Parameter window

Figure 4-10. The Strain rate mode screen

Strain rate calculates and color-codes the deformation per unit time i.e the speed at which the tissue deformation occurs.

Strain rate is calculated as the spatial gradient of velocity data.

NOTE: SRI (Strain Rate Imaging) is an option for Vivid T8.

NOTE: SRI is not available for Vivid T8 Pro.

Using Strain Rate

1. From TVI Mode, press **Strain Rate**.
2. Use the trackball to position the ROI frame over the area to be examined.
3. Press **Set**. The instruction *Size* should be highlighted in the trackball status bar.

*NOTE: If the trackball control Pointer is selected, press **Set** to be able to select between Position and Size controls.*

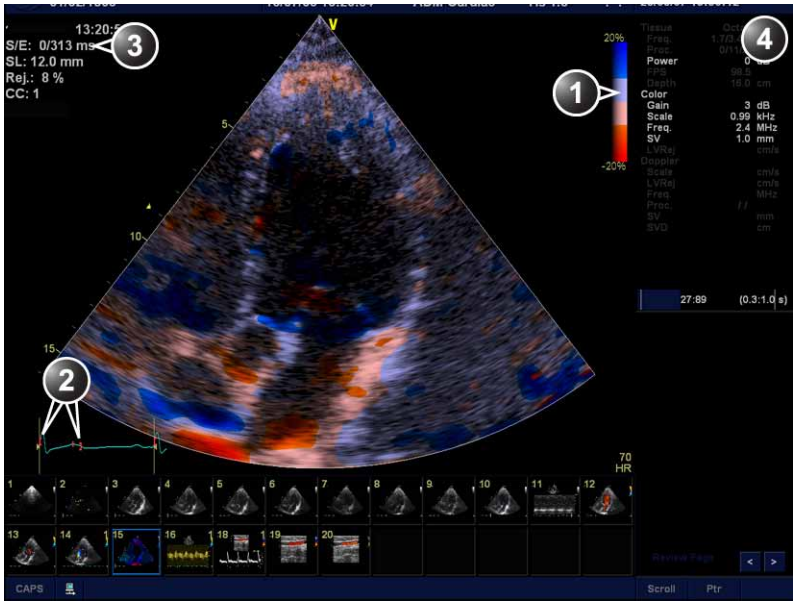
4. Use the trackball to adjust the dimension of the ROI.

Optimizing Strain rate

- To reduce quantification noise (variance), the Nyquist limit should be as low as possible, without creating aliasing. To reduce the Nyquist limit, reduce the scale while in TVI.
- To check for aliasing, freeze the loop and apply velocity trace (Press **Freeze** and **Q-Analysis**), see also ‘Quantitative Analysis’ on *page 8-1*).
- Strain rate provides information only in the beam direction. The apical view typically provides the best window since the beams are then approximately aligned to the longitudinal direction of the myocardium (except near the apex).
- There is a trade-off between noise and spatial resolution controlled by the **Strain Length** control. To minimize noise the **Strain Length** should be maximized.
- The maximum Strain rate that is color-coded can be adjusted using the **SRI Scale** control. If set too low, most of the wall will show the color indicating maximum Strain rate. If set too high, the maximum Strain rate color is never reached.
- Low strain rates may be masked out with a green color using the **SRI Reject** control.

Strain

Strain overview



1. Strain color bar
2. Strain start and end markers
3. Strain start and end from detected QRS and Strain sample size
4. Parameter window

Figure 4-11. The Strain mode screen

Strain calculates and color-codes the extent of tissue deformation (lengthening or shortening) relative to the original size over a given time interval, typically the systole.

NOTE: SI (Strain Imaging) is an option for Vivid T8.

NOTE: SI is not available for Vivid T8 Pro.

Using Strain

1. From TVI Mode, press **Strain**.
2. Adjust **Strain Start** close to the R-peak.
3. Adjust **Strain End** to end systole, typically near the T-wave.
4. Use the trackball to position the ROI frame over the area to be examined.
5. Press **Set**. The instruction *Size* should be highlighted in the trackball status bar.

*NOTE: If the trackball control Pointer is selected, press **Set** to be able to select between Position and Size controls.*

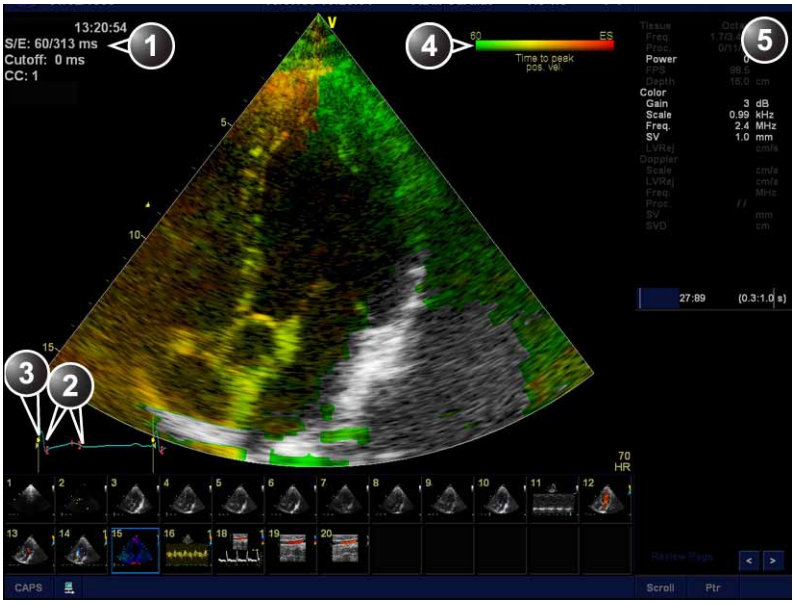
6. Use the trackball to adjust the dimension of the ROI.

Optimizing Strain

- From an optimized Strain rate display adjust strain tracking to pick out the systolic phase.
- The main use of Strain is to map negative systolic deformation. This means that **Strain Start** and **Strain End** should be adjusted to pick out the systolic phase of the cardiac cycle: Adjust **Strain Start** close to the R-Peak. Adjust **Strain End** to end systole, typically near the T-wave.
- The maximum deformation that is color-coded can be adjusted using the **Strain Scale** control. If set too low, most of the wall will show the color indicating maximum deformation. If set too high, the maximum deformation color is never reached.
- Strain provides information only in the beam direction. The apical view typically provides the best window since the beams are then approximately aligned to the longitudinal direction of the myocardium (except near the apex).
- Low strain values may be masked out with a different color using the **SI Reject** control.

Tissue Synchronization Imaging (TSI)

TSI overview



1. TSI start/end and TSI Cut-off
2. TSI start and end markers
3. QRS marker
4. TSI color bar
5. Parameter window

Figure 4-12. The TSI mode screen

TSI calculates and color-codes the time from detected QRS to a detected event, typically the time to peak systolic velocity. TSI is intended for adult cardiac images.

NOTE: TSI is an option for Vivid T8.

NOTE: TSI is not available for Vivid T8 Pro.

Using TSI

CAUTION

TSI requires correct QRS detection to function properly. Therefore always check that the yellow circle markers on the ECG are positioned correctly on each QRS complex before proceeding with the analysis.

1. Ideally, perform the AVO and AVC Event Timing measurements prior to starting TSI. See ‘Event timing measurements’ on *page 7-10*.
2. From TVI, Tissue Tracking, Strain or Strain rate mode, select **TSI**.
3. Use the trackball to position the ROI frame over the area to be examined.
4. Press **Set**. The instruction *Size* should be highlighted in the trackball status bar.

NOTE: *If the trackball control Pointer is selected, press **Set** to be able to select between Position and Size controls.*

5. Use the trackball to adjust the dimensions of the ROI.

TSI markers adjustments

The default TSI markers settings are:

- **TSI start**: The time of the Event Timing measurement Aortic Valve Opening (AVO). (If no AVO measurement is available, 60 ms from the detected QRS is used.)
- **TSI end**: The time of the Event Timing measurement Aortic Valve Closure (AVC). (If no AVC measurement is available, an estimated time of end systole is used.).

The system can be configured to not use AVO and AVC for TSI start and end, or to use other events.

TSI markers adjustments (continued)

The configuration alternatives are:

- **TSI start**: AVO, 60, 80, 100, 120 ms, or Manual control
- **TSI end**: AVC, AVC - 200 ms, AVC - 150 ms, AVC - 100 ms, AVC - 50 ms, AVC, AVC + 50 ms, AVC + 100 ms, AVC + 150 ms, AVC + 200 ms, MVO, MVO + 100 ms, MVO + 160 ms, MVO + 200 ms, MVO + 260 ms, ES - 200 ms, ES - 150 ms, ES - 100 ms, ES - 50 ms, ES + 50 ms, ES + 100 ms, ES + 150 ms, ES + 200 ms or Manual control.

*NOTE: Manual adjustment of TSI start and TSI end markers is available in Q Analysis. To store the modified marker settings, press **Store** and choose the configuration setting **Manual control** to avoid automatic adjustment of the markers.*

To configure TSI markers:

1. Press **Utility**/**Config** on the Touch panel and select the category **Meas/Text**.
2. In the *Measure category*, select the sheet **Advanced**.
3. In the *Application specific parameters section* adjust TSI start and TSI end parameters by selecting a new value from the combo menu displayed upon selection.

Optimizing TSI

- Use apical view when imaging and ensure that the LV wall or opposing wall are in the view.
- Activate TSI from an optimized TVI or Strain rate display.
- Low time to peak values may be masked out with a different color using the **TSI Cutoff** control.
- When analyzing TEE images where systolic velocities are negative, the detection mode may be changed to “Time to peak negative velocity” using the **Invert** control.

Additional scanning features

LOGIQ View

LOGIQ View provides the ability to construct and view a static 2D image which is wider than the field of view of a given transducer. This feature allows viewing and measurements of anatomy that is larger than what would fit in a single image.

LOGIQ View constructs the extended image from individual image frames as the operator slides the transducer along the surface of the skin in the direction of the scan plane.

LOGIQ View is available with all linear array probes.

NOTE: LOGIQ View is an option for Vivid T8.

NOTE: LOGIQ View is not available for Vivid T8 Pro.

Using LOGIQ View

1. Perform a detailed examination of the anatomy/pathology. Optimize parameters for tissue texture and visible window prior to activating LOGIQ View.
2. Press **LOGIQ View**.

NOTE: LOGIQ View is available only when Compound is turned off.

3. To start acquiring the image, press **Pause** key.

   Scan slowly and in a uniform motion lengthwise.

   - Continuous contact is required throughout the length of the extended image.
   - Always keep the transducer perpendicular to the skin surface.
   - Keep the motion within the same scan plane.
   - Do not make abrupt changes in speed of motion.

Using LOGIQ View (continued)

4. If required, press **Pause** again to restart the acquisition.
5. To complete the scan, press **Freeze**.
6. Adjust **LogiqV. Rotate** to rotate the acquisition.
7. Press **Store**.

NOTE: The quality of the resulting image is somewhat user-dependent and requires some additional skill and practice to develop proper technique.

Compound (Option for Vivid T8 Pro)

Compound is a process of combining three (default) or five frames from different steering angles into a single frame. The combined single image has the benefits of reduced speckle noise, reduced clutter, and continuity of specular reflectors. Therefore, this technique can improve contrast resolution.

Compound is available with all curved and flat linear probes in 2D live mode, or in the 2D image while in Color mode. Compound is on by default.

Using compound

1. Press **Compound**.

   A three frames compounded image is produced.
2. To change the number of compounded frames, adjust **Comp. Frames** to three or five frames on the Touch panel.

B-Flow (Option for Vivid T8 and Vivid T8 Pro)

B-Flow provides an intuitive representation of non quantitative hemodynamics in vascular structures. B-Flow enables visualization of complex hemodynamics and highlights moving blood and tissue. There are no artifacts such as bleeding, blooming, or aliasing.

B-Flow is available with all probes except TEE probes.

Using B Flow

1. While in Color flow, press **B-Flow**.
2. Adjust **Flow Speckle**. Increased Flow speckle enhances hemodynamics.

The greater the speed, the better the image scatter density and size. If the scan direction is the same as the flow direction, then the image scatter is elongated; if the scan direction is the opposite as the flow direction, then the image scatter is tighter. Therefore, have the scan direction opposite to that of flow direction. Switch the way you hold the probe, with the probe orientation marker inferior to maintain correct orientation on the monitor. Flow starts from where the focal zone is located.

Blood flow imaging (Option for Vivid T8 and Vivid T8 Pro)

Blood flow imaging (BFI) is a Color flow mode with added speckle information. The speckle information visualizes the blood flow direction.

NOTE: When scanning in BFI triplex mode it is normal to have a time delay between the Doppler display / Doppler audio and the BFI color display.

BFI is available with all probes except TEE probes.

Using Blood flow imaging

1. While in Color flow, press **BFI**.
2. Adjust **Flow Speckle**. Increased Flow speckle enhances hemodynamics.

Virtual Convex (Option for Vivid T8 Pro)

Virtual Convex is designed to provide a wider field of view in the far field, and is available on linear probes. While in 2D-mode, use the **Virtual Convex** to turn virtual convex ON or OFF. When Virtual convex is turned on, you may enter other scanning modes such as Color, Doppler or M-mode and Virtual convex will remain active on the 2D image.

NOTE: Virtual Convex is only available for linear probes.

NOTE: While Virtual Convex is turned on, the Zoom function will always activate in "Display-zoom" mode only.

*NOTE: While using any linear probe in **Virtual Convex** mode while in split-screen. The vertical depth-scale bar is missing. In this case, the measurements calipers cannot measure across the two parts of the screen. When Virtual convex is turned off, the vertical scale bar appears and calipers may measure across the two screens.*

Image controls

Control panel

	Focus
2D, M-Mode	Changes the location of the focal point(s). A triangular focus marker indicates the depth of the focal point. Adjust the Focus around the region of interest.

	Dual Focus
2D	Activates Dual focus mode. To adjust the Dual focus, rotate the **Focus Pos**.

	2D Gain
2D	When rotated clockwise, increases the overall gain applied to the received echo signals equally for all depth.

	Time Gain Compensation TGC
2D	Compensates for depth-related attenuation in an image. The sliders nearest the operator affect the far field. TGC amplifies returning signals to correct for the attenuation caused by tissue at increasing depths.

	Automatic Tissue Optimization (ATO)
2D	ATO provides an automatic optimization of the 2D image by adjusting the gray scale curve. Press **Auto** to toggle ATO on or off. When activated, ATO is displayed in the information window.

	Depth
2D	Sets the maximum (far field) distance that will be imaged. Decreasing the depth may allow higher frame rates.

Touch panel and rotaries

	Width/2D width
2D, TVI, TT, SRI, SI	Controls the size or angular width of the 2D image sector. A smaller angle generally produces an image with a higher frame rate.

	Frequency
2D, M-Mode	Enables the adjustment of the probe's operating frequency. The selected frequency is displayed in the *Parameter* window. For some probes/applications the lowest frequency settings will be Octave imaging settings.
CF, Doppler, TVI, SRI	Enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration. The selected frequency is displayed in the *Parameter* window. Adjusting Frequency may affect Sample Volume and LVR settings.

	Color Maps
2D, M-Mode	Displays the *Tissue color* menu to optimize the grayscale presentation. The menu enables the selection of non-linear gray-curves or different 2D-colorized curves to be selected.

	Frame rate
2D, TVI, TT, SR, SRI, TSI	Adjusts frame rate (FPS). The relative setting of the frame rate is displayed in the *Parameter* window. When adjusting frame rate, there is a trade off between spatial and temporal resolution.

	Cineloop/Cine Exit
2D, CF, TVI, TT, SRI, SI, TSI	Starts/stops the cineloop.

	Up/Down
2D, M-Mode	**Up/Down**: enables the 2D image to be flipped 180 degrees.

	Left/Right
2D	**Left/Right**: enables a mirror image of the 2D image to be created. The left/right reference marker **V** moves to the other side of the image.

Touch panel and rotaries (continued)

	Compress
2D, M-Mode	Controls the amount of contrast in the 2D image. An index number is displayed in the *Parameter* window to indicate the relative level of compression.
Doppler	Enables control over the contrast of the Doppler spectrum. When compression is raised, the spectrum image becomes softer and some low level background noise may appear. Compress is available in both Live and Freeze.
TVI, SRI	Controls the amount of color compression. The color bar is adjusted accordingly.

	Reject
2D, M-Mode	Adjusts the rejection level. When this control is increased, low-level echoes are rejected and appear darker in the 2D image. An index number is displayed in the *Parameter* window to indicate the relative level of rejection.
Doppler	Enables undesirable background noise to be removed from the Doppler spectrum resulting in a darker background. Reject is available in both Live and Freeze.
TVI	Adjusts the cut-off level for the low velocity of TVI to be discarded when generating the color image.

	Dynamic Range
2D, M-Mode	Enables control of the dynamic range or contrast of the image. When dynamic range is set high, the image is softer and more low-level data is visible.

	Data Dependent Processing (DDP)
2D	Performs a temporal processing which reduces random noise without affecting the motion of significant tissue structures. An index number is displayed in the *Parameter* window to indicate the relative DDP level.

	Tilt
2D	Enables the axis of the 2D image to be tilted to the left or right. By default the axis of symmetry of a 2D image is vertical.

	UD Clarity
2D (Cardiac)	Enables the user to create a personalized appearance of the tissue. A decrease of UD Clarity creates a smoother image, though keeping boundaries sharp. An increase of UD Clarity creates a crisper image.

Touch panel and rotaries (continued)

	UD Speckle reduce
2D (non-Cardiac)	Reduces the unwanted effects of speckle in the ultrasound image. Image speckle usually appears as a grainy texture in otherwise uniform areas of tissue. Its appearance is related to image system characteristics, rather than tissue characteristics, so that changes in system settings, such as probe type, frequency, depth, and others, can change the appearance of the speckle. Too much speckle can impair image quality and make it difficult to see the desired detail in the image. Likewise, too much filtering of speckle can mask or obscure desired image detail. Extra care must be taken to select the optimal Speckle reduction level.

	Edge Enhance
2D, M-Mode	Controls image processing related to the extent of edge enhancement applied to an image.

	PRF/Diff
2D	Affects the level of reverberations in the image. When turned on, the frame rate (or the number of focal zones) will decrease, while the reverberations will be attenuated.

	Power
2D, M-Mode, CF, Doppler, TVI, TT, SRI, SI, TSI	Controls the amount of acoustic power applied in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power permitted by the FDA. The Thermal Index (TI) and the Mechanical Index (MI) are displayed on the screen. When power is reduced, it reduces the signal-to-noise ratio, so that the image may become noisier.

	Horizontal sweep
M-Mode, Doppler	Adjusts the horizontal refresh rate of the M-Mode or Doppler area of the display. Horizontal sweep is available in live and cine replay.

	Scale
CF, Doppler, TVI	Adjusts the repetition rate of the Doppler pulses transmitted to acquire the data for color flow mapping. The Scale (Nyquist limit) should be adjusted so that no aliasing occurs, while still having good resolution of velocities. The Nyquist limit should be somewhat above the maximum velocity found in the data.

Touch panel and rotaries (continued)

	Baseline
CF	Adjusts the color map to emphasize flow either toward or away from the probe. Baseline is available in both Live and Freeze.
Doppler	Enables the Doppler baseline to be shifted up and down. The default Doppler baseline is set at the center of the vertical aspect of the Doppler display, dividing evenly the flow toward and away from the probe. By adjusting the baseline a larger portion of the analysis is assigned to the flow direction present. Baseline is available in live and cine replay.
TVI	Adjusts the color map to emphasize tissue motion either toward or away from the probe. Baseline is available in both Live and Freeze.

	Invert
CF	Enables the color scheme assigned to positive and negative velocities to be inverted. Invert is available in live and cine replay.
Doppler	Enables the Doppler spectrum to be flipped 180 degrees, so that negative velocities are displayed above the baseline and positive velocities below the baseline. Invert is available in live and cine replay.
TVI	Enables the color scheme assigned to positive and negative tissue velocities to be inverted. Invert is available in live and cine replay.
TT	Enables the color scheme assigned to the tissue displacements to be inverted. Invert is available in live and cine replay.
SRI	Enables the color scheme assigned to strain rate to be inverted. Invert is available in live and cine replay.
SI	Enables the color scheme assigned to shortening and elongation tissue deformation to be inverted. Invert is available in live and cine replay.

	Variance
CF	Controls the amount of variance data added to a color display. Variance enables computer-aided detection of turbulent flow (e.g. jets or regurgitation). Variance is available in live and cine replay.

	Color Maps
CF, TVI	Displays the *Color* menu for selection of different color maps. Each color map is assigning different color hues to different velocities.

	Tissue priority
CF	Emphasizes either the color of the color mode or the gray scale tissue detail of the 2D image. Tissue priority is available in both Live and Freeze.

Touch panel and rotaries (continued)

	Sample volume
CF	Lower setting gives better flow resolution while a higher setting increases sensitivity and helps to locate turbulent flows.

	Low Velocity Rejection (LVR)
CF	LVR, also called Wall motion filter, enables the extent of low velocity removal to be adjusted. Color data produced by very low flow may cause interference.
Doppler	Enables the low velocity portions of the spectrum to be filtered, since the Doppler spectrum and audio may contain strong wall-motion signals. The amount of Low Velocity Reject. is indicated by the green vertical bar at the right end of the baseline.

	Lateral averaging
CF, TVI, TT, SRI, SI	Smooths the image by averaging collected data along the same horizontal line. An increase of the lateral averaging will reduce noise, but this will also reduce the lateral resolution.

	Radial averaging
CF, TVI, TT, SRI, SI	Smooths the image by averaging collected data along the same radial line. An increase of the radial averaging will reduce noise, but this will also reduce the radial resolution.

	LPRF
PW Doppler	Sets the Pulse Repetition Frequency (PRF) for the PW Doppler acquisition of flow data. When the Doppler PRF is raised beyond a certain limit, more than one Doppler gate is displayed on the screen.

	Color maps
Doppler	Displays the *Doppler Color* menu for selection of different Doppler colorization maps.

	Angle correction and Quick angle
PW Doppler	Enables correction of the Doppler velocity scale by defining the angle between the Doppler beam and the investigated blood vessel or blood flow. A thin cross bar on the Doppler cursor will rotate as the control is adjusted. Angle correction is available in both Live and Freeze. Angle correction adjusts the angle between zero and 90 degrees with one degree increment. Quick angle adjusts the angle by 60 degrees.

Touch panel and rotaries (continued)

	Sample volume
PW Doppler	In PW mode, set the longitudinal size of the region to be sampled for measurement. Adjusting Sample volume may affect the PRF (Nyquist limit) settings. SV does not apply to CW mode, where the volume sampled is the full length of the area indicated by the cursor line.

	TSI
TVI, TT, SRI, SI	Starts TSI mode.

	Simultaneous
CF, TVI, TT, SRI, SI, TSI	Enables simultaneous display of a 2D image and a 2D image with color coded mode.

	TVI visible
TVI	Turns TVI display on/off.

	Q Analysis
TVI, TT, SRI, SI, TSI (In Freeze)	Starts the Quantitative analysis application.

	Threshold
TVI, TT, SRI, SI, TSI	Controls the level of grayscale intensity that is used as a threshold for color.

	Transparency
TVI, TT, SRI, SI, TSI	Controls the degree of transparency of the color display.

	Track start
TT	The time after ECG R-peak when the integration should start.

	Track end
TT	The time after tracking start when the integration should end.

	Tracking scale
TT	Controls the color cut-off value of max displacement displayed. The chosen values are shown on the color bar.

Touch panel and rotaries (continued)

	SRI scale
SRI	Defines the scale for the color coding of the strain rate.

	Strain length
SRI, SI	Determines the strain sample volume size.

	SRI reject
SRI	Adjust the cut-off level of the low Strain rate to be discarded when generating the color image. Rejected values are displayed in green.

	Strain start
SI	The time after ECG R-peak when the strain calculation should start. The strain start time is displayed on the screen and is represented on the ECG by a red marker.

	Strain end
SI	The time after strain start when the strain calculation should end. The strain end time is displayed on the screen and is represented on the ECG by a red marker.

	Strain scale
SI	Defines the scale for the color coding of the tissue deformation.

	Strain reject
SI	Adjusts the cut-off level of the low tissue deformation to be discarded when generating the color image. Rejected values are uncolored.

	Cine compound
TT, SRI, SI, TSI	Calculates and displays cineloops generated from a temporal averaging of multiple consecutive heart cycles. The number of cycles averaged is user adjustable. The number of averaged cycles is displayed on the top left corner.

	TSI Cut-off
TSI	Controls the cut-off time: using this control it is possible to color all parts of the TSI image that has a time to peak less than a certain cut-off time.

	T1/T2 (Timer)
Stress echo	Starts a timer.

Scan Assist Pro

Introduction

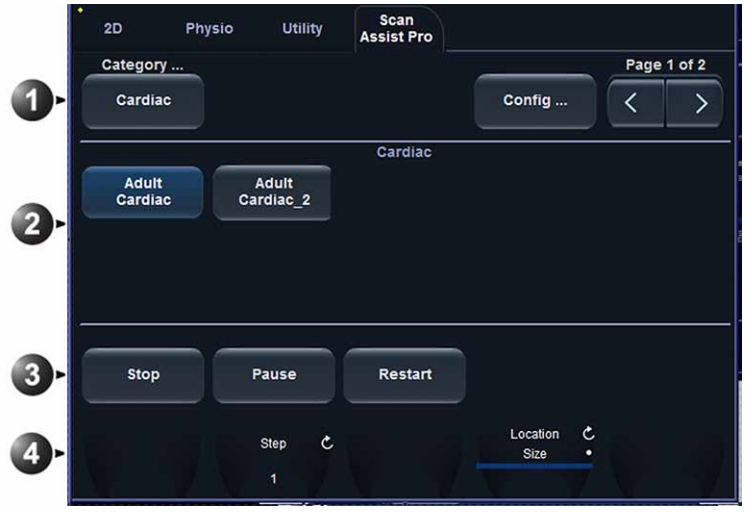
Scan Assist Pro provides an automated exam script that guides you through an exam step-by-step. The system automatically invokes the correct mode and imaging parameters, advances to the next step in an exam, annotates the image, initiates measurements, and assigns the measurements to the worksheet/report.

NOTE: Scan Assist Pro is an option for Vivid T8 and Vivid T8 Pro.

Scan Assist Pro overview

1. Protocol name
   Completed steps/number of steps
2. Step instruction area
3. Protocol steps
   Check mark: completed step
   Frame: current step (The frame is green when the Protocol is active or yellow when it is paused.)
4. This column indicates the scanning mode or when a measurement needs to be made.
5. This column indicates the action to move the Protocol to the next step.
6. Navigation: Stop, Pause/Continue the Protocol.

Figure 4-13. Scan Assist Pro window



1. **Category**: the Protocols are grouped according to the exam categories (e.g. Cardiac, Abdominal... etc.)
   Config: display Scan Assist Pro config sheet (Figure 4-15 *on page 4-43*).
2. Protocols available for the selected category.
3. Stop, Pause/Continue and Restart Protocol.
4. Change current step.
   Change position and size of the Scan Assist Pro window.

Figure 4-14. Scan Assist Pro Touch panel

Setting up Scan Assist Pro

Scan Assist Pro is ready to use with factory Protocols. However user-defined Protocols customized to better suit the user's needs can be added to the list of available Protocols on the Vivid T8/Vivid T8 Pro.

User-defined Protocols are created using the Scan Assist Pro Creator program, either on scanner or off scanner (see 'Scan Assist Pro Creator' on *page 15-2*).

To set up Scan Assist Pro with user-defined Protocols you need to:

- Import the user-defined Protocol that was created using the Scan Assist Pro Creator.

NOTE: *You do not need to import the user-defined Protocol if it was created with the on scanner Scan Assist Pro Creator program.*

- Add the Protocol to the Protocol selection so that it is available from the Touch panel.

Importing a Protocol

1. Insert the media with the saved Protocol from the Scan Assist Pro Creator or exported Protocol from another Vivid T8/Vivid T8 Pro.

   Refer to 'Scan Assist Pro Creator' on *page 15-2* for more information on how to create a Protocol.
2. Press **Utility**/**Config** on the Touch panel and log on if required.
3. Select **Imaging/Scan Assist Pro**.

Importing a Protocol (continued)

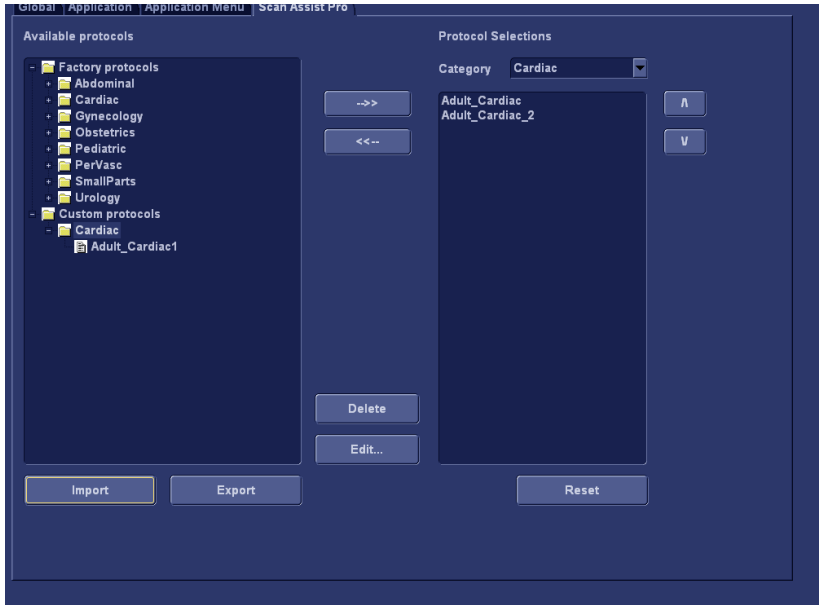


Figure 4-15. The Scan Assist Pro sheet

4. Select **Import** from the *Scan Assist Pro* sheet.
   The *Import Protocols* window is displayed.

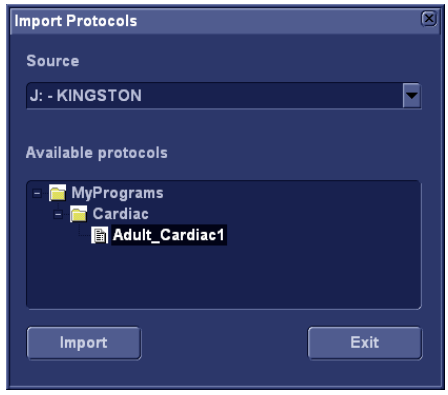


Figure 4-16. Import Protocols

Importing a Protocol (continued)

5. In the *Source* field, select the media that the Protocol is stored on.
6. Highlight the Protocol(s) to be imported. If a folder is highlighted, all Protocols in the folder are selected.
7. Select **Import**. The Protocol(s) are stored to the Vivid T8/ Vivid T8 Pro.

NOTE: If the Protocol(s) already exist a confirmation dialog is displayed asking the user to confirm the replacement of the existing Protocol(s).

Add the imported Protocol to the Protocol selection

The imported Protocol(s) must be added to the Protocol selection to be available on the Scan Assist Pro Touch panel.

1. Select the desired **Category** under Protocol Selections on the right-hand side of the *Scan Assist Pro* sheet (Figure 4-17).
2. Select the imported Protocol from Available Protocols/ Custom Protocols on the left-hand side of the *Scan Assist Pro* sheet. Press the **Right arrow** button to add the imported Protocol to the selected exam category.

*NOTE: Use the **Up** and **Down arrow** buttons to move the Protocol up and down in the list that will be displayed on the Scan Assist Pro Touch panel.*

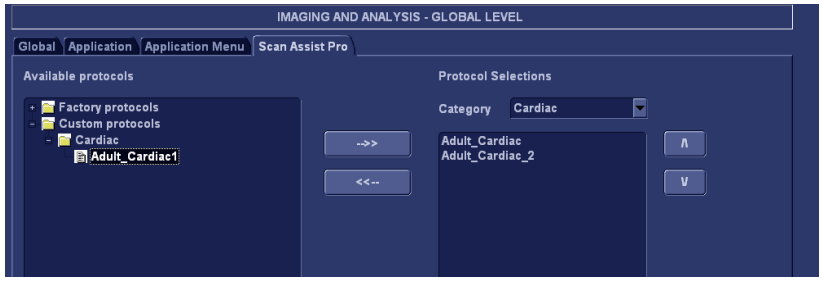


Figure 4-17. Add Protocol

Using Scan Assist Pro

1. Press **Protocol** on the Control panel and select the Protocol to run on the Touch panel.

NOTE: *The Protocols displayed on the Touch panel correspond to the current exam category. To use a Protocol from another exam category, Press **Category** on the Touch panel and select a Protocol from a different category.*

The *Scan Assist Pro* window is displayed on screen with the first step active. In the example below the annotation for the first step has been automatically added on the image, ready for you to scan the specified anatomy.

NOTE: *You can change the size and position of the Scan Assist Pro window using the rotary button under the Touch panel.*

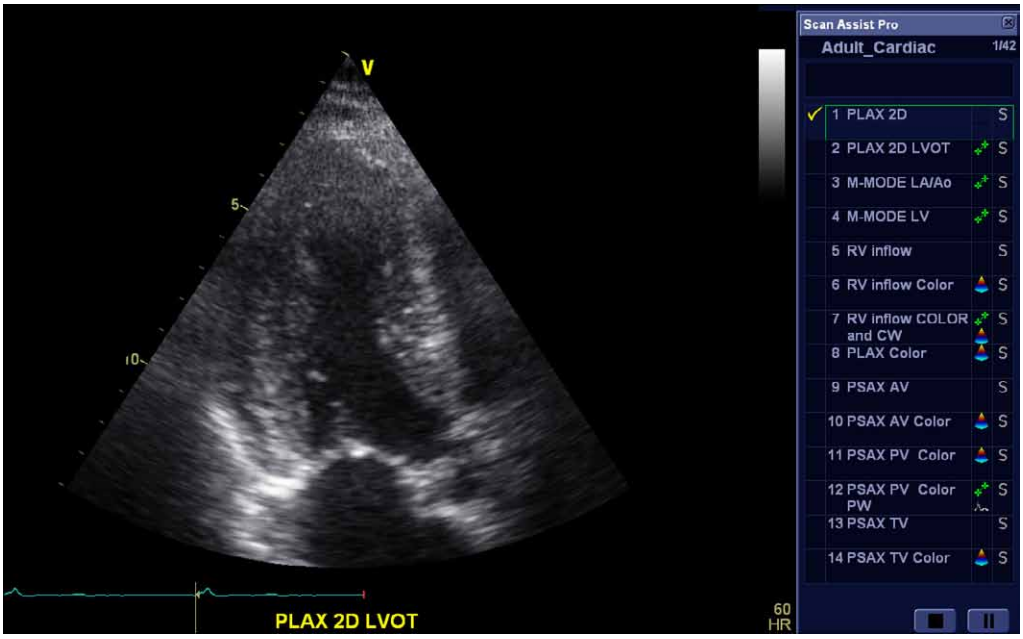


Figure 4-18. Scan Assist Pro screen

Using Scan Assist Pro (continued)

2. Follow the steps indicated in the Protocol: image/measure the appropriate anatomy.
3. Press **Store** to move to the next step in the Protocol.
4. To pause or unpause Scan Assist Pro, press the **Pause** button either in the *Scan Assist Pro* window or on the Touch panel. You can also press the **Left/Right arrow** () key on the alphanumeric keyboard.
5. To stop a Protocol, press the **Stop** button either in the *Scan Assist Pro* window or on the Touch panel. A dialog is displayed to confirm the operation.
6. To restart a Protocol, press **Restart** on the Touch panel. A dialog is displayed to confirm the operation.
7. To skip a step or move to a certain step, press the **Up**/**Down arrow** key on the alphanumeric keyboard or select the step you want to move to using the trackball.

Configuration – Imaging

Global imaging settings

1. Press **Utility**/**Config** on the Touch panel and log on if required.
2. Select **Imaging/Global**.

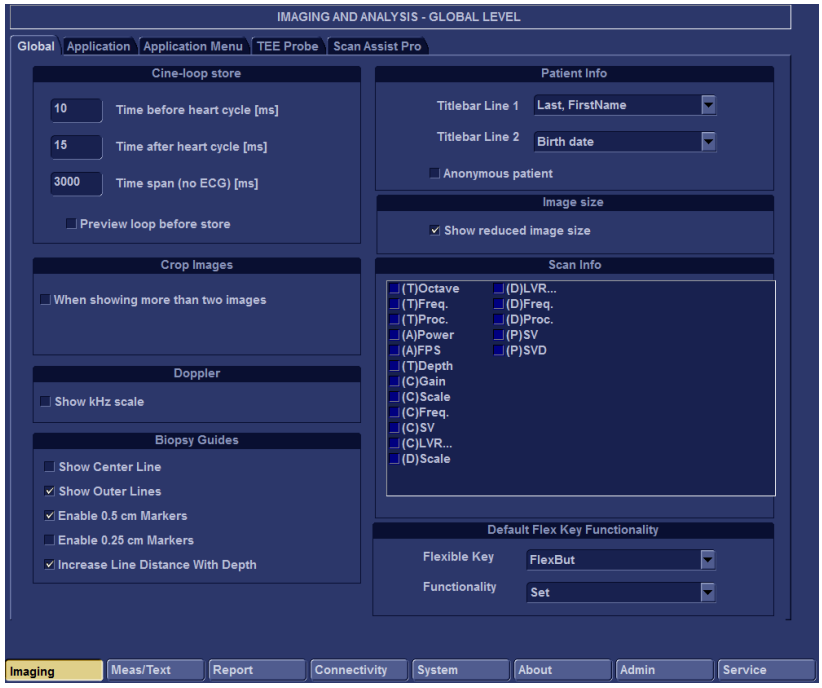


Figure 4-19. The Global sheet

Global imaging settings (continued)

The followings settings can be configured:

Table 4-1: Imaging Settings

Parameter	Description
Cineloop store	• **Time before/after heart cycle**: sets the total storage time span of the cineloop in ECG mode. • **Time span (no ECG)**: sets the total storage time span of the cineloop with no ECG. • **Preview loop before store**: when selected enable review of cineloops before storage.
Crop images	In the *Analysis screen*, removes top and bottom of the image when more than two images have been selected.
Doppler	• **Show KHz scale**: when selected, displays the KHz scale on the left side of the Doppler spectrum (see Figure 4-7 *on page 4-13*).
Biopsy Guides	Configure the biopsy guide zone display
Patient Info	• **Title bar Line 1 & 2**: selects from the drop-down menu the patient information to display on the *Title bar*. • **Anonymous patient**: when checked, no patient information is displayed on the *Title bar*.
Image size	**Show reduced image size**: check to show the reduced image size on the screen.
Scan Info	• Select the scan information to be displayed on the video record.
Default Flex Key Functionality	• **Flexible Key**: select a button from the pop-up menu as a flexible key. • **Functionality**: choose the specific function for the selected flexible key.

Application presets

1. Press **Utility/Config** on the Touch panel and log on if required.
2. Select **Imaging/Application**.

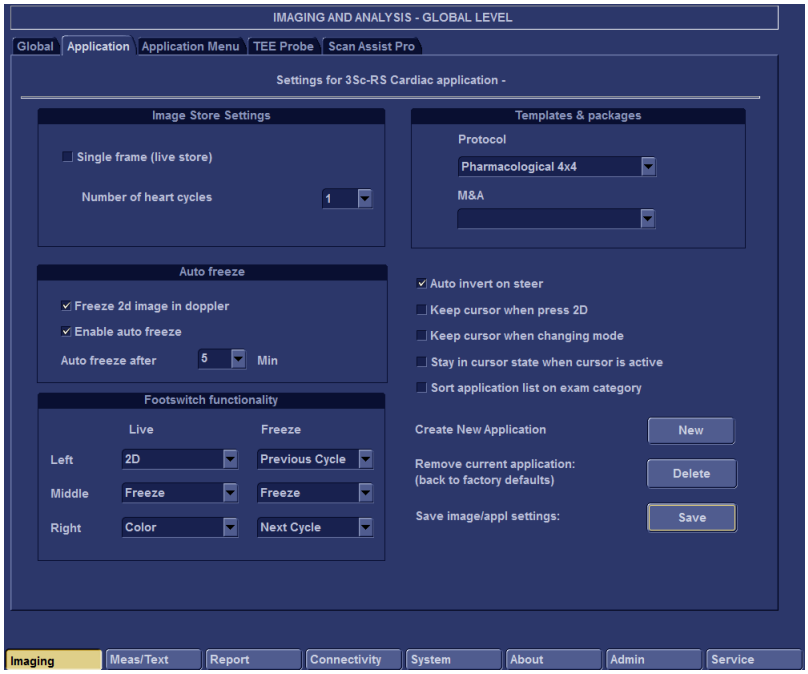


Figure 4-20. The Application sheet

Create a new Application

The application created is probe dependent. Select the desired probe before creating a new application.

1. Adjust the settings as desired (see table below).
2. Press **New**.

   A Dialogue window is displayed.
3. Enter a name for the new application.
4. Press **Save**.

The followings settings can be configured:

Parameter	Description
Image Store settings	• **Single frame (live store):** ☐: Store cineloop ☑: Store single frame image only • **Number of heart cycles:** select the number of heart cycles to store (Single frame must be unchecked).
Auto freeze	• ☑ **Freeze 2D image in Doppler**: the last 2D or color flow image is displayed when entering in Doppler mode (works as Duplex only). • ☑ **Enable auto freeze**: check to enable auto freeze. • **Auto freeze after**: sets the time after which the system enters in freeze when not in use.
Footswitch functionality	Configure the footswitch pedals. For each pedal, select the operation to perform from the drop-down menu when in Live or in Freeze.
Templates and Packages	Defines the default stress protocol associated to the application.
☑ **Auto invert on steer**	In Color flow, the color bar is inverted when steering the color flow sector angle.
☑ **Keep cursor when pressing 2D** ☑ **Keep cursor when changing mode**	The PW, CW or M-Mode cursor is kept on the 2D display when pressing **2D** on the Control panel.
☐ **Keep cursor when pressing 2D** ☑ **Keep cursor when changing mode**	The PW, CW or M-Mode cursor is kept in the 2D display when turning off these modes (by pressing **PW**, **CW** or **M-Mode** on the Control panel). The PW, CW or M-Mode cursor is removed in the 2D display when pressing **2D** on Control panel.
☑ **Keep cursor when changing mode** ☑ **Stay in cursor state when cursor is active**	If cursor is active while in PW, CW or M-Mode, display the Cursor Touch panel when switching mode.
☑ **Sort application list on exam category**	Display only the factory application in the Application menu when pressing **Probe** on the Control panel. Enable to change Category from the Application menu when pressing **Probe** on the Control panel.

Delete an application

1. Press **Probe** and select the application to delete.

NOTE: Factory applications cannot be deleted.

2. Press **Utility**/**Config** on the Touch panel and select **Imaging/Application**.
3. Press **Delete** to remove the selected application.

Application menu configuration

The *Application* menu can be configured to best suit the user's requirements.

The *Application* menu is a two-levels pop-up menu. The first level called **Application**, displays the most frequently used applications in any desired order. The second level called **More...** displays the less frequently used applications.

1. Press **Utility**/**Config** on the Touch panel and log on if required.
2. Select **Imaging/Application menu**.

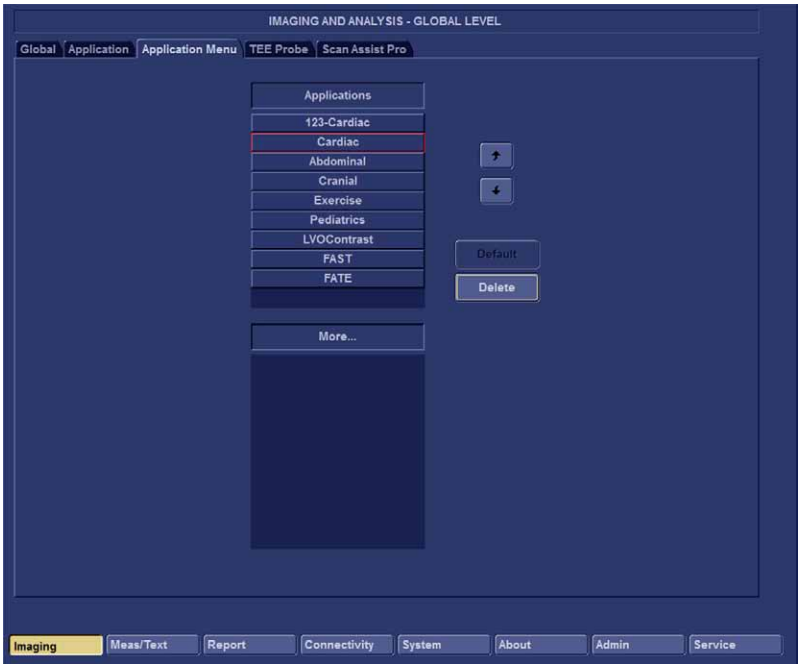


Figure 4-21. The Application menu sheet

3. The following can be done:
   - Move a selected application using the Arrow buttons.
   - Set a selected application as default for the current probe.
   - Delete a selected application.

6Tc-RS TEE probe configuration

CAUTION

Probes for Transesophageal applications require special handling. Transesophageal examinations and probe insertions should be performed only by personnel with adequate training. Refer to the user documentation enclosed with these probes.

WARNING

Please ensure you are qualified operator for TEE probe.

1. Press **Utility**/**Config** on the Touch panel and log on if required.
2. Select **Imaging/TEE probe**.

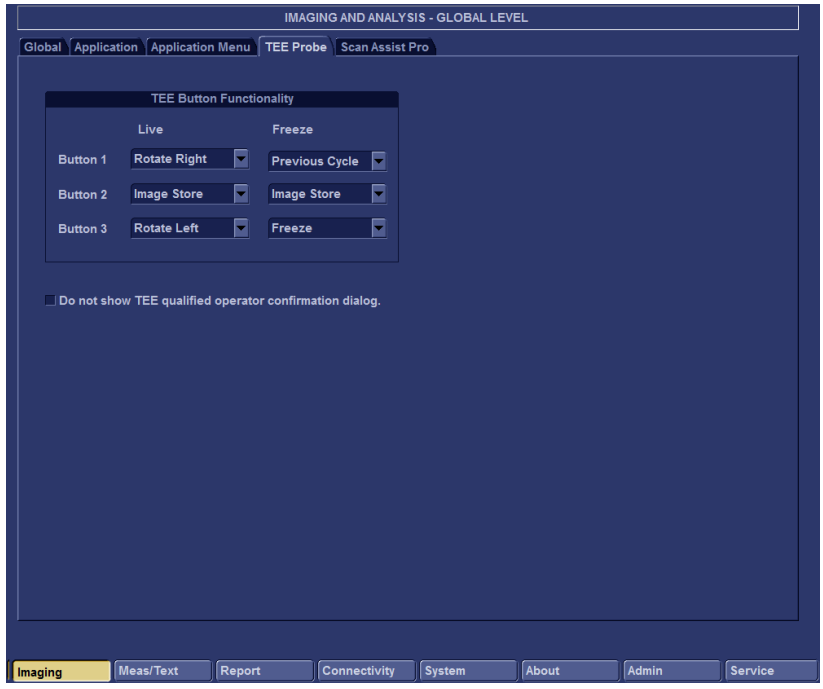
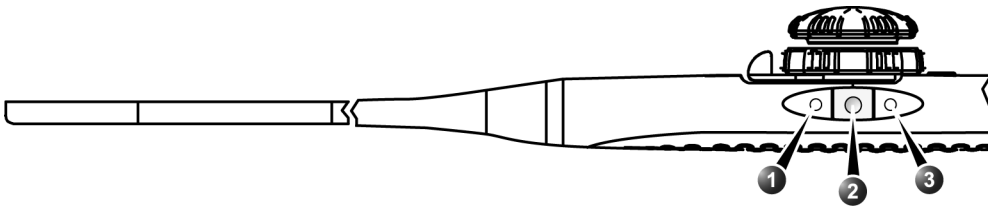


Figure 4-22. The TEE probe sheet

6Tc-RS TEE probe configuration (continued)

3. For each button on the TEE probe handle, select the operation to perform from the drop-down menu when in Live or in Freeze.



1. Button 1 (closest to the probe tip)
2. Button 2
3. Button 3

Figure 4-23. The TEE probe buttons

Chapter 5

Stress Echo

This chapter describes:

Introduction

The ultrasound unit provides an integrated stress echo package, with the ability to perform image acquisition, review, image optimization, and wall segment scoring and reporting for a complete, efficient stress echo examination.

The stress package provides protocol templates for exercise, as well as pharmacological stress examinations. In addition to preset factory protocol templates, templates can be created or modified to suit users' needs. Users can define various quad screen review groups, in any order and combination, that will suit their normal review protocol. When reviewing stress examination images, the images are viewed at their original image quality, and different post-processing and zoom factors may be applied to the images under review for effective image optimization. The protocol template may be configured for Continuous capture. In addition to standard wall motion scoring analysis, the user can perform quantitative stress analysis based on tissue velocity information (TVI), see page 5-22.

A stress echo examination consists of three steps:

- Selection of a stress test protocol template (page 5-3)
- Image acquisition (page 5-4)
- Stress analysis (page 5-17)

Selection of a stress test protocol template

1. Press **Protocol** on the Control panel and select **Stress** on the Touch panel to enter the stress echo mode.

   The *Protocol* screen is displayed (see Figure 5-1) showing the default stress protocol for the current probe and application.
2. Turn freeze off to initiate scanning using the current template.

   To use another template, press **Template** and select the desired template from the template list. Turn freeze off to initiate scanning.

NOTE: *To create or edit a template see page 5-29.*

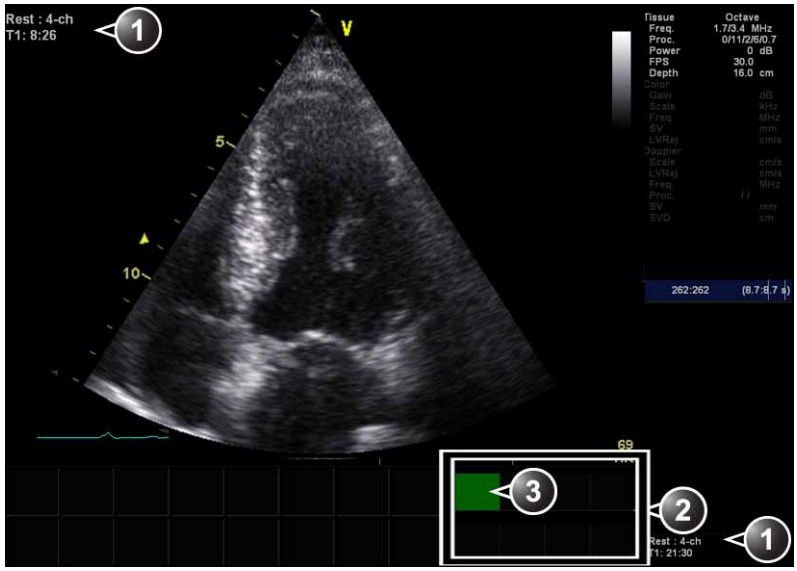
NOTE: *Stress is an option for Vivid T8 Pro.*

1. Level selection
2. Projection selection
3. Current acquisition
4. Group of views

Figure 5-1. The Protocol screen

Image acquisition

Images are acquired in a pre-defined order, according to the selected template. The highlighted cell (green) of the matrix, displayed in the *Clipboard* window indicates which view is currently being acquired (see Figure 5-2). The names of both the view and the level for the current cell are displayed on the top corner of the image area and under the template matrix.



1. Current view, level and timers
2. Template matrix view and level
3. Current view (Green cell)

Figure 5-2. The stress mode acquisition screen

Starting acquisition

1. Turn freeze off to initiate scanning.

NOTE: To use the Timer, see page 5-9.

2. Perform a scan that conforms with the view that is highlighted in the template matrix on the *Clipboard* window.

   If the selected template has the option **Smart Stress** turned on (see page 5-31), a subset of the image acquisition settings for each view in the baseline level will be stored and automatically reused in the corresponding views in the next levels.

NOTE: Smart Stress is turned on by default in factory templates.

3. Press **Store**.
   - If the actual stress level is configured to preview cineloop before storing, use the cineloop controls to select the most appropriate heart cycle and, if desired adjust the loop markers (see ‘Cineloop’ on *page 3-14* if desired, for further information). Press **Store** to save the selected cineloop.
   - If the actual stress level is not configured to preview cineloop before storing, the system will automatically store the last cardiac cycle.

NOTE: For further information on stress test configuration, see page 5-29.

When storage of the cineloop is completed, the actual highlighted cell in the template matrix is filled with dark blue color indicating that the view has been acquired. After storing the loop, the system automatically highlights the next view in the matrix to be acquired.

Stress levels can be configured for side-by-side display/ comparison of the reference loop from baseline or previous level and the loop to acquire (see Figure 5-3).

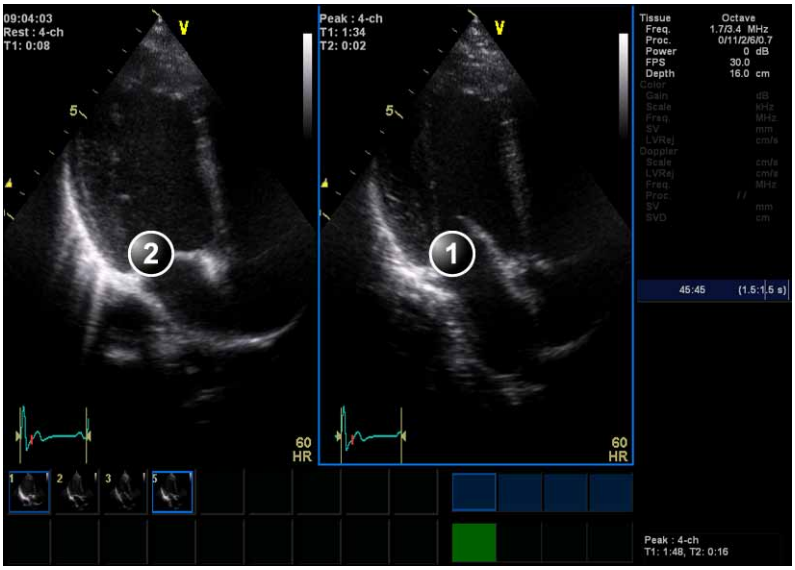
Starting acquisition (continued)

4. Repeat previous steps until all required views are completed.

CAUTION

If using DICOM Server dataflow for stress-echo acquisition, images should not be saved to permanent archive before the complete protocol exam is acquired.

The template used can be configured so that analysis is automatically started, displaying the first protocol group. The wall segment scoring diagrams for each view is displayed in the *Parameters* window on the right side of the screen (see Figure 5-9 *on page 5-19*).



1. Current acquisition loop
2. Corresponding reference loop

Figure 5-3. Display of the Reference loop during acquisition

Protocol Pause function

During the stress acquisition it is possible to temporarily exit the protocol acquisition mode to acquire images in any mode outside the stress protocol.

1. To temporarily exit the protocol mode, press **Protocol Pause** on the Touch panel.
2. Acquire the desired images outside the protocol.
3. Press **Protocol Pause** to restart the protocol acquisition mode and resume the stress acquisition.

Selecting a view during acquisition

A fixed protocol is provided for scanning, based on the selected template. The system automatically highlights the next view to be acquired in the template matrix, as images are stored. However, the order of scanning may be changed manually as follows.

Manual selection of a view during acquisition

1. Use the arrow keys on the Control panel to highlight the cell that represents the view that is to be acquired.

   The selected cell in the template matrix is highlighted in red, indicating non-default position and is blinking if it contains a previously stored acquisition.
2. Scan and save the selected loop as explained in the previous section.

After storage the system automatically highlights the next available view to be acquired.

Replacing an acquired image

1. Use the arrow keys on the Control panel to highlight the cell that represents the view that is to be replaced.

   The selected cell in the template matrix is blinking red, indicating non-default position.
2. Scan and save the selected loop as explained in the previous section.
3. Select in the dialog window if you want to **Replace** or **Keep** the existing loop.

   - **Replace**: the original image is deleted from the examination and replaced by the acquired image.
   - **Keep**: the original image is replaced by the acquired image, but it is not deleted from the examination.

NOTE: *When selecting Keep, both the new and the old image will be associated with the current protocol cell and you may later perform Wall Motion Scoring for this level in the protocol using either the new or the old image. The new image may be opened from the protocol, while the old image may be opened manually from the clipboard.*

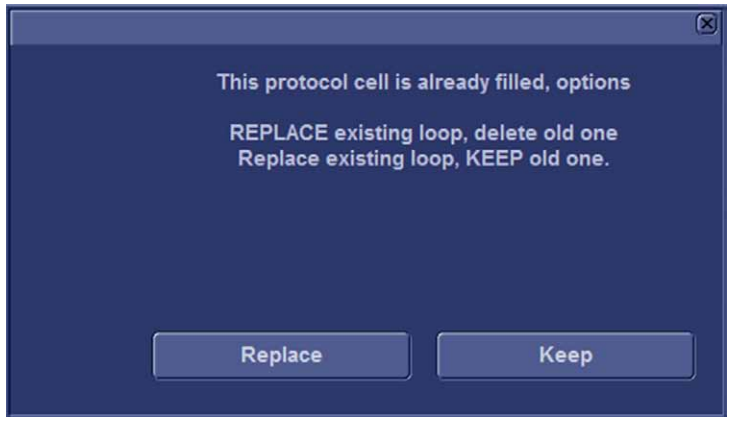


Figure 5-4. Replace/Keep

After storage the system automatically highlights the next available view to be acquired.

Moving an acquired image

An Image can be moved from one cell to another during acquisition. There are two ways to move images.

Procedure 1

1. in the *Protocol* screen, press **Move image**.
2. Trackball to the image to move (source cell).
3. Press **Set**.
4. Trackball to the destination cell.
5. Press **Set**.

   The image is moved from the source cell to the destination cell.

Procedure 2

1. In the *Protocol* screen, trackball to the cell containing the image to move (source cell).
2. Press and hold down **Set**.
3. With the **Set** key still depressed, trackball to the destination cell.
4. Release the **Set** key.

   The image is moved from the source cell to the destination cell.

If the destination cell already contains an image, the images from the source and destination cells will be exchanged.

Timers

Two timers can be displayed in the *Stress mode acquisition* screen, beside the template matrix.

- **T1** displays the elapsed time from the start of the stress examination.
- **T2** starts when entering live scanning on the second stress level.

Press Protocol T2 on the Touch panel to stop/start the T2 timer. Timers always restart at zero.

The display of T1 and T2 is user-configurable (see page 5-29).

Continuous capture mode

Continuous capture mode enables the user to perform acquisition continuously for several views at any level depending on the selected template configuration. Continuous capture consists of temporarily saving images acquired in a storage buffer. To enable best possible use of the limited storage buffer capacity, a Pause/Capture mode is provided, as opposed to the normal Freeze/Scan mode. The Pause mode enables scanning and live display on the screen, without any capture, thereby leaving the buffer available.

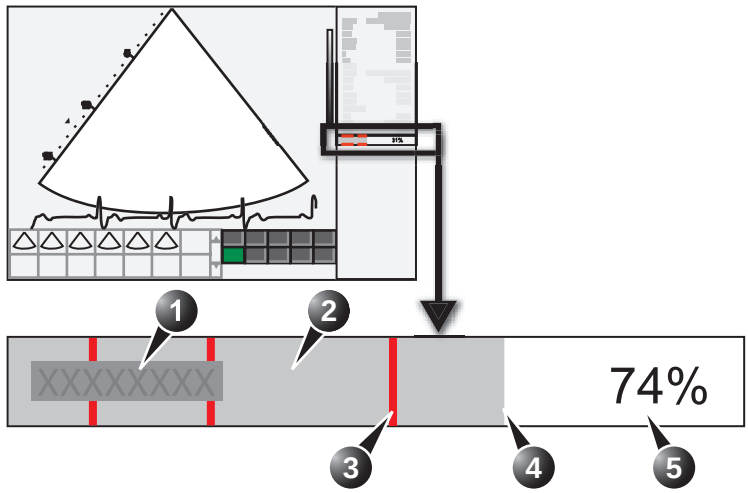
To run Continuous capture, the user has to select a template where this feature is activated (see page 5-29 about template configuration).

The buffer bar

When entering a cell with Continuous capture enabled, a *Buffer bar* is displayed in the *Info* window (see Figure 5-5). The *Buffer bar* displays the following information:

- The scanning state:
  - **PAUSE**: live scanning without storing
  - **CAPTURE**: live scanning with storing to buffer
- The percentage of the buffer that is filled
- The buffer filling progression showed by a filling gauge
- The capturing sessions, reflected by the red lines along the Buffer bar

The buffer bar (continued)



1. Scanner's state
2. Capture session
3. Pause session
4. Buffer gauge
5. Percentage of filled buffer

Figure 5-5. The buffer bar in Continuous capture

Controlling the capture process

When entering a cell with Continuous capture enabled, the unit is automatically set in Pause mode.

1. Press **Store** or **2D Freeze** to start image capture.

   “Capture” is displayed in the buffer bar, the gauge starts filling and the percentage of filled memory buffer increases (see Figure 5-5).

2. Press **Store** or **2D Freeze** again to stop capture.

   “Pause” is displayed in the buffer bar.

When 90% of the memory buffer is filled up, the text display in the buffer bar turns red.

The unit enters Freeze mode automatically once the buffer is full and the captured loops are displayed in the *Continuous capture selection* screen (see below).

Running Continuous capture

1. Do all your pre-stress acquisitions in the Cardiac application.
2. Press **Protocol** on the Control panel and select **Stress** on the Touch panel to enter the stress echo mode.

   The *Protocol* screen is displayed (see Figure 5-1 *on page 5-3*).

*NOTE: The application **Exercise** should be used in order to get maximum continuous capture buffer.*

3. Press **Template**.

   The template list is displayed.
4. Select the template **Exercise 2x4**.

*NOTE: The Exercise protocol template is automatically selected when the application **Exercise** is active.*

5. Press **Begin/Cont**.

   If the application Exercise was not previously selected, the Application menu is displayed. Select **Exercise**.
6. Acquire the resting loops in all four views.
7. Once the fourth loop is acquired the system enters a waiting mode where Continuous Capture is in pause state awaiting the patient to exercise.
8. When the patient is back on the bed, press **Store** or **2D Freeze**. The Continuous capture acquisition is started.
9. Acquire all your views. You may pause the acquisition when moving the probe between parasternal and apical position.

   The memory buffer gauge increases (Figure 5-5). When memory filling exceeds 90%, the percent number turns red.
10. Press **Freeze** to finish.
11. Press **Select cycle**.

    The *Continuous capture selection* screen is displayed (see Figure 5-6 *on page 5-15*).

    If the buffer is filled up the system will automatically display the *Continuous capture selection* screen.

    Refer to the next section if additional image acquisition is necessary after the buffer is filled up.
12. Assign the cineloops to the four views (see page 5-15).
13. Press **Select later** if you want to reselect any loops (open the capture again from the *Protocol* screen).
14. Perform Analysis and scoring (see page 5-17).

Continuous capture with additional image acquisition

After acquiring Continuous capture, additional images can be stored to the clipboard before the patient's heart rate decreases toward recovery level. These additional images may be acquired with other scanning modes (using the same probe and application), before doing image assignment to the views:

1. Perform Continuous capture as described above (steps 1 to 10).
2. If the buffer is not filled up: press **Protocol Pause** on the Touch panel. Live scanning is activated outside the stress protocol.

   If the buffer is filled up: press **Select later**. Live scanning is activated.
3. Perform the additional acquisition (e.g. Color flow, Doppler). Images will be stored outside the protocol.
4. In order to resume the stress echo exam and assign loops for the views from the Continuous capture buffer, press **Protocol**.
5. Select the **Continuous capture** thumbnail on the lower left corner of the *Protocol* screen.

   The *Continuous capture selection* screen is displayed.
6. Assign the cineloops to the views (see page 5-15).

   A dialogue window is displayed asking whether the entire Continuous capture acquisition should be saved or not.
7. Press **Delete** to discard the acquisition

   OR

   Press **Select later** if you want to reselect any loops (open the capture again from the *Protocol* screen).

   OR

   Press **Store all** to keep the entire acquisition.

   The normal procedure is to discard the acquisition. The loop is very large and will take a lot of disk space.
8. Perform Analysis and scoring (see page 5-17).

Postponed image assignment

The assignment of the cineloops to the views can be done on a later stage on a stored Continuous capture acquisition.

1. Perform Continuous capture as described in ‘Running Continuous capture’ on *page 5-12*.
2. Re-open the examination if necessary.
3. Press **Protocol**.

   The *Protocol* screen is displayed.
4. Press on the **Continuous capture** thumbnail on the lower left corner of the *Protocol* screen.

   The *Continuous capture selection* screen is displayed.
5. Assign the cineloops to the views (see page 5-15).
6. Press **Done** when finished.
7. Perform Analysis and scoring (see page 5-17).
8. When exiting this patient a dialogue window is displayed asking whether the remaining continuous capture images should be deleted.

   - Press **Yes** to delete the remaining continuous capture images

     OR
   - Press **No** to keep the entire continuous capture acquisition.

   The normal procedure is to delete the remaining images as they take a lot of disk space.

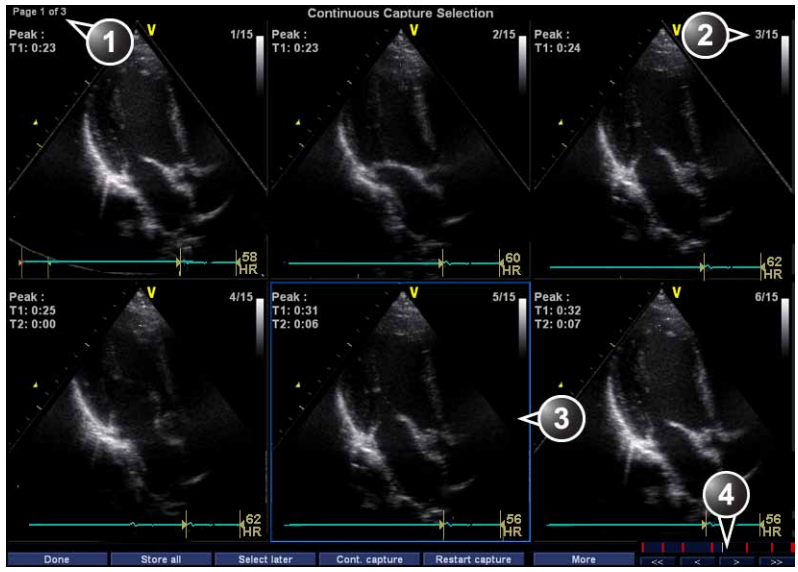
Restart capture from the Continuous capture selection screen

1. Press **Restart capture**.

   The Continuous capture is started again.

Assigning and storing the loops

The cineloops captured in the buffer are assigned to the stress protocol views and stored from the *Continuous capture selection* screen (see Figure 5-6).



1. Rotate Change Page to display other pages.
2. Cycle number and total number of cycles
3. Highlighted loop
4. Buffer bar: to browse through the acquisition, select an area in the buffer bar to display the corresponding page or select the first, last, previous or next page buttons.

Figure 5-6. The Continuous capture selection screen

Assigning a cineloop to a view

1. Trackball to the desired loop in order to assign it to a particular view of the stress template.

   The frame of the loop is highlighted.
2. Press **Set**.

   A pop-up menu is displayed with the view names of the template (see Figure 5-7).
3. Trackball to the required view name.
4. Press **Set**.

   The name of the view is displayed above the timers in the loop window.
5. Repeat steps 1 through 4 to assign loops to the other views of the level.
6. Press **Done** when completed.

1. Assigned loop
2. Highlighted loop
3. Already assigned view
4. Highlighted views

Figure 5-7. Loop assignment in Continuous capture

Stress Echo analysis

Stress Echo analysis consists of viewing previously saved loops and assigning scores to each cardiac segment, in order to quantify the function of the muscle, or wall motion.

Depending on the protocol configuration, the analysis stage can be started automatically after completion of the stress test or it can be started manually. In this case, the usual procedure consists of sequentially opening all image groups (if defined) and perform scoring from image to image.

The quad screen is the standard display for comparing heart cycles (Figure 5-9). The heart cycle loops in the display are synchronized to enable comparison. Each loop in the quad screen can be magnified, using the zoom control.

Image selection for analysis

Images can be selected manually or from a pre-defined group in the *Protocol* screen.

Selection of images from a group

If groups of images have been defined in the protocol template (see page 5-32), the user can select a group of images for analysis and sequentially analyze all images from all groups from within the *Analysis* screen (see Figure 5-9 *on page 5-19*).

1. In a stress examination, press **Protocol**.

   A preview of the acquisitions is displayed.

2. Trackball to a group in the *Group list*.

   The frames of the images belonging to the group are highlighted.

NOTE: *Pressing **Analyze** (while no images are selected in Protocol screen) will automatically open the first group of images in Analyze screen.*

Selection of images from a group (continued)

3. Press **Set** to open images in the *Analyze* screen (see page 5-19).

1. **Select a Projection**
2. Select an image
3. Select and open an Image group

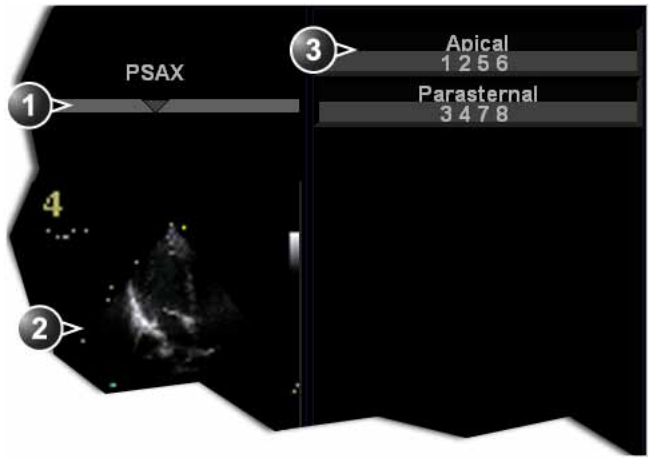


Figure 5-8. Image selection from the Protocol screen

Manual selection of images in the Analysis screen

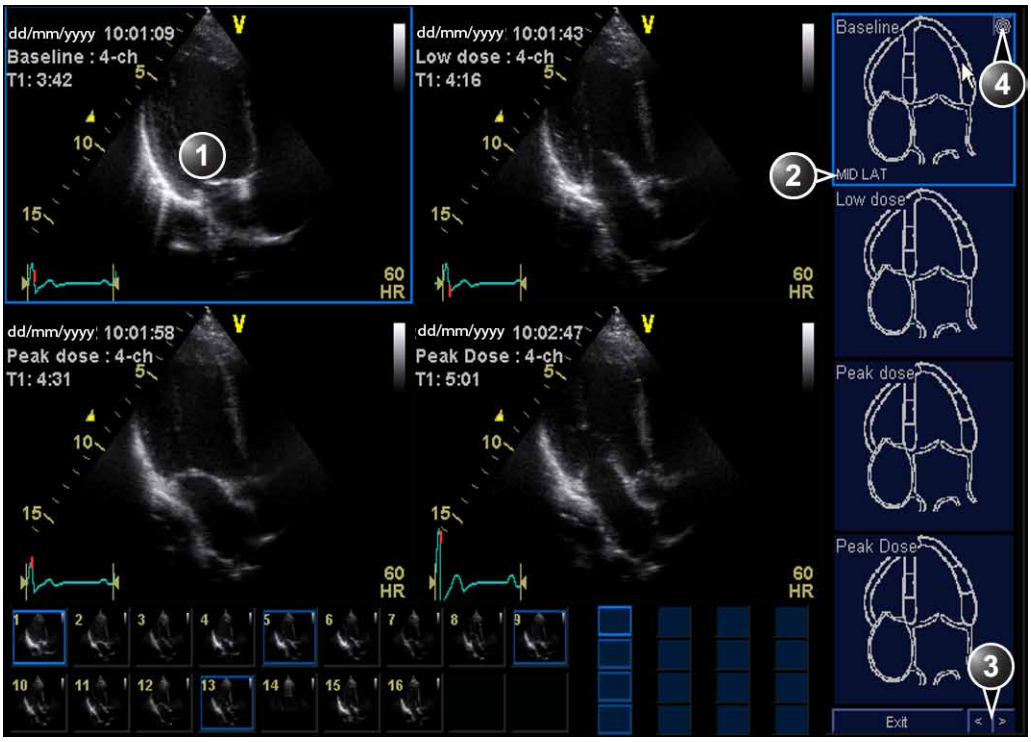
1. When currently in protocol analysis in the *Stress analysis quad* screen (Figure 5-9), hold down **Shift** while selecting the images on the clipboard on the stress template matrix.

Manual selection of images in the Protocol screen

1. In a stress examination, press **Protocol**.
   A preview of the acquisitions is displayed.
2. Trackball to the first image to select.
3. Press **Set**.
   The frame of the selected loop is highlighted.
4. Repeat steps 2 and 3 to select other images.
5. Press **Analyze** to open images in the *Analyze* screen (see page 5-19).

NOTE: Alternative: Double click on the last selected image to open images.

Wall motion scoring



1. Selected loop (highlighted frame)
2. Highlighted segment name (see pointer)
3. Change page or enter next image group
4. Display Bull's eye diagram

Figure 5-9. The stress echo analysis screen (Quad screen)

Wall motion scoring is used to evaluate wall motion in each cardiac segment. The left ventricle myocardium is divided into a number of segments (e.g. 16 or 18), and each segment is assigned a score based on visual evaluation/"eye-balling". The wall motion scoring results are linked to the stress level of the image being evaluated. This means that for instance when scoring a short axis projection and a long axis projection from the same stress level, then common segments with the same scoring value will be shown in the respective scoring diagrams.

Wall motion scoring (continued)

CAUTION

The wall motion scoring result is assigned to the stress level of the image, but will not be updated if the image is moved to another stress level in the protocol at a later time. Images should be correctly placed in the protocol when performing wall motion scoring.

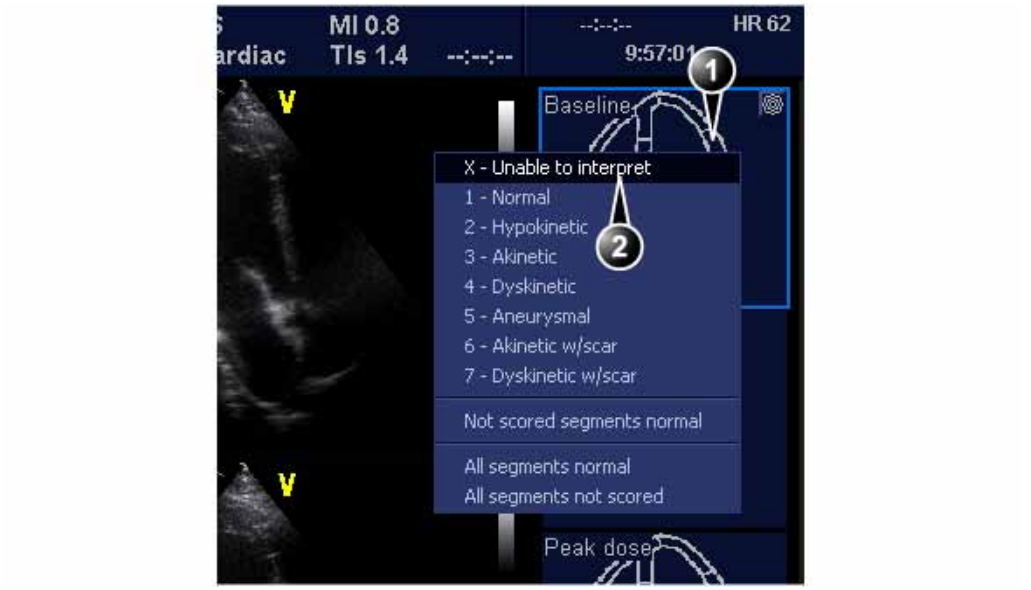
NOTE: The number of segments (WMS segment model), the range of scoring values (WMS scoring legend) and the initial scoring value (WMS initial scoring) may be configured in Config/Meas Text/Advanced under the Cardiac M&A category.

1. In the *Stress Echo Analysis* screen, trackball to a segment in one of the scoring diagrams and press **Set**.

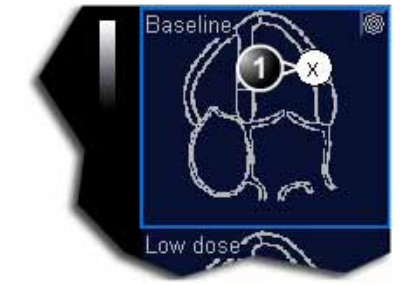
   The *Score pop-up list* is displayed (see Figure 5-10).
2. Trackball to a score.
3. Press **Set**.

   The score is displayed in the relevant segment area in the diagram (see Figure 5-10).
4. Repeat steps 1 through 3 to score relevant segments.
5. Rotate **Review page** to display next group of images.
6. Repeat steps 1 through 3 to score relevant segments on the new loops.

Wall motion scoring (continued)



1. Selected segment
2. Selected score



1. Scored segment

Figure 5-10. Segment scoring

Quantitative TVI Stress Echo Analysis

Quantitative TVI Stress Echo Analysis

QTVI Stress analysis is meant as a guide to wall motion scoring.

Diagnosis must not be based on results achieved by QTVI Stress analysis only.

The ultrasound unit provides a Quantitative TVI (QTVI) Stress analysis package based on Tissue velocity information (TVI). The TVI data is stored in a combined format with gray scale imaging during stress examination.

When selecting a template supporting TVI data acquisition, the ultrasound unit will automatically store TVI information, generally for the apical views of the stress examination.

The QTVI Stress analysis option currently applies only to Dobutamine stress-echo.

Wall Motion Scoring remains the basis for the diagnosis of Coronary Artery Disease (CAD) in stress echocardiography. QTVI Stress may be used as a guidance tool to check this interpretation.

The current version of QTVI Stress is based on the assessment of peak velocity at peak Dobutamine stress (See ‘References’ on *page 5-28 for more information.*). The normal ranges have been validated in the “average” patient presenting for stress testing. The velocity cutoff values for the Vpeak measurement will not work in the following cases:

- Submaximal stress (<85% predicted max HR)
- Patients at extremes of age (<40 or >70)
- Previous myocardial infarction / revascularization
- Previous heart-failure / cardiomyopathy / hypertrophy / arrhythmia / aortic regurgitation

Quantitative TVI Stress Echo Analysis (continued)

The velocity cutoff values are based on placing the sample volume at center of each cardiac segment at start of systole, the left ventricle myocardial segments are defined by the American Society of Echocardiography 16 segments model. However, the velocity cutoff model does not cover the apical segments (due to low velocities and segment orientation), (see note).

NOTE: Velocity measurements in mid and basal segments of the myocardium will contain contributions from the apical region of the myocardium. E.g. if measured value in a mid segment is below the cutoff value for this segment then this might relate to a reduced function in the mid or apical region.

Tissue Doppler does not have perfect site-specificity because of tethering by adjacent segments. Thus, although an ischemic segment has little thickening (and therefore could be expected to show low velocity), measured velocity may be influenced by local tethering, reflecting contraction in surrounding segments. Conversely, a normal segment may have its velocity reduced by an adjacent segment with reduced velocity. This tethering effect may decrease the sensitivity for single vessel disease, but nonetheless the sensitivity and specificity of the cut-offs are approximately 80% (See 'References' on *page 5-28 for more information.*).

Three different analysis tools based on TVI data are available:

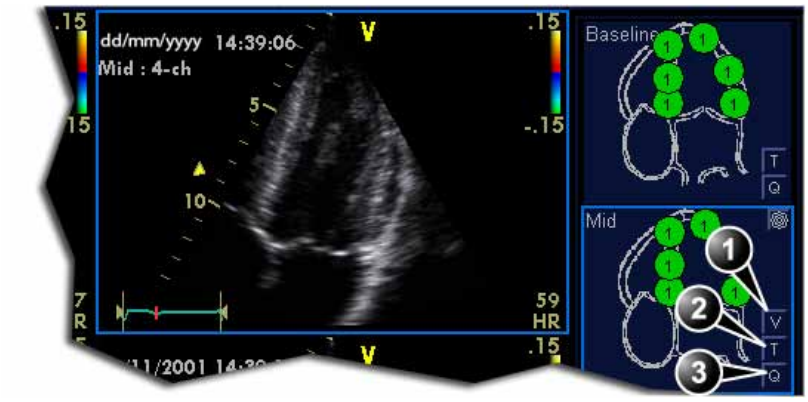
- **'Vpeak measurement' on *page 5-24***, enables the display of a tissue velocity trace for a selected region of a previously scored segment through the entire heart cycle. In addition Vpeak is color-coded on the 2D image. From the velocity trace, the user can estimate the peak systolic velocity (See 'References' on *page 5-28 for more information.*).

  This tool is available in views from peak levels only and only when a segment has been scored in one of these views.
- **'Tissue Tracking' on *page 5-27***, enables visualization of the systolic contraction of the heart by color-coding the myocardial displacement through the systole.
- **'Quantitative analysis' on *page 5-27***, enables further quantitative analysis based on multiple tissue velocity traces.

  The quantitative analysis is described in Chapter 'Quantitative Analysis' on *page 8-1*.

Accessing QTVI Stress analysis tools

The three QTVI Stress analysis tools are entered by pressing a dedicated button on the scoring diagram (see Figure 5-11) of the selected view. Only views with TVI data acquired will display QTVI Stress tools buttons on the respective diagrams.



1. Vpeak measurement (V-peak measurement is displayed in views from peak levels and only after scoring.)
2. Tissue Tracking
3. Quantitative analysis

Figure 5-11. QTVI Stress tools buttons

Vpeak measurement

This tool enables the user to generate a tissue velocity profile for a given wall segment through the entire heart cycle and display color-coded Vpeak in tissue.

From the velocity trace, the user can determine whether the systolic Vpeak is over or under a clinically determined velocity threshold (see reference 1 on page 5-28) to confirm the wall motion scoring.

CAUTION

QTVI Stress can be used only in conjunction with wall motion scoring analysis, as a guiding tool.

When activating QTVI Stress, the measurement *applies only to the currently highlighted segment* for the current level and projection view.

To display a Vpeak measurement

1. Perform segment scoring as described on page 5-19.

   When performing scoring in a view from a peak level, the Vpeak measurement button (**V**) is displayed in the corresponding diagram.
2. In the *Scoring* diagram, press **V**.

   The cursor is changed to sampling area and the scored peak views are updated showing:

   - A diagram with the current segment highlighted (scoring bullet with a ring) and the segment's velocity cutoff (see Figure 5-12).
   - Color-coded velocity in tissue. The color-coding convention is as follow:

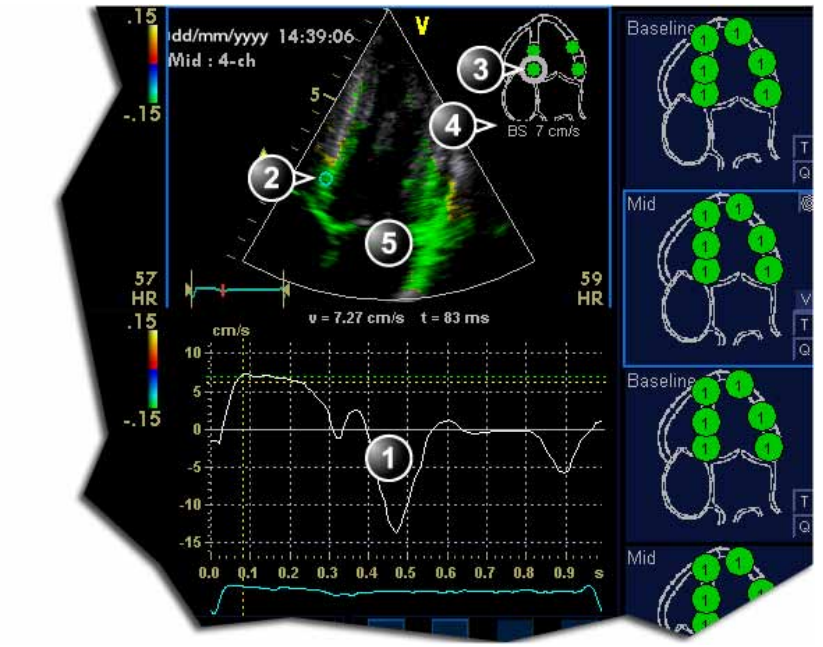
     - **Green**: Velocities above threshold value + 5%

     - **Yellow**: Velocities near threshold (+/- 5% interval)

     - **White**: Velocities below threshold value - 5%
   - A result window to display tissue velocity profile, shown when moving the sampling area in the view.
3. In the 2D sector, place the sampling point over the wall area corresponding to the current segment (shown as the highlighted segment in the diagram).

   A tissue velocity profile for the actual segment is generated in the *Result* window (see Figure 5-12).
4. Select another scoring bullet in the diagram in one of the peak views.

To display a Vpeak measurement (continued)



1. Tissue velocity profile
2. Sampling point
3. Current segment
4. Vpeak threshold for current segment
5. Color-coded tissue velocity:

Color-coding (velocity thresholds and tissue):
- **Green**: velocities above threshold value
- **Yellow**: velocities near threshold (0 to -10% interval)
- **White**: velocities below threshold value - 10%

Figure 5-12. Vpeak QTVI Stress display

Turn-off the Vpeak measurement tool

1. Select the **V** button in the peak view scoring diagrams.

V-peak measurement interpretation

The systolic Vpeak in the tissue velocity profile is automatically detected and highlighted by a vertical bar (see Figure 5-12). The automatically detected Vpeak should be visually verified by the user. In addition Vpeak thresholds are displayed as color-coded horizontal lines (see Figure 5-12). These thresholds represent statistical guideline values for peak velocity at peak stress level (Dobutamine stress procedure) for the three apical views. Only threshold values for basal and mid-segments for each apical view are defined (see reference 1 on page 5-28). The result is highlighted by a color-coding of the thresholds lines, the color-coding in the 2D image and the scoring bullet (see Figure 5-12).

Tissue Tracking

Tissue Tracking calculates and color-codes the displacement in tissue over a given time interval. The displacement is found as the time integral (sum) of the tissue velocities during the given time interval. The color-coded displacements calculated in the myocardium are displayed as color overlay in the respective acquisition window.

By studying the color patterns generated in the different segments, the user can confirm the standard segmental wall motion scoring at peak levels.

To display Tissue Tracking

1. Press **T** in one of the *Wall segment diagram* field (usually an apical view at peak level).

   The Tissue Tracking color overlay is displayed in the *Acquisition* window.

Quantitative analysis

Quantitative analysis enables further analysis based on multiple tissue velocity traces. Quantitative analysis is performed using the Quantitative analysis package described in Chapter ‘Quantitative Analysis’ on *page 8-1*.

To start quantitative analysis

1. Press **Q** in one of the *Wall segment diagram* field (usually an apical view at peak level) to launch the Quantitative analysis package (see page 8-1).

References

1. **Application of Tissue Doppler to Interpretation of Dubotamine Echocardiography and Comparison With Quantitative Coronary Angiography.** Cain P, Baglin T, Case C, Spicer D, Short L. and Marwick T H. *Am. J. Cardiol. 2001; 87: 525-531*

Editing/creating a Stress Echo protocol template

The stress package provides protocol templates for exercise as well as pharmacological stress examinations. The user can create new templates or modify existing templates to suit the individual needs. Up to ten projections and fourteen stress levels can be created in a template.

Templates created may be temporary, used only during the current examination, or saved as new templates, for future use and reference. The editions that may be performed include:

- Adding/deleting levels and projections, page 5-31
- Assigning new labels to levels and projections, page 5-32
- Defining level options, page 5-32
- Defining new groups, page 5-32

Templates are edited/created from the *Template editor* screen.

Entering the Template editor screen

1. Press **Protocol** on the Control panel and **Stress** on the Touch panel to enter the stress echo mode.
2. Press **Template**.

   The *Template* menu is displayed.
3. Select **Template Editor**.

   The *Template editor* screen is displayed (see Figure 5-13).

Figure 5-13. The Template editor screen

Editing/Creating a template

Selecting a base template to edit

1. From the *Template* drop-down menu on the upper left corner of the *Template editor* screen select a base template to edit.

NOTE: *Determine the required number of projections and levels you need and select the most appropriate foundation template.*

The selected template is displayed in the *Protocol template preview* field, showing the levels and projections and their labels.

Adding/deleting levels and projections

1. Enter the number of levels and projections in the *Grid size* field (see Figure 5-13).

   The new grid size is displayed in the *Protocol template preview* field.
2. Press **New Template** to create a new template.

   Or

   Press **Save Template** to update the base template.

NOTE: *Factory templates cannot be changed.*

Scan mode selection

1. From the **Scan mode** drop-down menu, select a scan mode (e.g. gated, color... etc.) to be associated to the actual column (projection).

Display timer(s)

1. Check the box(es) to display timer(s) as specified (see Figure 5-13).

Start analysis automatically

1. Check **Auto start analysis** to display the Stress Echo Analysis screen when the last acquisition is performed.

Smart stress

NOTE: *Smart stress is option for Vivid T8.*

NOTE: *Smart stress is not available for Vivid T8 Pro.*

Check **Smart stress** to store a subset of the image acquisition settings (e.g. geometry, zoom, gain, compress, reject, power...etc) for each view in the protocol. Smart Stress enables to set image acquisition settings for each view at baseline level and automatically get the same image settings in the corresponding views in the next levels. In Continuous capture acquisition at peak stress, the active cell must be moved manually through the views using the arrow buttons.

Assigning new labels to levels and projections

1. Select a label from the *Label* drop-down menu or type a new label.

Configuring levels

The following options can be set up for each level:

Number of cycles to be stored in the cineloop

1. Enter the desired number in the *Cycles* field.

   Up to four cycles/cineloop can be stored.

Continuous capture

1. Check **Continuous capture** if continuous image acquisition throughout the level is desired.

   When Continuous capture is selected, preview of cineloop and reference display (see below) during acquisition are not possible.

Preview of store

1. Check **Preview of store** if review and adjustment of cineloops before storage is desired.

Show reference

1. Check **Show reference** if the display of the corresponding reference loop is desired during acquisition (dual screen mode).

Adding a group

1. In the *Protocol template preview* field select the cells to be part of the group.
2. In the *Pre-defined group* field, press **New group**.

   A dialogue box is displayed asking the user to enter a name for the new group.
3. Enter the group name.
4. Press **OK**.

   The new group is displayed in the *Pre-defined group* field.

Updating an existing group

1. In the *Pre-defined group* field, select the group to edit.
2. Either select (a) new cell(s) to add to the group or deselect (an) existing cell(s) to remove from the group.
3. Press **Update group** in the *Pre-defined group* field.

   The display in the *Protocol template preview* field is updated accordingly.

Deleting a group

1. In the *Pre-defined group* field, select the group to delete.
2. Press **Delete group**.

   The group is removed from the list in the *Pre-defined group* field.

Configuration

Each application can have a default stress protocol defined.

- Select a probe and an application.
- Press **Utility**/**Config** on the Touch panel and log on if required.
- Select **Imaging/Application**.
- In the *Application* sheet (Figure 4-20 *on page 4-49*), select the desired stress protocol in the *Templates and Packages* field.

Chapter 6

Contrast Imaging

This chapter describes:

Introduction

The two basic steps of contrast imaging are data acquisition and quantification. Data acquisition is described in this chapter. Quantification is described in ‘Quantitative Analysis’ on *page 8-1*.

Data acquisition

Appropriate training

Only physicians or echo technicians who have received appropriate training can use the Contrast applications.

Always read and follow carefully the manufacturer instructions on the contrast agent label.

NOTE: This system is designed for compatibility with commercially available contrast agents. Because the availability of these agents is subject to government regulation and approval, product features intended for use with these agents may not be commercially marketed nor made available before the contrast agent is approved for use. Advanced contrast features are only enabled on systems for delivery in countries or regions where the agents are approved for use or for investigational or research use.

Cardiac rhythm disturbances during cardiac studies using gas ultrasound contrast agents have been observed in the diagnostic range of Mechanical Index (MI) values. See the specific package insert for the contrast agent being used for further details.

Cardiac imaging

- **Left Ventricular Contrast imaging**: The LVO Contrast application is optimized for endocardial border detection and assessment of wall motion and wall thickening. LVO Contrast application requires the LVO Contrast option enabled.

Quantification

Quantification enables the user to perform the following analysis:

- **Time-Intensity analysis**: allows instant time-intensity calculation from up to eight regions of interest (Angio power or tissue intensity display).
- **Curve fitting analysis**: for research studies of myocardial perfusion rates using contrast agents.
- **Arbitrary Anatomical M-Mode (Curved and Straight)**: M-Mode applied to intensity data calculates and color-codes tissue and Angio intensity along a path drawn by the operator vs. time.

Misdiagnosis based on image artifacts

Misdiagnosis in ultrasound contrast images may be caused by several artifacts, most importantly:

Motion artifacts: gives rise to signals independently of contrast presence. This may be caused by patient movement, including respiration, or by probe movement influenced by the operator.

Regional drop outs: caused by unintentional destruction of the contrast agent, too low concentration of contrast agent, poor acoustic penetration due to rib/lung shadows or system failing to detect the contrast agent due to erroneous settings induced by the operator.

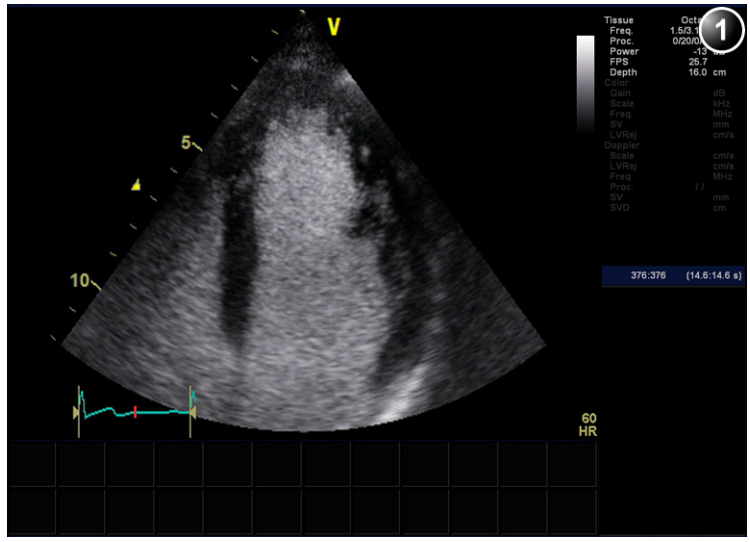
Tissue harmonics: gives contrast-like signals independently of the presence of contrast agent.

Data acquisition

Left Ventricular Contrast Imaging

The Left Ventricular (LVO) Contrast application has an optimized system preset for optimal resolution of endocardial borders and for optimal assessment of wall motion and wall thickening.

The LVO Contrast application may help to identify LV thrombus and evaluate wall motion.



1. **Parameter window**

Figure 6-1. The LVO Contrast acquisition screen

NOTE: LVO Contrast is an option for Vivid T8.

NOTE: LVO Contrast is not available for Vivid T8 Pro.

Using LVO Contrast

The LVO Contrast application works with the 3Sc-RS probe.

1. Press **Probe** on the control panel.

   A list of the connected probes is displayed.
2. Trackball to the desired probe supporting the LVO Contrast application.

   The *Application* menu for the selected probe is listed.
3. Trackball to **LVO Contrast** application.
4. Press **Set** to launch the application.
5. Perform the acquisition.

Always read and follow carefully the manufacturer instructions on the contrast agent label.

Optimizing LVO Contrast

The default setting for the LVO Contrast application is optimized for contrast detection and not tissue imaging. Therefore, with some patients it may be difficult to orient the probe before the contrast agent arrives. In this case we recommend to stay in the Cardiac application until the contrast agent is observed in the right ventricle and quickly switch to the LVO Contrast application.

If a swirling pattern is observed and persists after the LV cavity has been filled with contrast agent, the power should be reduced until homogenous opacification is obtained.

Too high Power setting will destroy the contrast agent in the LV cavity.

Chapter 7

Measurements and analysis

This chapter describes:

Introduction

Overview

The ultrasound unit provides functionality for two measurement conventions:

- **Assign and Measure (Measure Protocols)**: the user selects a study consisting in a set of pre-labeled measurements related to the active scanning mode and clinical application. The user is prompted through the measurements in the order of the measurement labels. This convention is started from the **Measure** button on the control panel. A set of tools is implemented to make the measurement process as fast and easy as possible for the user:
  - The user is guided through the study: an auto-sequence functionality automatically selects the next measurement in a study.
  - The selected measurement is highlighted in the *Measurement* menu.
  - The performed measurement is indicated in the *Measurement* menu.

The studies and their parameters are user-configurable. The user can create its own studies containing the relevant measurements (see page 7-56).

- **Measure and Assign (Free style)**: the user performs a measurement and assigns a label. This convention is started either from **Measure** or **Caliper** button on the control panel.

Only assigned measurements are saved when ending the examination.

Overview (continued)

After doing measurements, the system automatically makes the calculations related to the measurements performed. Measurements and calculations are displayed in the *Measurements result* table (see page 7-79).

Assigned measurements and calculations are automatically gathered into a Worksheet and used to populate the patient report.

General recommendations about measurements

- When doing time-measurements in Doppler or M-Mode, it is recommended to freeze the 2D image during acquisition.
- Distance and area measurements should be done on grayscale 2D images, not on color flow or TVI-based images. Similarly, in M-Mode, distance measurements should be done on grayscale M-mode images and not on Color M-mode images. If doing Color M-mode measurements of propagation of flow, please refer to your specific laboratory protocols.

About Measurement results display

Be aware of the following:

- Measurement results display

  By default the system always displays absolute values for parameters measured in Doppler. This means that values from above and below baseline will all be displayed as positive results.

  For Cardiac this behavior cannot be changed. For non-Cardiac the Absolute Value setting can be turned off in **Config** -> **Meas/Text** -> **Advanced**, by setting the attribute **Absolute Value** to Off.
- Calculated parameters

  For calculated parameters the system uses signed values in calculation formulas, and displays the absolute value of the result.

About Measurement results display (continued)

- When a parameter is measured several times, the individual values for the parameter will be listed in the m1, m2... columns in the worksheet. The *Value* column in the worksheet will contain a derived value for the parameter, e.g. the average of the individual values (Figure 7-1).

  When calculating formula derived parameters, the m1, m2... columns in the worksheet contain calculated values based on the individual input parameter values in the same column (Figure 7-1). The *Value* column contains calculated values based on the input parameter values in the *Value* column.

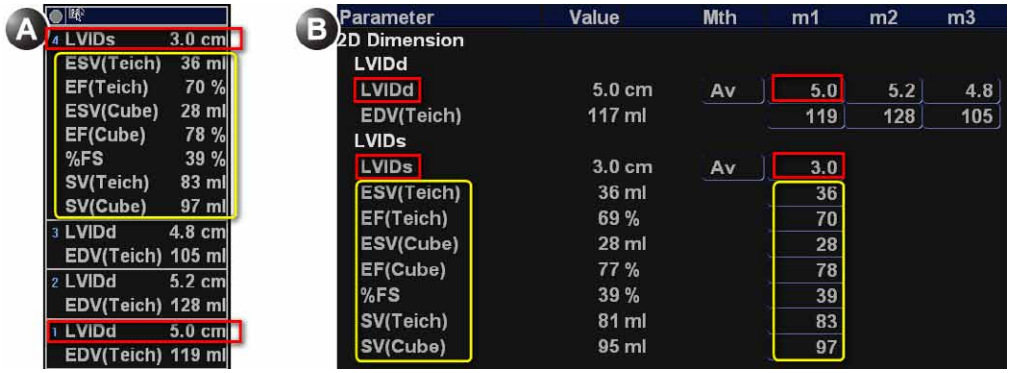


Figure 7-1. Measurement result window (A) and Worksheet (B)

The *Measurement result* window always displays values from the m1, m2... columns. It is therefore recommended to consult the worksheet (see page 7-80) to get an overview of measured and calculated parameters.

Assign and Measure modality

Assign and Measure

1. Measurement category for the current application
2. Study
3. Opened study
4. Performed measurement
5. Pre-selected measurement
6. Access to other studies for the current measurement category.
7. Controls for the current measurement
8. General controls for the measurement application

Figure 7-2. Example of a measurement study

1. Press **Measure** on the control panel.

   The *Measurement* menu is displayed, showing the measurement category for the current application (Figure 7-2).

   The cursor is in the scanning window, ready for a caliper measurement.

Assign and Measure (continued)

To change Measurement category:

1. Select the heading in the *Measurement* menu and choose another category.

NOTE: This can also be done from the Touch panel (page 2).

To perform measurements from a study:

1. Select a study (folder).

   The study folder is opened and the first measurement is selected.

*NOTE: This can also be done from the Touch panel: press **Folders** and select a study.*

2. Perform the measurement. Follow the instructions displayed on screen.

   Make sure to follow the current medical practices when placing the specific points on the image.

   If the folder is configured with auto-sequence measurement (see page 7-57), the next measurement in the study is pre-selected. To skip a pre-selected measurement, select another measurement.

   Completed measurements are marked with a check mark.

Measure and Assign modality

Measure and Assign

1. Press **Caliper** on the Control panel and select the desired measurement tool.

   Or

   Press **Measure** and select the desired measurement tool in the *Generic* folder in *Measurement* menu.

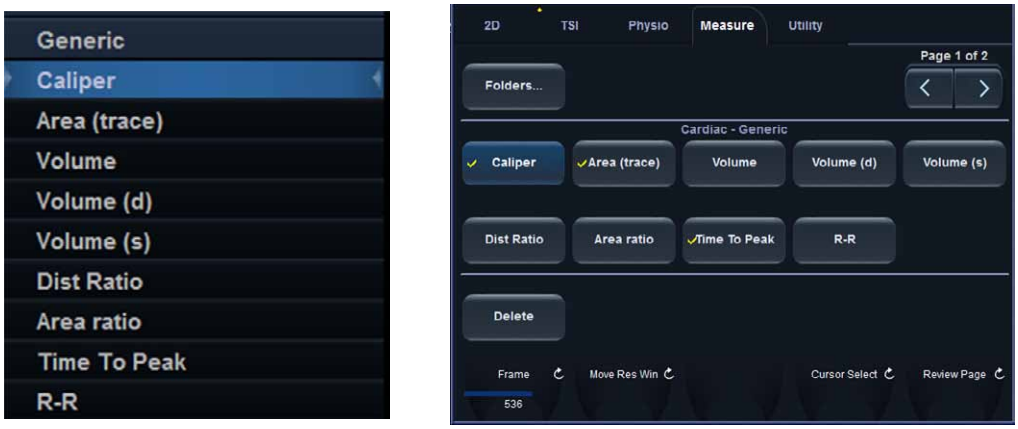


Figure 7-3. Measurement tools

2. Perform the measurement. Follow the instructions displayed on screen.

   Make sure to follow the current medical practices when placing the specific points on the image.

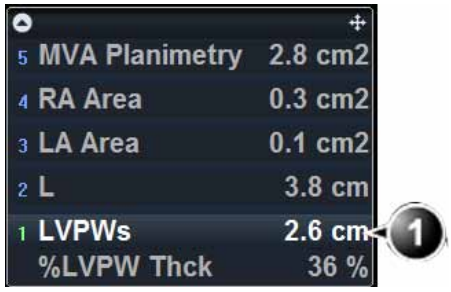
NOTE: *The system supports up to 15 separate measurements per M&A session. When exceeding this limit the measurements are still correct but will no longer have unique labelling for the tool graphics and results.*

Measure and Assign (continued)

3. To assign a label, select the measurement in the *Measurement result* table and select the required label.

1. Label menu

Assignment



1. Assigned measurement

Figure 7-4. Measurement assignment

Measurements on protocol images

When performing measurements on images acquired in a protocol, the measurement results will be associated with the protocol level of the image. Average values will be calculated for each protocol level.

For example you may measure LVOT Diam for images acquired outside protocol and for images on each level of an Exercise 2x4 protocol, leading to the following results in worksheet:

Parameter	Value	Method	m1	m2
LVOT Diam	1.0 cm	Average	1.1	0.9
LVOT Diam, Rest	1.1 cm	Average	1.0	1.2
LVOT Diam, Peak	1.2 cm	Average	1.2	

CAUTION

Measurement results associated with a stress level will not be updated if the image is moved to another stress level at a later time. Images should be correctly placed in the protocol when performing measurements.

Advanced cardiac measurements and analysis

Event timing measurements

Event timing enables the time measurement for opening and closure of the Aortic and Mitral valves, as referred to the automatically detected QRS marker, which normally is on the rising slope of the R-wave.

Event timing can be performed on a Doppler spectrum or an M-Mode acquisition showing the corresponding valves. The procedure is similar in both modes. In addition event timing can be done on traces in Q Analysis. The measurements are shown as dashed lines in the *Analysis* window and *Anatomical M-Mode* window in Q Analysis.

The measurements can be used as default start and end times for TSI.

1. Generate the spectrum or M-Mode image to be measured.
2. Press **Freeze** to stop the cineloop.
3. Press **Measure** on the Control Panel.
4. Select **Event Timing** in the *Measurement* menu.

   The following event timing measurements are available (with the first measurement on the list selected):

   - **AVO**: Aortic Valve Opening
   - **AVC**: Aortic Valve Closure
   - **MVO**: Mitral Valve Opening
   - **MVC**: Mitral Valve Closure
5. Place the cursor to the corresponding point on the spectrum for the selected measurement.

Event timing measurements (continued)

6. Press **Set** to anchor the point.

   The event timing measurement (ms) is displayed in the *Measurement result* table.

   When an event timing measurement is performed, the QRS markers are displayed on the ECG trace and correct QRS marker position should be verified before the Event Timing measurements are performed.

TSI Measurements

Each sample in the TSI image represents the time to the maximum velocity within the chosen TSI search interval from TSI Start to TSI End. (See page 4-26 on how to set the TSI search interval.)

There are two automatic TSI time to peak measurement tools:

- **Generic TSI Time to peak measurement**: displays the TSI value at the location point set by the user.
- **Segmental TSI Time to peak measurement**: measures the time to peak velocity in specific wall segments and gets automatically calculated TSI indexes based on these measurements. The measurements may be presented in a color coded Bull's eye diagram.

Alternatively, time to peak measurement can be done in Q Analysis by manually measuring the time between the QRS marker and the peak velocity on the velocity trace.

Generic Time to peak measurement

1. Acquire a TSI apical loop.
2. Press **Measure**.
3. In the *Measurement* menu, select **Generic** and **Time to peak** (see Figure 7-5).

   The TSI loop freezes at the TSI end frame.
4. Place a point in the middle of a basal or mid-level myocardial segment in the TSI image.
5. The Time to peak value for the segment is displayed in the *Measurement result* window.

NOTE: To judge the quality of your data at the measuring point in the 2D image the TSI trace may be used (see 'TSI trace' on page 7-15). See also the Caution text on page 7-17.

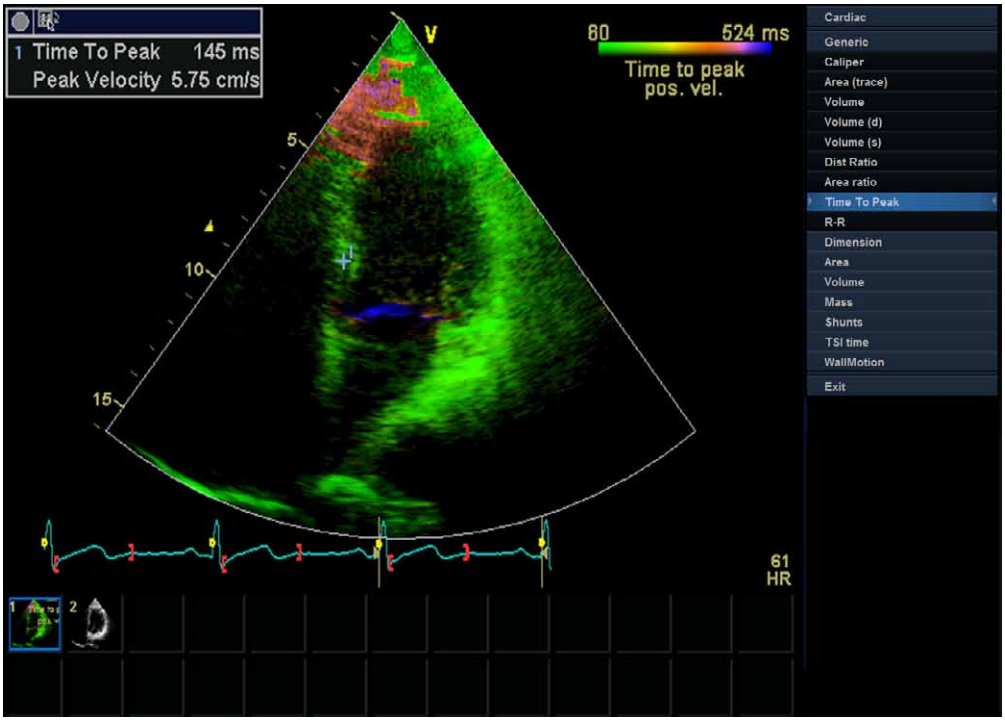


Figure 7-5. TSI Generic Time to peak measurement screen

Segment Time to peak measurements

1. Acquire TSI loops from all three apical views.
2. Press **Measure** and select the **TSI time** study.

   The TSI loop freezes at the TSI end frame.

   The first measurement in the study is automatically selected (see Figure 7-6).
3. Place a point in the middle of the corresponding segment in the TSI image.

   The Time to peak and the Peak velocity for the segment are displayed in the *Measurement result* window.
4. Perform a measurement for all basal and mid-level segments in all three apical views.

   In addition to the Time to peak and the Peak velocity for each segment, the following TSI indexes are calculated:

   - *Septal lateral delay*: difference in Time to peak velocity in the basal lateral wall and basal septum.
   - *Septal posterior delay*: difference in Time to peak velocity in the basal posterior wall and the basal antero-septum.
   - *Basal seg. max diff.*: difference between the maximum and minimum time to peak measurements in the six basal segments. Requires at least four of the six basal segment measurements.
   - *Basal standard deviation*: the standard deviation of the time to peak measurements in the six basal segments. Requires at least four of the six basal segment measurements.
   - *All seg. max diff.*: difference between the maximum and minimum time to peak measurements in all the measured basal and mid level segments. Requires at least eight of the twelve segmental measurements.
   - *All segments standard deviation*: the standard deviation of the time to peak measurements in all measured basal and mid level segments. Requires at least eight of the twelve segmental measurements.

Segment Time to peak measurements (continued)

The TSI indexes indicate degrees of asynchrony in time to peak velocity

5. Select **TSI Bull's eye report** in the *Measurement* menu.

   The measurements are displayed in a color coded bull's eye diagram together with a list of the calculated TSI indexes.

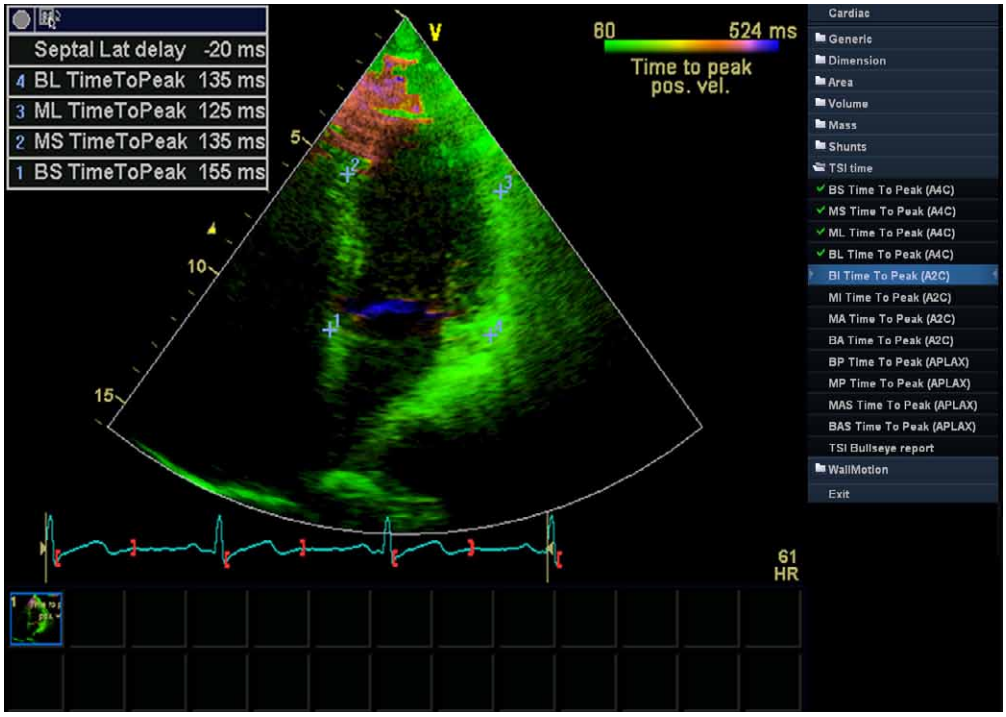


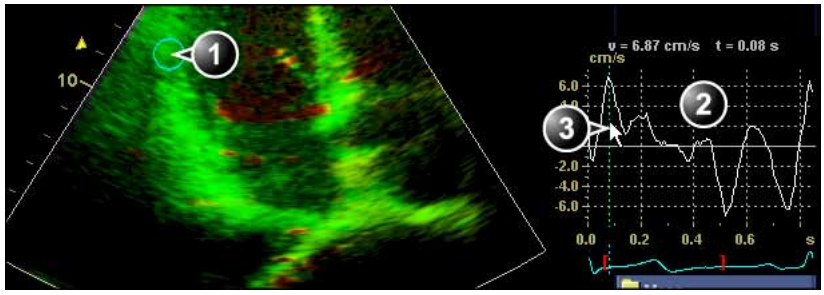
Figure 7-6. Segment Time to peak measurements screen

TSI trace

The TSI Time to peak measurement can be verified and eventually manually changed from the TSI trace.

1. Double click on the measurement point.

   The ROI and the corresponding TSI curve are displayed (see Figure 7-7).
2. Press **Set** to anchor the ROI and trace.
3. If required, select a new peak location in the trace.
4. Click in the acquisition window to exit the TSI trace.



1. TSI ROI
2. TSI trace
3. TSI Time to peak marker

Figure 7-7. TSI trace

Time to peak measurement in Q Analysis

1. From a TSI apical loop, press **Q-Analysis**.
2. Place a sample area in a myocardial segment.

   A velocity trace is displayed in the *Analysis* window (see Figure 7-8).
3. Press **Measure**.
4. In the *Measurement* menu, select **Generic** and **Time**.

*NOTE: If **Time** is not available in the Generic folder, Press **Active Mode** on the Control panel.*

5. In the *Analysis* window, measure the time from the yellow QRS marker to the peak velocity of the velocity trace.

1. Time measurement tool
2. Sample area
3. QRS marker
4. Time to peak measurement

Figure 7-8. Manual TSI Time to peak measurement in Q Analysis

Time to peak measurement in Q Analysis (continued)

*NOTE: It is possible to do a Generic or a Segment Time to peak measurement from within Q Analysis and compare the result with a manual Time to peak measurement. To access the corresponding measurement tool in Q Analysis you may have to press **Active Mode** to display the relevant Measurement menu.*

The Time to peak measurement in Q Analysis may differ from the TSI Time to peak measurements due to the following considerations:

- The TSI Time to peak measurements find the maximum velocity only within the TSI search interval. If the desired peak on the velocity trace is outside the TSI search interval, the TSI Time to peak measurements will return a different result than the manual Time to peak measurement.
- If the maximum velocity is at one of the ends of the TSI search interval, the TSI time to peak measurements return the time of the end of the TSI search interval. In some cases the falling flank of an iso-volumic contraction peak at the time of TSI Start or the rising flank of a post-systolic contraction peak at the time of TSI End may be detected. In a manual measurement the time to a peak within the TSI search interval with a lower velocity than the velocity at the end of the interval may be measured instead. The color map *TSI Trace* may be used to identify regions in the image where the peak detection is near the ends of the TSI search interval. The TSI Trace tool should be used to verify TSI measurements in the identified regions.
- If there are two or more peaks of comparable velocity within the TSI search interval, or a poor signal quality, the TSI Time to peak measurements may return the time to a different peak than what a manual method would do. Typically in these situations, the TSI image will show a wide range of colors over a small spatial region.

Automated Function Imaging

NOTE: Automated Function Imaging is an option for Vivid T8.

NOTE: Automated Function Imaging is not available for Vivid T8 Pro.

Automated Function Imaging (AFI) is a decision support tool for regional assessment of the LV systolic function. AFI is a tool derived from 2D Strain, which calculates the myocardial tissue deformation based on feature tracking on 2D gray scale loops.

NOTE: Poor tracking quality may lead to incorrect measurement results. The tracking for each segment must be visually controlled and validated.

AFI is intended for adult cardiac images.

AFI is performed on apical views in the following order: apical long-axis, 4-chamber and 2-chamber view, following an on screen guided workflow (see also Figure 7-9). The apical views may be acquired sequentially in 2D mode, or simultaneously in Tri-plane mode.

AFI is also available for standard apical views acquired with a TEE probe.

The result is presented as a Bull's eye display showing color coded and numerical values for peak systolic longitudinal strain.

The result can also be presented as a Bull's eye with a score index (Auto scoring).

All values are stored to the worksheet. In addition, Global Strain for each view, Average Global Strain for the whole LV and the Aortic Valve Closure time used in the analysis are stored to the worksheet.

Automated Function Imaging (continued)

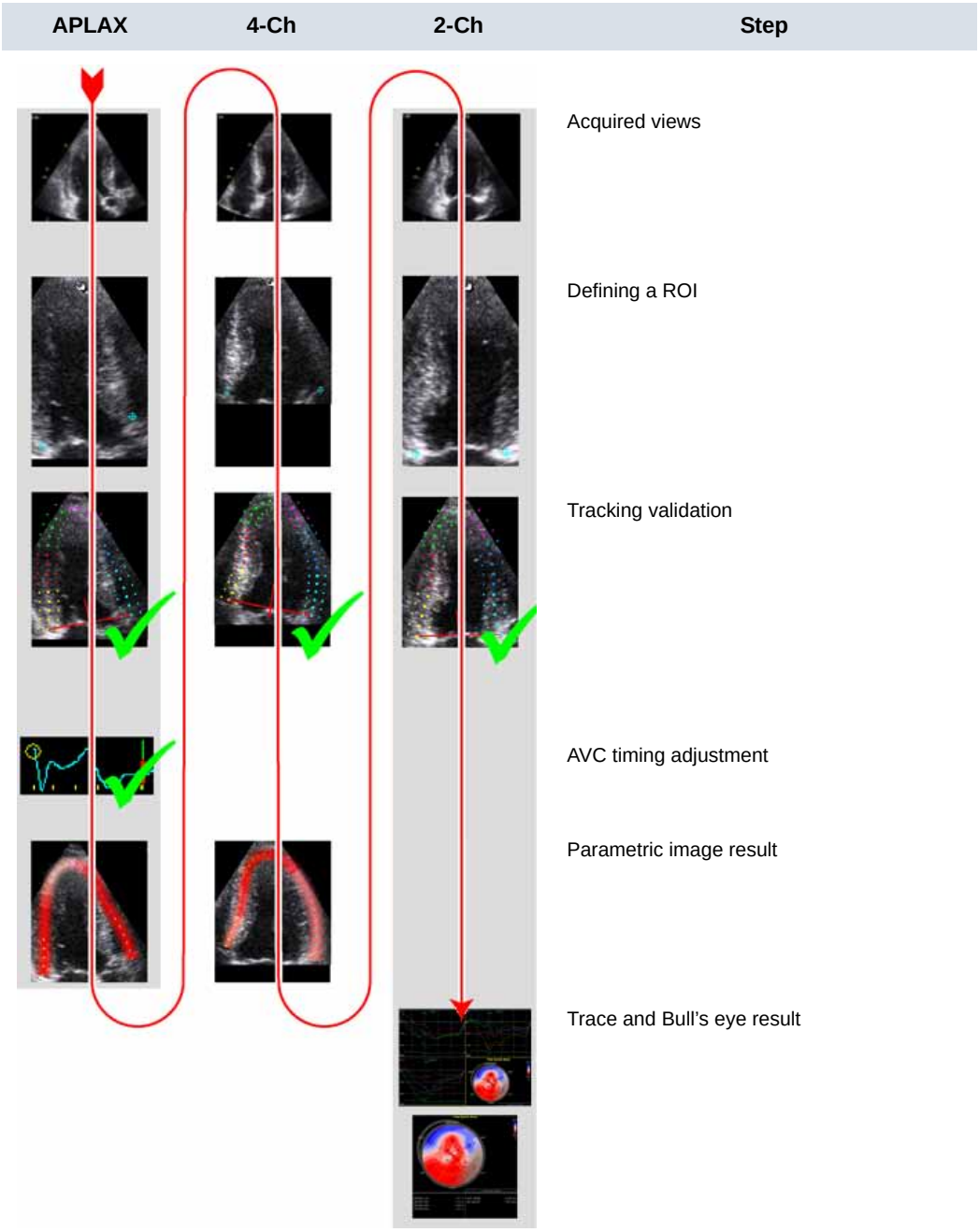


Figure 7-9. AFI workflow

Acquisition

1. Create an exam, connect the ECG device and make sure to obtain a stable ECG trace.
2. **Sequential acquisition:**
   - Acquire 2D gray scale cineloops of an Apical long axis (APLAX) view, an Apical 4 chamber view and an Apical 2 chamber view.

NOTE: It is recommended to acquire all three apical views sequentially in order to get similar heart rate in all views.

- The frame rate should be between 40 and 80 frames per second. A higher frame rate is recommended for high heart rate.
- The scanner should be configured to store 100 ms before and after each heart cycle.
- If the acquisition has more than one heart cycle, the analysis will be done on the second to last heart cycle.
- The entire myocardium should be visible.
- A depth range that includes the entire left ventricle should be used.

Starting AFI

Starting AFI from sequential acquisition

1. Open an APLAX view and press **Measure**.
2. In the *Measurement* menu, select **AFI**.
   The *View selection* menu is displayed (see Figure 7-10).

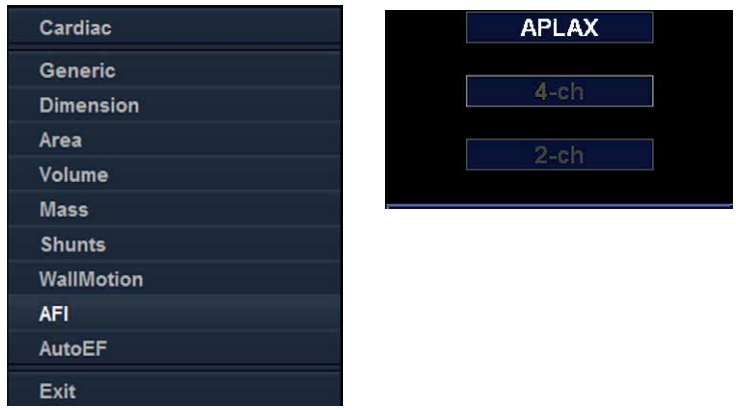


Figure 7-10. Measurement and View selection menus

3. Select **APLAX**.
   The AFI application is started. A ROI can be defined.

CAUTION

When performing AFI on all three apical views, the user is asked to start with the APLAX view. This allows manual adjustment of the Aortic Valve Closure (AVC) event timing that is used in the calculation of the longitudinal systolic strain in all apical views.

AFI on the APLAX view

Defining a ROI

When selecting the view to analyze the system automatically displays a frame where the endocardial border is usually clearly visible. To use another frame, adjust **Select frame**. The ROI is defined by placing two annular points and one at the apex following the order shown on screen.

To define a ROI, place three points at the endocardial border; two annular points and one at the apex (see Figure 7-11). Follow the indications displayed next to the pointer and on the *Status bar* when placing the three points.

NOTE: The Yo-yo function is turned on to help find correct location for the points.

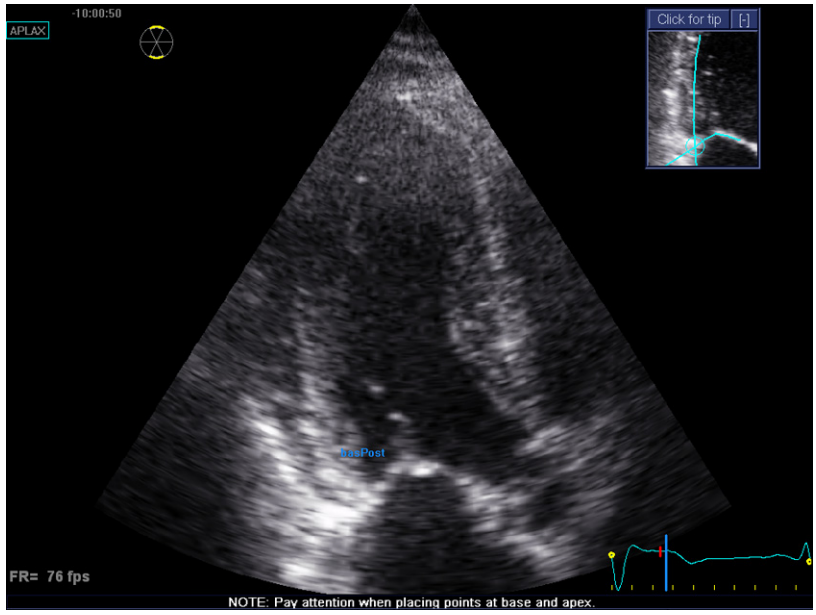


Figure 7-11. Defining a ROI

After placing the apex point the ROI is displayed.

NOTE: Correct ROI definition is important for an accurate strain measurement. The system has an adaptive ROI function: using the endocardial three points as a guide, the system will analyze the image and automatically adapt the ROI to an optimal position.

Defining a ROI (continued)

You may adjust the shape of the ROI by moving the cursor over the inner ROI border, select an anchor point and move it to a new location. The shape of the ROI is updated accordingly.

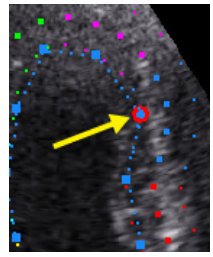


Figure 7-12. Selected anchor point on the inner ROI border

NOTE: Data processing is started automatically if the cursor is not moved for a few seconds. If the ROI needs to be adjusted make sure to make the changes immediately after the ROI is displayed.

NOTE: The auto processing function is configurable (from Config/ Meas-Text/Advanced/AFI auto processing).

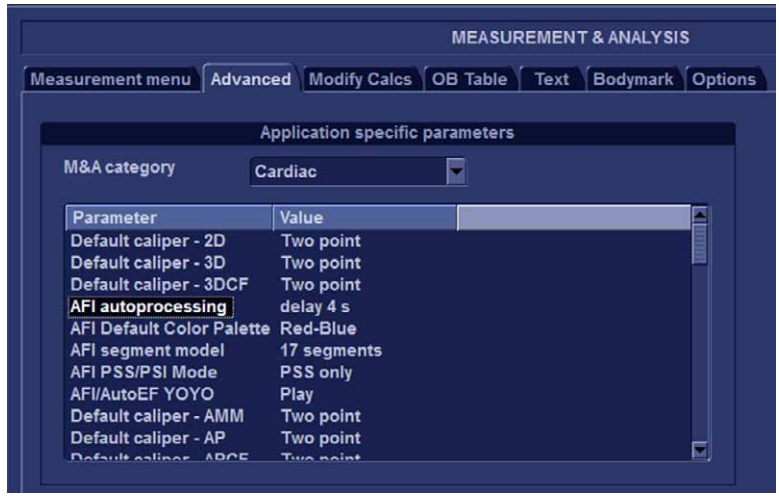
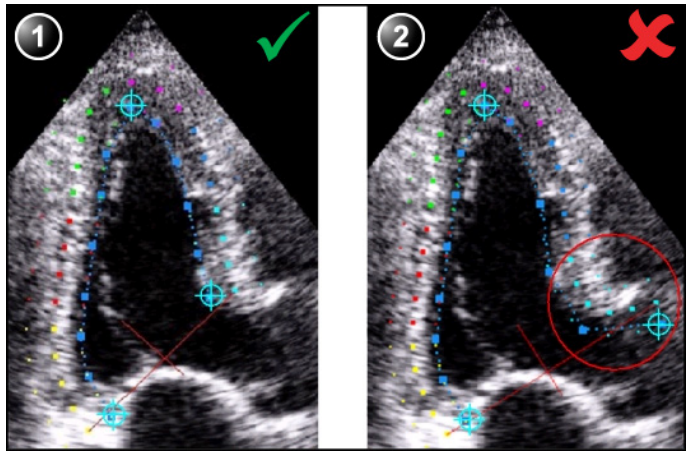


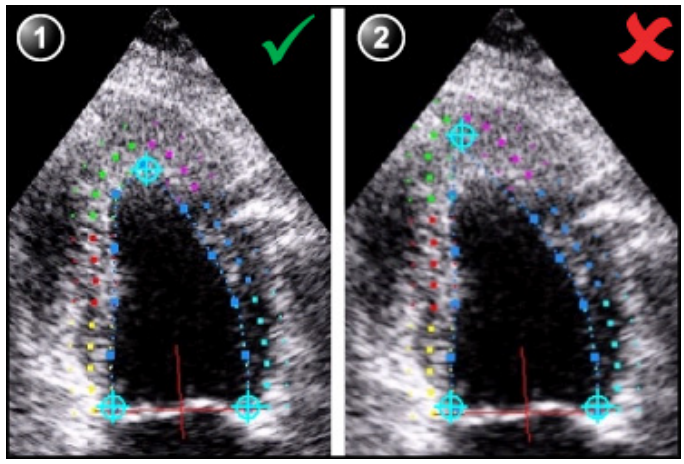
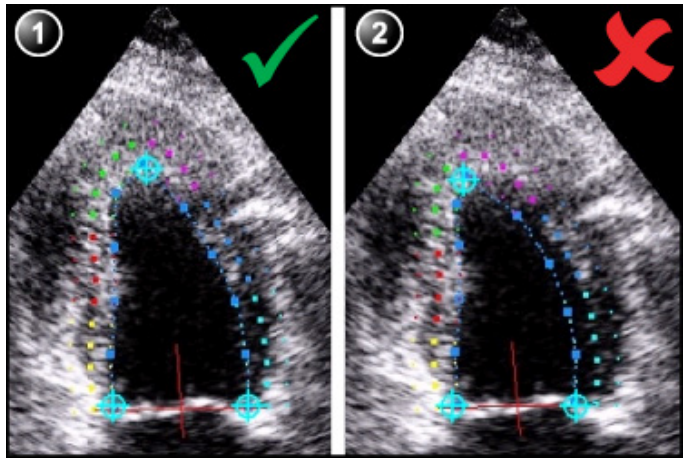
Figure 7-13. AFI auto processing configuration

Quick tips

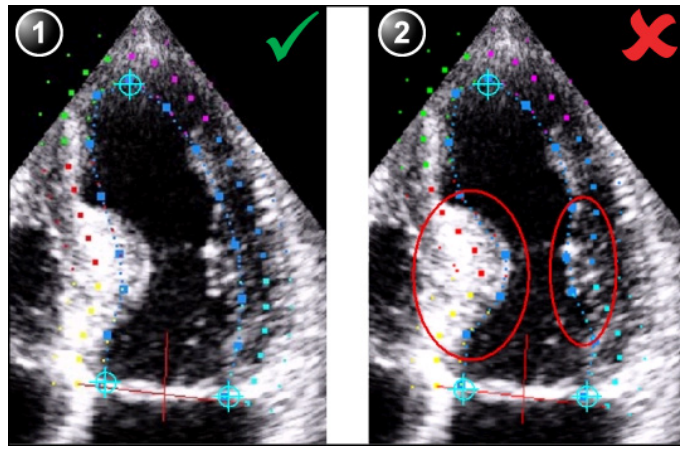
Correct ROI definition is crucial to get good tracking. Refer to the example displayed in the *Tip* window for correct point placements. To display additional guidelines, select **Click for tip**. Make sure to follow the recommendations when placing the three points (see below).

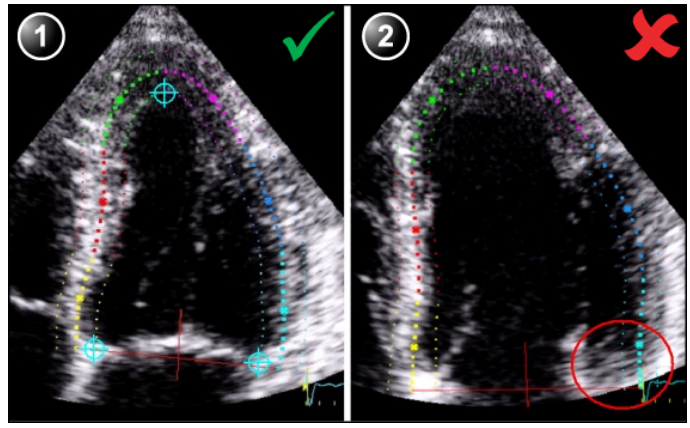
Base	Correct	Wrong
1. Correct position of the base points. 2. The ROI extends into the aortic tract.		

Quick tips (continued)

Apex	Correct	Wrong
1. Correct position of the Apex point. 2. The apex point is placed too high. The ROI is extending beyond the epicardium.		
1. Correct position of the Apex point. 2. The upper right border of the ROI is way too much into the chamber cavity.		

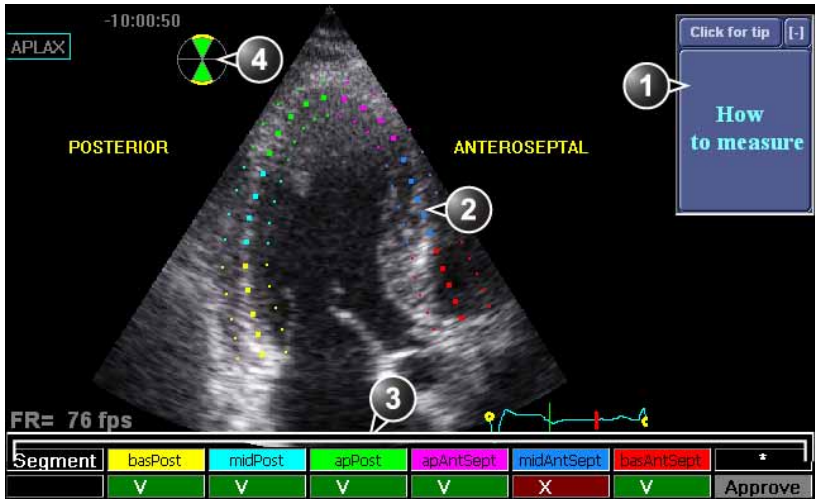
Quick tips (continued)

Bulges	Correct	Wrong
1. Correct ROI. 2. ROI should not be bulging or follow the papillary muscle. To edit the ROI, see 'ROI adjustment' on *page 7-29*.		

General	Correct	Wrong
The left ventricle must be visible through the entire cycle. 1. End systole frame: the entire left ventricle is displayed. 2. End diastole frame: the annulus is not displayed.		

The data is processed and the *Tracking validation* screen is displayed.

Quick tips (continued)



1. Display Quick Tips on tracking quality assessment
2. The ROI divided in segments
3. The Scoring table
   - ✓: acceptable tracking
   - X: not acceptable tracking
4. Bull's eye icon:
   - Green sectors with yellow border: views being analyzed.
   - Green sectors: views already analyzed.
   - Black sectors: views not analyzed.

Figure 7-14. Tracking validation screen

The ROI is divided into segments. The tracking quality for each segment is automatically evaluated and summarized in the *Scoring* table (see Figure 7-14).

Tracking validation

The tracking for each segment must be visually controlled and validated. Poor tracking quality could result from a variety of causes. Select **Quick tips** (see Figure 7-14) to get tips on the most common causes for bad tracking. The common causes for bad tracking are:

- Erroneous placement of the basal points when defining the ROI. If the basal points are placed too far from the annular region, the ROI segments at the annular base will not move together with the underlying 2D image throughout the entire heart beat (see example cineloops in the Quick tips).
- Erroneous placement of the apex point when defining the ROI. The point should be placed so that the resulting ROI covers mainly the myocardium. If the apex point is placed too high, the ROI will mainly cover the epicardium resulting in poor tracking (see example cineloops in the Quick tips).
- Too narrow ROI width. Narrowing the ROI too much will result in poor tracking due to lack of tissue data in the ROI (see example cineloops in the Quick tips).
- Too much clutter. Images with too much static clutter will result in poor tracking (see example cineloops in the Quick tips).

1. Inspect each segment and make sure that the center line is moving together with the underlying 2D image.

NOTE: *To get a better visualization you may press **Show/Hide ROI** to show or hide the ROI borders.*

The tracking quality is automatically evaluated for each segment and displayed in the *Scoring* table.

The tracking in each segment is scored as either Acceptable (✓) or Not acceptable (X).

If the tracking needs to be improved for some segments, the user can modify the ROI as described in ‘ROI adjustment’ on *page 7-29*.

The user may override the tracking quality evaluation done by the system by clicking on the evaluation result in the *Scoring* table.

2. Once the tracking quality has been controlled for all segments, press **Approve** in the *Scoring* table.

   The user is asked to confirm or adjust the AVC timing setting (see ‘Timing validation’ on *page 7-29*).

ROI adjustment

1. Press **Recalc**.
2. The following adjustments can be done:
   - Adjust **ROI Width**.
   - Press **New ROI** to re-define the ROI.
   - Adjust the shape of the existing ROI: move the cursor over the inner ROI border, select an anchor point and move it to a new location. The shape of the ROI is updated accordingly.

   Data processing is started automatically if the cursor is not moved for a few seconds.

   The *Tracking validation* screen is displayed for tracking validation.

Timing validation

Timing information may be crucial to accurate diagnosis. The most important event timing is the aortic valve closure (AVC), since it is part of the definition of the end systolic strain parameter.

Determination of the AVC timing by the system is as follows, depending on the situation:

- If AVC timing has been measured by the operator (through an event timing measurement, see page 7-10) prior to running AFI, the system is using this data.
- If event timing is not available, an automatic AVC estimate is used, determined by the temporal contraction of all LV segments (Strain curves).
- From the APLAX view, the user can adjust the estimated AVC timing. The adjusted AVC timing will then be used in the other apical views when running AFI on these views. This option is only available from the APLAX view.

AVC timing adjustment

This procedure is available in the APLAX view only.

1. After validation of the tracking quality, the frame for the current AVC setting (automatic or event timing measurement) is displayed and highlighted on the ECG.
2. To keep the current AVC setting, press **Set**. To change the AVC setting, use the trackball to display another frame and press **Set**.

   If the AVC setting was changed, a Confirmation window is displayed. Select one of the following options:

   - **Manual** to accept the manual AVC setting.
   - **Event Timing** to discard the manual AVC setting (if for example the AVC setting was not possible to assess from the APLAX view). The AVC event timing measurement will then be used.

   NOTE: This choice is only visible if AVC event timing has been done.

   - **Auto** to discard the manual AVC setting and use the automatic AVC timing.

   The *Parametric systolic strain APLAX view* is displayed (see Figure 7-15).

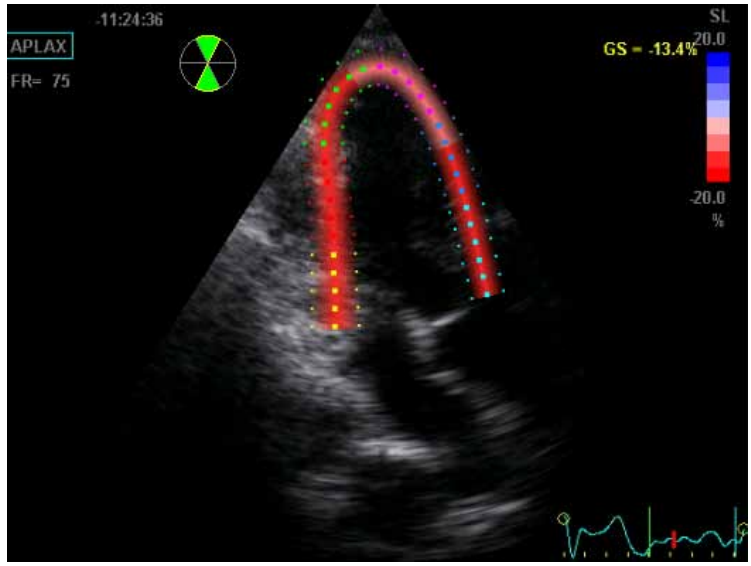


Figure 7-15. Parametric systolic strain APLAX view

*NOTE: The image will not be saved unless **Store** is pressed.*

AVC timing adjustment (continued)

Press Quad screen to display a quad screen (see Figure 7-16) showing:

- 2D image with the ROI
- 2D image with Peak systolic strain parametric data
- Segmental curves with peak marker
- M-Mode image with strain parametric data

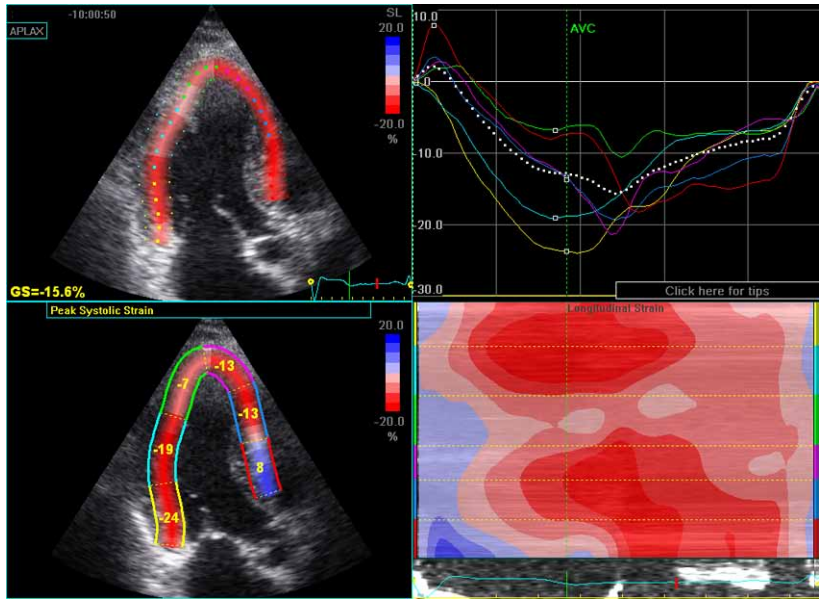


Figure 7-16. Quad screen for the APLAX view

*NOTE: The Quad screen will not be saved unless **Store** is pressed.*

AFI on A4-Ch and A2-Ch views

The procedure for AFI on Apical 4-chamber and 2-chamber views is similar to the one used in the APLAX view.

For sequential acquisition

1. Open the apical view from the clipboard.
2. Select the corresponding view in the *View selection* menu (see Figure 7-10).
3. Define a ROI (see page 7-22).
4. Validate tracking (see page 7-28).

NOTE: The AVC timing setting defined in the APLAX view is used by the system when running AFI on the other apical views.

Results

For the APLAX and apical 4-chamber views the following results are available:

- *Single* screen (see Figure 7-15) displaying a 2D image with strain parametric data.
- *Quad* screen (see Figure 7-16) displaying:
  - 2D image with the ROI
  - 2D image with Peak systolic strain parametric data
  - M-Mode image with strain data
  - Segmental curves

If auto-AVC is used as AVC timing calculation method when running AFI (see page 7-29), the strain values displayed in the *Quad* screen for the APLAX and 4 Chamber views may differ from the strain values obtained after the system has performed the final calculation from all three views. The reason for this is that the Auto-AVC calculation derived from all three views is most accurate and may be different from the intermediate AVC calculations used for each view. The strain values displayed in the *Quad* screen on APLAX and 4 Chamber views are therefor preliminary values (A warning text about this is displayed on the *Quad* screen). Only final strain values should be reported. Note: If you enter *Quad* screen again after all three loops have been processed, the strain values will be correct.

Results (continued)

When performing AFI on all three apical views the following results are also available:

- *Bull's Eye and Traces* screen (Figure 7-17) displaying:
  - Segmental curves for each three Apical views
  - Bull's eye presentation with segmental Peak systolic strain color coding and segmental Peak systolic strain values.
- *Bull's Eye Only* screen (see Figure 7-18) displaying:
  - Bull's eye presentation with segmental Peak systolic strain color coding and segmental Peak systolic strain values

NOTE: The Bull's eye can be configured to display either 18 or 17 segments (from Config/Meas-Text/Advanced/AFI Segment model).

*NOTE: Press **BE Maps** to select another color map for the Bull's eye.*

NOTE: The system can be configured so that the user can also choose to display Post systolic strain index (PSI) color coding and segmental PSI values in the Bull's eye (from Config/Meas-Text/Advanced/AFI).

- Global Strain (GS) values for all three apical views.

  In a given view the Global Strain (GS), also called Global Longitudinal Peak Strain (GLPS), is defined as the percentage of maximal contraction over the whole cardiac cycle of the entire myocardial wall relative to its end diastolic length.
- Averaged Global Strain value from all three apical view data.
- AVC measurement (either automatic, event timing measurement or manual, see page 7-29)

Getting the results

When approving the tracking in the Apical 2-chamber the *Bull's Eye and Traces* screen with segmental curves and Bull's eye is displayed (Figure 7-17). Select **Bull's eye only** to display the *Bull's Eye Only* screen (Figure 7-18).

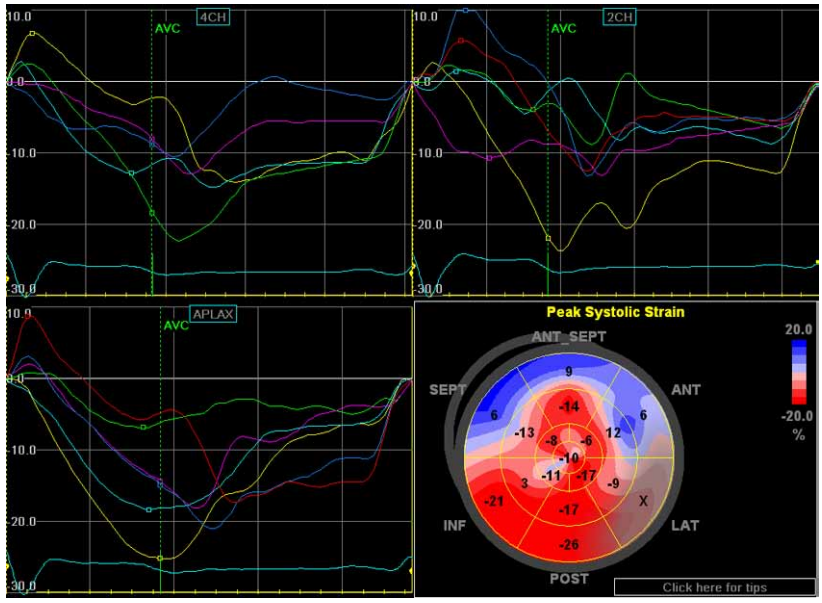


Figure 7-17. Quad screen

Getting the results (continued)

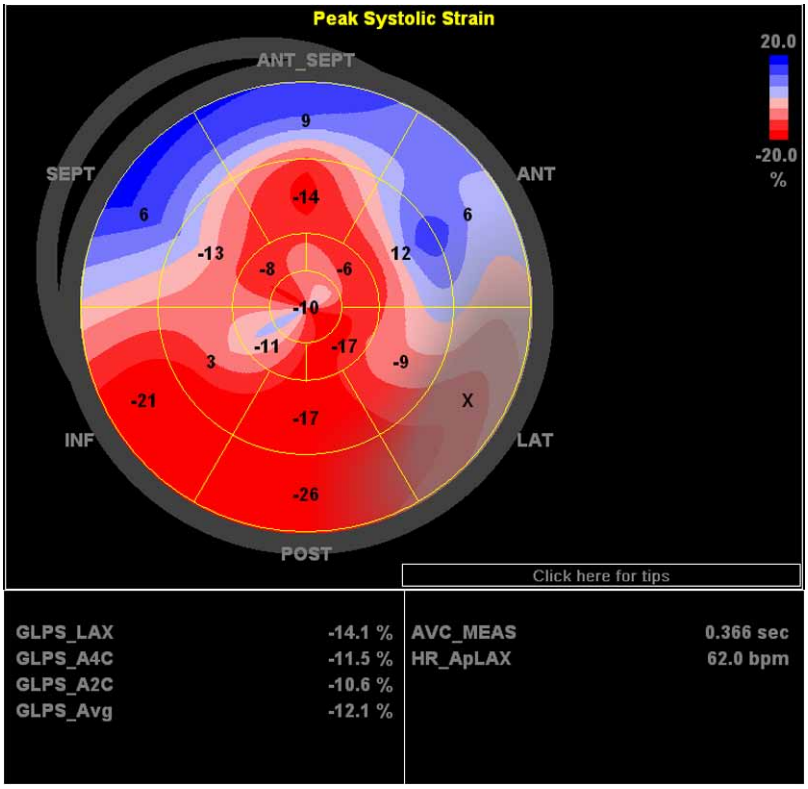
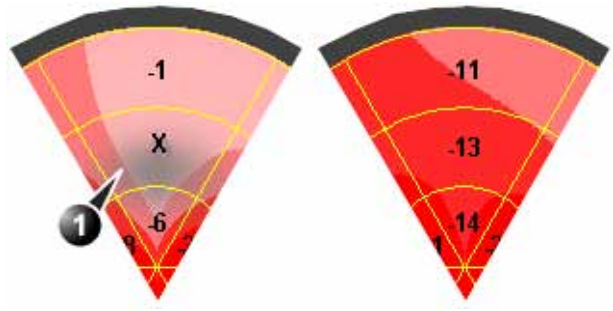


Figure 7-18. Bull's Eye Only screen

To save the results, exit AFI and answer yes to the question "Do you want to store?". Once the results are saved, the measurements are available in the Worksheet and can be used in the report.

If the tracking quality of a segment was scored as Not acceptable (X), the colorimetric display on the Bull's eye is grayed (see Figure 7-19).

Getting the results (continued)



1. Segment with tracking quality scored as Not acceptable (X).

Figure 7-19. Colorimetric display

Peak detection

The peak systolic strain detection for each segment can be verified and eventually manually changed.

To adjust the peak detection:

1. Press **BE+Traces**.

   The *Bull's Eye and Traces* screen is displayed (see Figure 7-17) showing:

   - Trace plots for all three loops
   - Bull's Eye with Peak systolic strain values

2. To change the peak marker position on a curve:

   - Press **Set** on the peak marker (square point) on one of the curves, move the peak marker to a new position and press the **Set** key again to fix the point.

     OR

   - Place the cursor on a segment in the Bull's Eye. The corresponding curve is highlighted.

     Click on the segment to select the corresponding peak marker and move it to a new position.

The position of the AVC marker can also be checked in the *Bull's Eye and Traces* screen. If needed, the APLAX view should be reprocessed to change the AVC time.

About the results

Be aware of the following:

- Clinical assessments should be made based on both color and segmental Peak systolic strain values.
- The Save As function is intended for research purposes and should not be used to archive diagnostic data.
- To populate the worksheet and the report the *Bull's Eye Only* screen must be saved.
- All results shown (curves, colors and values) are based on drift compensated values. Any strain drifting is linearly compensated throughout the cycle. If the drift compensation in a given segment is too high, the tracking quality is automatically set to Not acceptable (**X**).
- If the tracking quality was scored as Not acceptable (**X**) in more than one segment, the Global Strain value is not calculated.

Reprocessing data

The data from one or several views from a saved AFI analysis may be reprocessed. When reprocessing an AFI analysis new result screens are created.

1. Double-click on the Bull's eye thumbnail.

   A quad screen is displayed showing the three apical views and the Bull's eye diagram.
2. Select the view to reprocess and perform the analysis as described on page 7-22.

AutoEF measurements (Option for Vivid T8 and Vivid T8 Pro)

Automated Ejection Fraction (AutoEF) is a semi-automatic measurement tool used for measurement of the global EF (Ejection fraction). The AutoEF tool is used as an optional decision support tool.

The AutoEF tool is derived from 2D speckle tracking algorithm, which tracks and calculates the myocardial tissue deformation based on feature tracking on 2D gray scale loops.

NOTE: Poor tracking quality may lead to incorrect measurement results. The tracking must be visually controlled and validated.

AutoEF is performed on either one or both apical 4-chamber or 2-chamber views, in any order.

The result is presented as Ejection Fraction value for each view and average Ejection Fraction for the whole LV. All values are stored to the worksheet.

NOTE: The AutoEF tool is intended for adult cardiology and is not intended to be used in pediatrics cardiology.

Acquisition

1. Create an exam, connect the ECG device and make sure to obtain a stable ECG trace.
2. Acquire 2D gray scale cineloops of an Apical 4 chamber view and an Apical 2 chamber view.
   - The frame rate should be between 35 and 100 frames per second. A higher frame rate is recommended for high heart rate.
   - The scanner should be configured to store at least 100 ms before and after each heart cycle.
   - If the acquisition has more than one heart cycle, the analysis will be done on the second last heart cycle.
   - The entire myocardium should be visible.
   - A depth range that includes the entire left ventricle should be used.

Starting AutoEF

1. Open any one of the stored views and press **Measure**.
2. In the Measurement menu, select **AutoEF**.
   The *View selection* menu is displayed (Figure 7-20).

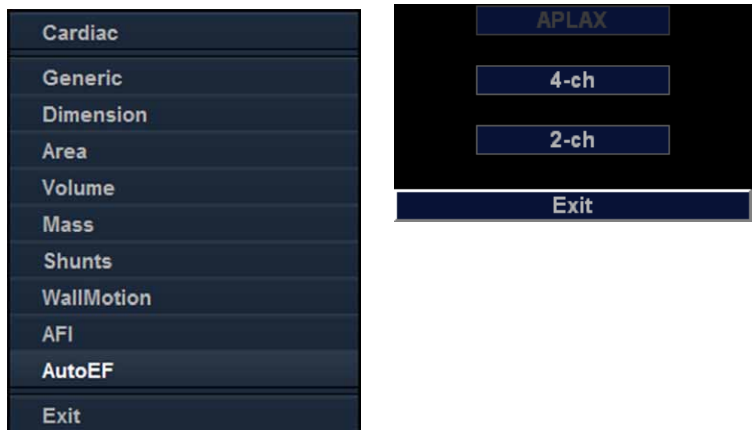


Figure 7-20. Measurement and View selection menus

3. Select the name of the current view: **4-ch** or **2-ch**.
   The endocardial border trace can be defined.

Tracing the endocardial border

When selecting a view to analyze, the system automatically displays a frame where the endocardial border is usually clearly visible. To use another frame, adjust **Init frame**.

1. To trace the endocardial border, place three points at the endocardial border; two annular points at the base and one at the apex. Follow the indications displayed on the screen when placing the three points.
   After placing the third point on the Apex an endocardial border is automatically traced (Figure 7-21).

Tracing the endocardial border (continued)

NOTE: Correct border tracing is important for an accurate EF measurement. The system has an adaptive border tracing function: using the endocardial three points as a guide, the system will analyze the image and automatically adapt the border tracing to an optimal position.

NOTE: The Yo-yo function is turned on to help finding correct location for the points.

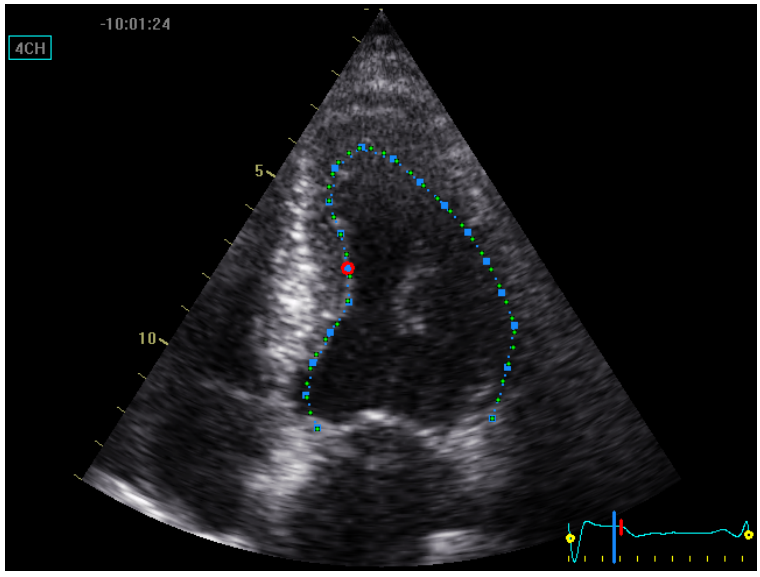


Figure 7-21. Tracing the endocardial border

2. Data processing is configured by default to start automatically if the cursor is not moved for a few seconds. If the trace needs to be adjusted make sure to make the changes immediately after the ROI is displayed. See 'Editing the endocardial border trace' on *page 7-41* for more information on how to edit the trace.

NOTE: The auto processing function is configurable (from Config/ Meas-Text/Advanced/AFI/AutoEF auto processing).

The data is processed and the *EF result* screen is displayed.

Editing the endocardial border trace

1. If required, use the **Left/Right Edge shift** controls to delineate separately the left or right portions of the endocardial border visually as best as possible. These controls are not available if the endocardial border trace is adjusted
2. You may adjust the trace by moving the cursor over the endocardial border trace, select an anchor point and drag it to a new location. The shape of the endocardial border trace is updated accordingly.

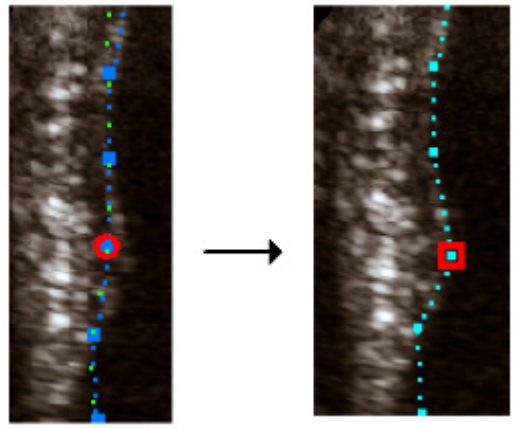


Figure 7-22. Moving an anchor on the trace

EF results

When processing is complete the *EF results* screen is displayed. (Figure 7-23).

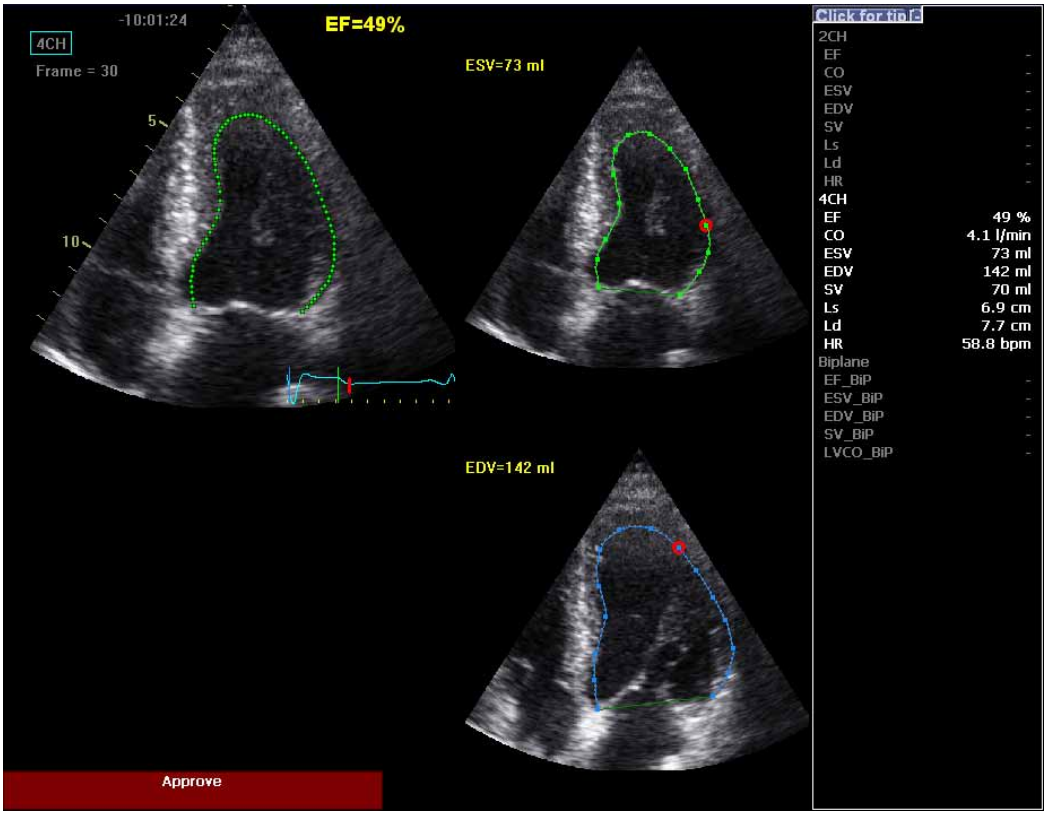


Figure 7-23. The EF results screen

The running loop is shown on the left. A green dotted line marks the inner border of the chamber. In case of poor tracking, the system automatically displays parts of the border in red.

The frames with the maximal area (ED) and minimal area (ES) are displayed on the right side.

*NOTE: Press **EF Dual** to only display the ED and ES frames.*

The End Diastolic volume (EDV), the End Systolic Volume (ESV) and the resulting Ejection Fraction (EF) are displayed.

Results for each view are summarized in a table on the right side.

Tracking Validation

The tracking must be visually controlled and validated. If the tracking results are visually correct press the red **Approve** button on screen. The calculated values are stored and available in the worksheet and can be used in a report.

The following can be done if tracking needs correction:

- Press **EF dual** to display ES and ED frames side-by-side.
- Adjust **ES frame** and **ED frame** controls if different frames need to be selected for ES and ED.
- Edit misaligned points on the endocardial border trace on the ES frame and ED frame as described on page 7-41.
- Press **Recalc** to display the initial endocardial border trace and either adjust the trace (see page 7-41) or press **New ROI** and create a new endocardial border trace (see page 7-39).

Possible causes of poor tracking

- Erroneous placement of the basal points when defining the border. If the basal points are placed too far from the annular region, the border segments at the annular base will not move together with the underlying 2D image throughout the entire heart beat.
- Erroneous placement of the apex point when defining the border. The point should be placed so that the resulting border trace covers mainly the endocardium. If the apex point is placed too high, the border trace will mainly cover the epicardium resulting in poor tracking.
- Too much clutter. Images with too much static clutter will result in poor tracking.

Exit AutoEF

1. Press **Exit** on the Touch panel.

   A dialog is displayed asking the user about storage of the loop.

   - Press **Yes** to store the loop.
   - Press **No** to discard the loop.

Pediatric Z score measurement study

Calculated Z Scores are used to normalize pediatric heart measurements to the patient's body size. Z Score values are calculated based on **"Regression Equations for Calculation of Z Scores of Cardiac Structures in a Large Cohort of Healthy Infants, Children, and Adolescents: An Echocardiographic Study"**, M.D. Pettersen et.al. The parameters defined in this publication are calculated when present in the *Dimension* folder both for M-mode and 2D images.

BSA value must be known. BSA is automatically calculated when entering the patient's height and weight in the *Patient information* window (see Figure 2-15 *on page 2-27*).

In addition, all Z Score values from the above publication are found in a separate *Z Scores* folder. By default this *Z scores* folder is hidden in the *Measurement* menu. To display the *Z scores* folder, see 'Configuration of the Measurement menu' on *page 7-58*. Please note that Z Score values from the *Z Scores* folder are not averaged together with the values in the *Dimension* folder.

1. Open a pediatric cardiac acquisition.

   Make sure the height and weight of the patient was entered in the *Patient information* window.
2. Press **Measure** and select the **Z Scores** folder (only available from the *Pediatric Heart* measurement category, if turned on).
3. In the *Z Scores* folder select the measurement to perform.
4. Make the measurement.

   The Z0 and Z values are displayed in the *Measurement result* table.

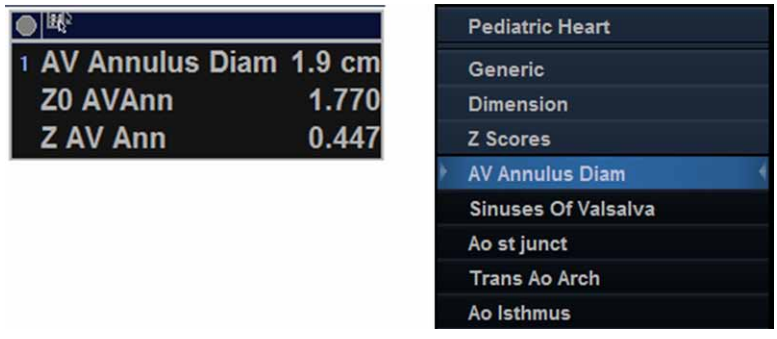


Figure 7-24. Pediatric cardiac measurement with Z Score

Advanced vascular measurements and analysis

Intima-Media Thickness

NOTE: Intima-Media Thickness is an option for Vivid T8.

NOTE: Intima-Media Thickness is not available for Vivid T8 Pro.

The Intima-Media Thickness (IMT) is calculated based on automatic contour detection of the Intima and Media layers on a user-defined search region along the vessel wall. Multiple IMT measurements are made between pairs of intima and adventitia points along the wall (Figure 7-25). IMT can be measured both on the posterior and the anterior walls of the vessel. IMT should be done on 2D mode images, not on Color mode images.

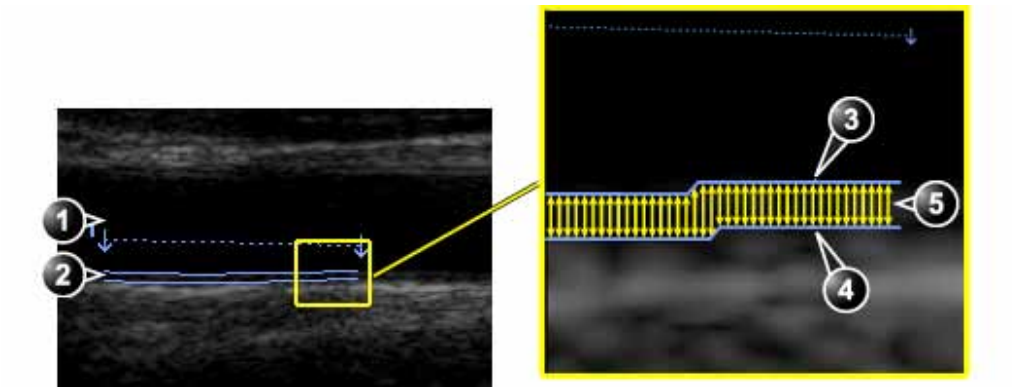
The IMT measurement is available with linear probes only.

NOTE: Due to the physical properties of ultrasound imaging, the posterior IMT measurement is generally more accurate than the anterior IMT measurement.

The following parameters are calculated:

- Average IMT
- Maximum IMT
- Minimum IMT
- Standard deviation of IMT measurements
- Number of successful IMT measurements

Intima-Media Thickness (continued)



1. Vessel lumen
2. Vessel wall
3. Lumen-Intima boundary
4. Media-Adventitia boundary
5. Multiple IMT measurements

Figure 7-25. IMT measurement (Posterior wall)

IMT Measurement procedure

The following procedure describes the posterior IMT measurement.

1. Acquire a longitudinal scan of the carotid artery and optimize the image.
2. Press **Freeze**.
3. Scroll to an end-diastolic frame where the intima layer is clearly visible.
4. Press **Measure**.
5. Select the appropriate IMT measurement. If measuring the IMT of the posterior wall of the right common carotid select **Rt** and **CCA IMT Post** (Figure 7-26).

IMT Measurement procedure (continued)

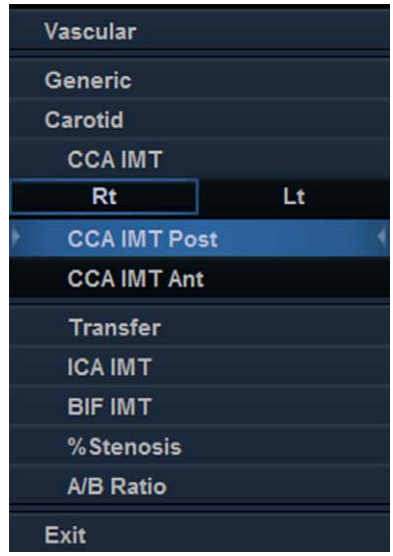


Figure 7-26. IMT Measurement menu (Right Common Carotid Posterior IMT measurement tool)

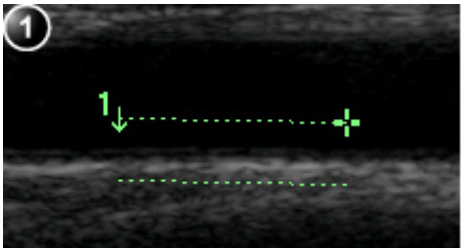
6. Place the cursor in the artery closer to the posterior wall and press **Set** to anchor the start of the search region (Figure 7-27, left).
7. Move the cursor parallel to the artery to define the end point of the search region. Make sure the Intima and Media layers are within the search region (indicated by the lower dotted line in Figure 7-27, left).

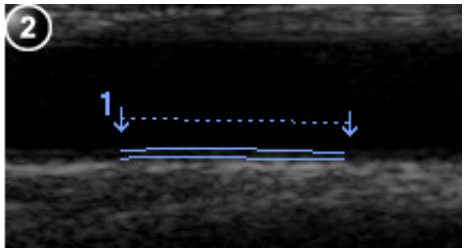
   Press **Set** to anchor the point. For the posterior wall the contour detector searches for the leading of the edges of the intima and adventitia layers. The detected contours are drawn in the image (Figure 7-27, right).

   The measurement calculations are displayed in the *Measurement result* table.

NOTE: *If the Intima and Media layers are not within the search region, the contour is not drawn. Select (double click) and move the anchored points closer to the Intima layer.*

IMT Measurement procedure (continued)





1. Measurement segment
2. IMT trace

Figure 7-27. IMT Measurement segment and traces

8. If the contour is not optimal, adjust **Trace Fit** to modify the traces according to different threshold values.

   If the contour is still not optimal, try to perform the IMT measurement on another frame, preferably close to the end diastole.

IMT trace approval

NOTE: Erroneous contour detection of the Intima and Media layers may lead to incorrect measurement results. The contour detection should be visually checked and edited if required.

Since the IMT measurements are done semi-automatically, the operator has to approve the detection by visual inspection before storing the results in worksheet and report.

1. If the traces fit both layers of the posterior wall, approve the measurement by selecting **Transfer** in the *Measurement* menu.

   Once transferred, the calculations can be viewed in the worksheet and report.

NOTE: Measurements that are not approved will not be saved.

*NOTE: Any image adjustments (e.g Gain or zoom) on approved (transferred) measurements will unassign the measurements. Press **Transfer** to approve the measurements again.*

OB measurements

1. From an obstetric exam on a scan in Freeze, press **Measure**.
2. Select the desired study.
3. Perform the required measurements from the selected study.

   Follow the on-screen indications when performing measurements.

OB graphs

OB Graphs allow you to assess fetal growth compared to a normal growth curve. When a patient has completed two or more ultrasound exams, you can also use the graphs to look at fetal trending. For multi-gestational patients you can show curves for all fetuses and compare the growth on the graphs. The Vivid T8/Vivid T8 Pro provides the following two basic types of graphs:

- **Fetal Growth Curve graphs** – show one measurement per graph. These graphs show the normal growth curve, positive and negative standard deviations or applicable percentiles, and ultrasound age of the fetus using the current measurement. For multi-gestational pregnancies, you can show curves for all fetuses. If previous exam data is available, the graph can show fetal trending.
- **Fetal Growth Bar graph** – shows the ultrasound age and the gestational age based on patient data. Plots all measurements on one graph.

The system provides calculations (e.g. estimated foetal weight) and charts based on published scientific literature. The selection of the appropriate chart and clinical interpretation of calculations and charts are the sole responsibility of the user. The user must consider contraindications for the use of a calculation or chart as described in the scientific literature. The diagnosis, decision for further examinations and medical treatment must be performed by qualified personnel following good clinical practice.

To view OB graphs

1. Press **Worksheet**.
2. Press **Graph**.

   The Fetal growth curve graph is displayed (Figure 7-28). The horizontal axis shows the fetal age in weeks. The system determines this age from the data entered in the *Patient information* window. Depending on the measurement selected the vertical axis displays measurements (mm or cm), ratios (%) or fetal weight (g).

   The Fetal growth curve graph shows the following information for the selected measurement:

   - The normal growth curve
   - The standard deviations or relevant percentiles
   - The gestational age of the fetus, using patient data (vertical dotted line)
   - Using the current ultrasound measurement data, where the fetus is on the growth curve

From the OB graphs screen, the user can enter relevant information in the *Fetus position* and *Placenta* fields.

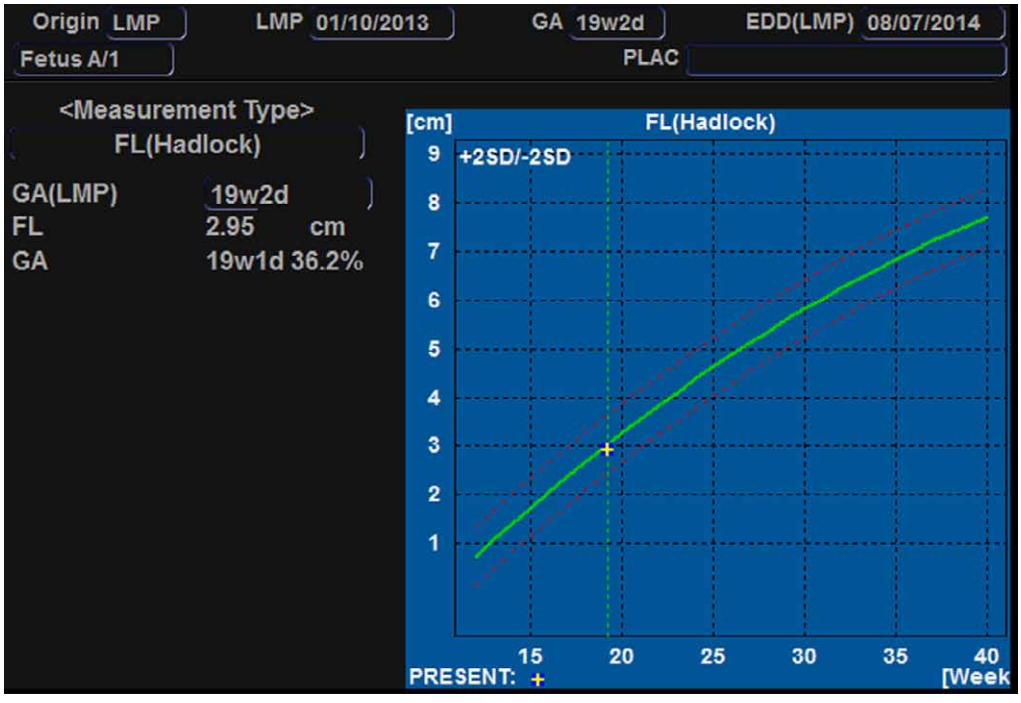


Figure 7-28. Fetal growth curve graph

To select the measurement

1. Select the measurement in the *Measurement type* field.

   A list of available measurements is displayed.

2. Select the measurement to display.

   To scroll through all Fetal growth curve graphs, adjust **Graph Change**.

To select the age to use

1. Adjust **Select GA**.

   The plot displays either gestational age (GA) from the LMP, or the composite ultrasound age (CUA).

When selected, the gestational age may be changed by the user.

1. Select the **GA (LMP)** value.

   An editing window is displayed.

2. Enter a new value and select **OK**.

   The GA (LMP) label is changed to GA(GA) showing the new value entered. This information is also updated in the *Patient information* window. In addition the EDD (LMP) is updated to EDD (GA) with new calculated value.

To view single or quad screen

1. Press **Quad** to display four graphs simultaneously.
2. To select the measurements to display in the quad screen, select the drop-down button on the left of each graph and select the desired measurement.
3. Press **Single** to display single graph screen again.

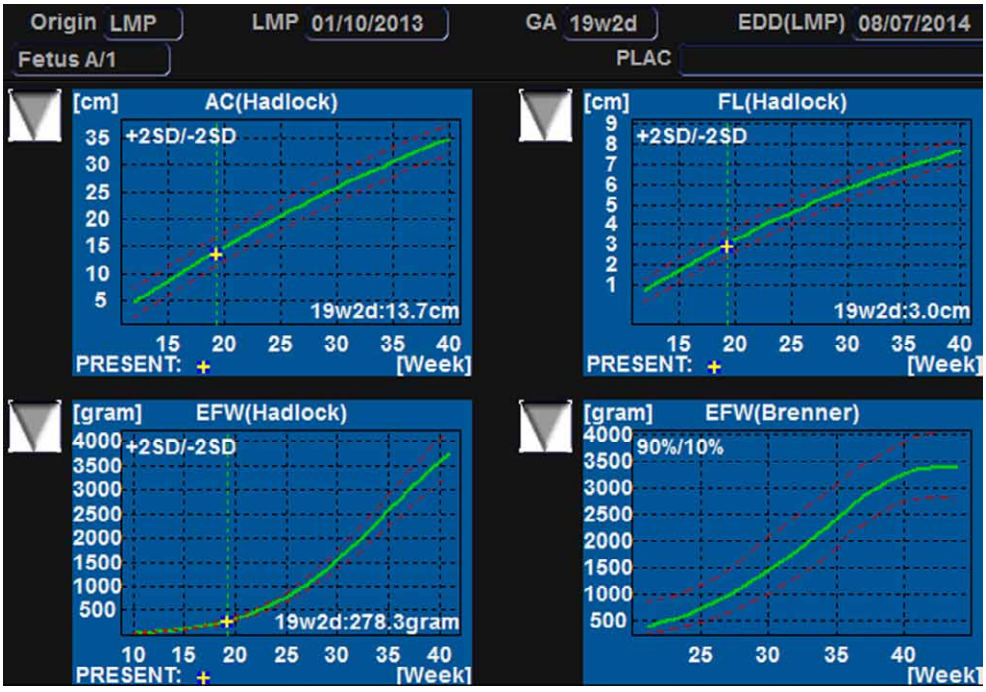


Figure 7-29. Fetal growth curve graph: quad screen

Fetal trending

When you have ultrasound data for more than one exam for a patient, you can use the data to look at fetal trending on the Fetal growth curve graphs. Fetal trending requires that a LMP value is entered in the *Patient information* screen.

1. Press **Worksheet**.
2. Press **Graph** and select the desired measurement to display.
3. Press **Plot Both**.

   The system automatically finds the data from previous ultrasound exams, and displays it on the graph with the present data.

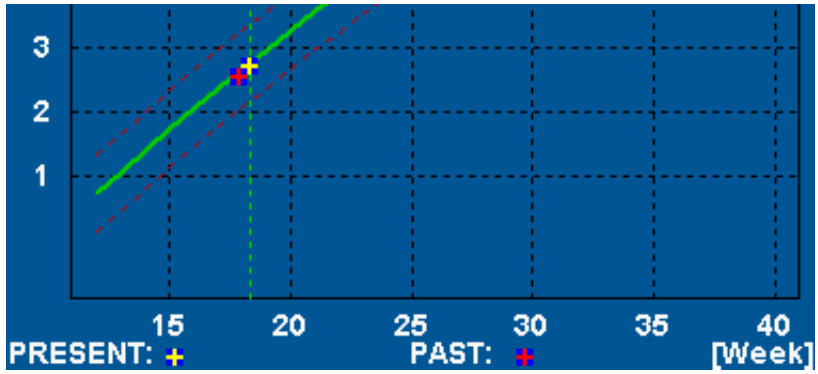


Figure 7-30. Fetal trending graph

Fetal growth bar graph

The fetal growth bar graph shows current exam measurements and the normal growth range based on the gestational age. It shows all measurements on one graph.

1. Press **Worksheet**.
2. Press **Graph**.
3. Press **Bar**.

   The fetal growth bar graph is displayed.

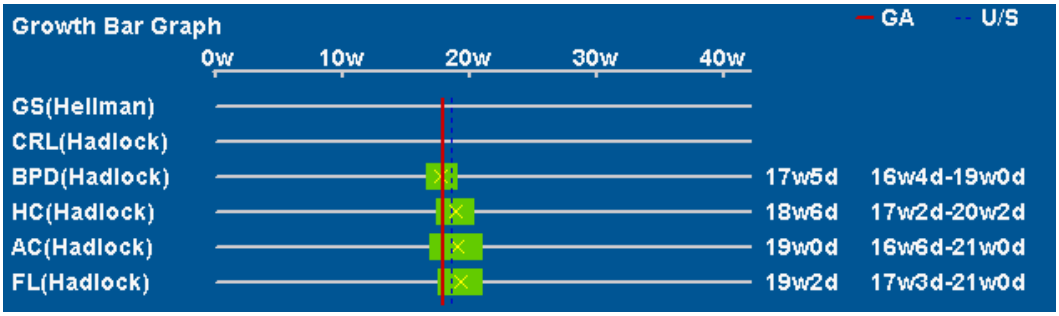


Figure 7-31. Fetal growth bar graph

- The horizontal axis shows the gestational weeks.
- The red vertical line shows the gestational age using the patient data.
- The blue dotted vertical line shows the ultrasound age using the current measurements.
- The yellow x shows the ultrasound age for each measurement.
- The green rectangle shows the normal age range for the measurement.

Measurement package configuration

There are many more measurements and parameters in the measurement package than shown in the default *Measurement* menu. Use the configuration system to set up the measurements that should be available in the *Measurement* menu and which parameters should be calculated.

A list of all cardiac calculations with needed measurements and location in the Measurement package can be found in the Reference manual.

Basic operations

Opening the Measurement configuration package

1. Press **Utility**/**Config** on the Touch panel and select the category **Meas/Text**.

   The *Measurement menu* sheet is displayed (see Figure 7-32).

Display of the Measurement categories

1. Press **M&A categories** in the *Configuration* window.

   The M&A categories are displayed in a pop-up window.
2. Check the categories to be displayed.

   Uncheck the categories to hide.

To select a Measurement category in the *Measurement* menu:

1. Select the heading of the *Measurement* menu.

   The measurement categories are displayed in a sub-menu.
2. Select the Measurement category to display.

Moving an item in the Measurement menu

1. Select an entry in the *Measurement* menu.
2. Press  or  to move the selection up or down inside the *Measurement* menu.

Deleting an item in the Measurement menu

Only user-created items can be deleted.

1. Select an entry to delete in the *Measurement* menu.
2. Press  to delete the item.

Display/hide a folder or a measurement in the Measurement menu

The Measurement menu (Folders and Measurements) can be configured to display only the entries (folders and measurements) of interest.

To hide a folder or a measurement:

1. Uncheck the actual folder or measurement in the *Folder* or *Measurement* field in the *Configuration* window.

To display a hidden folder or measurement:

1. Check the actual folder or measurement in the *Folder* or *Measurement* field in the *Configuration* window.

Auto-sequence of measurements within a folder

1. In the *Measurement menu* sheet, select a folder in the *Measurement* menu.
2. Check **Auto sequence**.

   When performing the first measurement in the folder, the next measurement is automatically selected.

Creating a user-defined folder

1. If the folder is to be inside another folder, select the actual folder in the *Measurement* menu.
2. Press **Add folder**.

   The *Measurement* menu is updated.
3. Enter the folder name in the *Name text* field.

Measurement package configuration - example

The following example based on calculation of AV CO (Cardiac Output by Aortic Flow) describes how to configure the measurement package so that necessary measurements and the resulting calculations are displayed on screen.

Calculation of Cardiac Output by Aortic Flow requires the measurement of:

- AV diameter located in the folder *Dimension* (2D mode)
- AV VTI located in the folder *Aortic* (Doppler AV Trace).
- Heart rate

If a calculated parameter (e.g. AV CO in AV Trace measurement) requires another parameter to be calculated (e.g. AV Diam) the user must first measure the required parameter (e.g. AV Diam) before the dependent parameter (e.g AV CO in AV Trace) gets calculated.

Configuration of the Measurement menu

If the AV diameter measurement is not present in the folder *Dimension* in the *Measurement* menu, follow the following procedure:

1. Press **Utility**/**Config** on the Touch panel and select the category **Meas/Text**.

   The *Measurement menu* sheet is displayed (see Figure 7-32).
2. AV Diam is a 2D measurement, make sure that **2D** is checked in the *Measurement* sheet.
3. Select folder **Dimension** in the *Measurement* menu.

   A list of all available measurements for the selected folder is displayed in the *Measurement menu* sheet.
4. Check the box in front of **AV Diam**.

   The AV Diam measurement is displayed in the folder *Dimension* in the *Measurement* menu.
5. For the AV VTI measurement, check **Doppler** in the *Measurement menu* sheet and select the folder **Aortic** in the *Measurement* menu.

Configuration of the Measurement menu (continued)

6. Check the box in front of **AV Trace**.

   The AV Trace measurement is displayed in the folder *Aortic* in the *Measurement* menu.

1. Select the scanning mode for the measurement to add to the Measurement menu.
2. Select the folder for the measurement to add.
3. Select the measurement to add.

Figure 7-32. Configuration of the Measurement menu

Configuration of the Measurement result table

If AV CO calculation is not displayed in the *Measurement result* table, follow the following procedure:

1. Press **Utility**/**Config** on the Touch panel and select the Config category **Meas/Text**.

   The *Measurement menu* sheet is displayed.
2. The AV CO calculation is based on Doppler AV Trace measurement in the folder *Aortic*, check **Doppler** in the *Measurement menu* sheet and select the folder **Aortic**.

   A list of all available measurements and calculations for the selected folder is displayed in the *Measurement menu* sheet.

NOTE: Entries in green are calculated measurements.

3. In the *Measurement menu* sheet, double-click on the **AV Trace** measurement.

   A list of all available output parameters for the AV Trace measurement is displayed in the *Measurement menu* sheet.
4. Check the box in front of **AV CO**.

   The AV CO calculation will be displayed in the *Measurement result* table.

User-defined formulas

User-defined formulas can be created using existing measurements or by defining new measurements. The following example describes the creation of a formula based on existing measurements.

GE does not take any responsibility for the correctness of the user-defined studies, parameters or functions.

User-defined formula - example

The workflow for user-defined formula is:

- If the user-defined formula is based on several measurements of different types, create a user-defined folder in the *Measurement* menu so that all measurements and the formula are grouped together. If the formula is based on a single measurement you may select an existing appropriate folder.
- Add the measurement(s) needed for the formula to the user-defined (or existing) folder.
- Create the formula based on the added measurements.

The following procedure describes the creation of user-defined LIMP formula as follows: My LIMP = (MCO-AVET)/AVET.

Creation of a user-defined folder

1. Select the appropriate scanning mode.
2. Create a folder in the Measurement menu.

Figure 7-33. The Measurement menu sheet

1. Press **Utility**/**Config** on the Touch panel and select the category **Measure**.
2. MCO and AV ET are Doppler measurements, select **Doppler** in the *Measurement menu* sheet.
3. Select **Add folder**.
4. Give the folder a name (e.g. “My Folder”).

Adding measurements

1. Select the user-defined folder.
2. Press Add measurement.

Figure 7-34. The Measurement menu sheet

1. Select the user-defined folder (e.g. “My Folder”) in the *Measurement* menu.
2. Press **Add Measurement** in the *Measurement menu* sheet.

   The *Add measure* window is displayed.

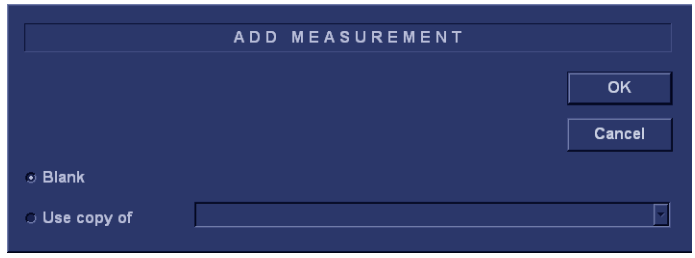


Figure 7-35. The Add measure window

3. MCO and AVET are measurements that already exist on the system, check **Use copy of** and select **MCO** from the drop down menu.
4. Select **OK** to add the MCO measurement.
5. Repeat steps 2 to 4 to add the AVET measurement.

Creation of the formula

1. Select the last measurement.
2. Double click and enter the formula name.
3. Select “=” to create the formula.

Figure 7-36. The Measurement menu sheet

The formula for this example is as follows:
My LIMP = (MCO-AVET)/AVET

1. In the user-defined folder (e.g.”My folder”), select the last measurement created (e.g. AV ET).
2. Double-click **(Name)** in the last line in the *Parameter list* in the *Measurement menu* sheet.
3. Enter the name for the formula (e.g. My LIMP).
4. Select =.
   The *Edit formula* window is displayed.

Creation of the formula (continued)

Figure 7-37. The Edit formula window

5. Select "**(**"from the *Operators* drop-down menu.
6. In the *Doppler* drop-down list, select **MCO [My Folder, MCO]**.

   Make sure to select the measurement located in the user defined folder (e.g. "My Folder").
7. Select "**-**" from the *Operators* drop-down menu.
8. In the *Doppler* drop-down list, select **AVET [My Folder, AVET]**.
9. Select "**)**" from the *Operators* drop-down menu.
10. Select "***/***" from the *Operators* drop-down menu.

NOTE: Operators may also be entered using the alphanumeric keyboard.

11. In the *Doppler* drop-down list, select **AVET [My Folder, AVET]**.

    The Formula line should display: *({MCO}-{AVET})/{AVET}*.

    No units are necessary since the formula is a ratio (see also 'About units' on *page 7-66*).
12. Press **Check** to make sure that the syntax for the formula is correct.

User-defined measurements

Some user-defined formula may require measurements that do not exist on the system. The following example based on a generic distance measurement illustrates how to create user-defined measurements.

1. Select the appropriate scanning mode.
2. Select the appropriate folder.
3. Press Add measurement.

Figure 7-38. The Measurement menu sheet

1. Press **Utility**/**Config** on the Touch panel and select the category **Measure**.
2. In the *Measurement menu* sheet, select the appropriate scanning mode for the measurement to be created (e.g. 2D).
3. Select the appropriate folder in the *Measurement menu* (e.g. Dimension).
4. Press **Add Measurement** in the *Measurement menu* sheet.

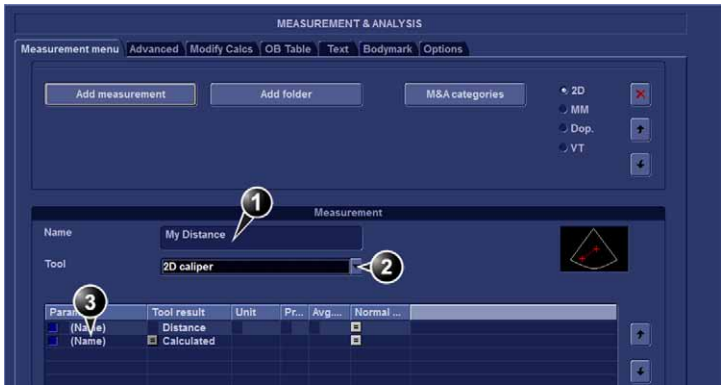
   The *Add measure* window is displayed.

Figure 7-39. The Add measure window

User-defined measurements (continued)

5. Check **Blank** and press **OK**.

   The *Measurement menu* sheet is updated.



1. Enter a name for the measurement.
2. Select the appropriate measurement tool.
3. Double click and enter the formula name.

Figure 7-40. The Measurement menu sheet

6. In the *Measurement menu* sheet, enter the name for the measurement (e.g. My Distance).
7. Select the appropriate measurement tool in the drop-down menu, next to **Tool** (e.g. 2D Caliper).
8. Double-click **(Name)** in the appropriate parameter (e.g Distance) and enter a name for the parameter (e.g. My Length).

   If desired change the unit and the number of decimals for the measurement by double clicking the values under *Unit* and *Precision* (see also ‘About units’ on *page 7-66*).

About units

Be aware of the following:

- All formulas are calculated in SI units (see table below).
- If no unit is specified in the *Edit formula* window when defining a formula, the displayed value will be in SI unit.

To define a different unit

1. When creating a formula, enter the unit to use when displaying the formula output. E.g. if Y in the formula Y=f(x) is to be displayed in cm, enter cm in the *Unit* field (see Figure 7-37 *on page 7-64*).

   The *Unit* field is case sensitive, make sure to enter the exact unit as shown in the table below (Alternative unit column).

2. The output of a formula must always be in an SI unit (see table below). Conversion to the specified display unit is then done automatically.

   Example: an user wants to add a regression formula for estimating a length **B** from a measured length **A**, both in cm.

   The formula is: B = 2.4 + 1.1*A.

   - As **A** is a measurement value the system will enter the formula in the SI unit for length (m). The formula expects A in cm, and to get that, **A** must be multiplied by 100:

     B = 2.4 + 1.1*A***100**

   - The formula now gives **B** in cm. Converting the output from cm to the SI unit (m), is done by dividing by 100:

     B = (2.4 + 1.1*A*100)**/100**

   The output is now in m, and by entering this formula into the system the user gets the expected result. Measuring an **A** of 2 cm gives: B = (2.4 + 1.1*0.02*100)/100 = 0.046 m.

   Before display of the value it is converted according to the specified display unit (cm), and the system displays 4.6 cm. If the selected display unit was set to mm the formula would give the exact same output, 0.046 m, but the automatic unit conversion would now instead give a displayed value of 46 mm.

To define a different unit (continued)

Calculation	SI	Alternative unit
Time	s	ms - msec - min - h
Ratio	%	
Frequency	bpm	
Angle	rad	deg - grad
Distance	m	cm - dm - cm - mm - inch - feet- pixels
Velocity	m/s	dm/s - cm/s - mm/s - inch/s
Acceleration	m/s^2	dm/s2 - cm/s2 - mm/s2 - inch/s2
Area	m^2	dm2 - cm2 - cm^2 - mm2 - inch2
Volume	m^3	dm3 - cm3 - l - dl - cl - ml - gallon - quart
Volume flow	m^3/s	dm3/s - cm3/s - l/s dl/s - cl/s - ml/s - m3/min dm3/min - cm3/min - l/min - L/min - dl/min cl/min - ml/min - ml/m2
Pressure	mm Hg*	Pa - kPa - bar - torr - atm - psi
Pressure/time	mm Hg/s	mmHg/s
Mass	kg	g - ounce - pound
Other		mmHG - Date - WeekDay - Day - NoUnit l/minm2 - g/m2 - cm/m2

* The correct SI unit for pressure is Pa, but here mm Hg was used as base unit as it is a standard pressure unit to use in medicine.

Advanced settings

The Advanced sheet

The *Advanced* sheet enables further configuration of the Measurement function. The settings are divided into application specific parameters and global parameters.

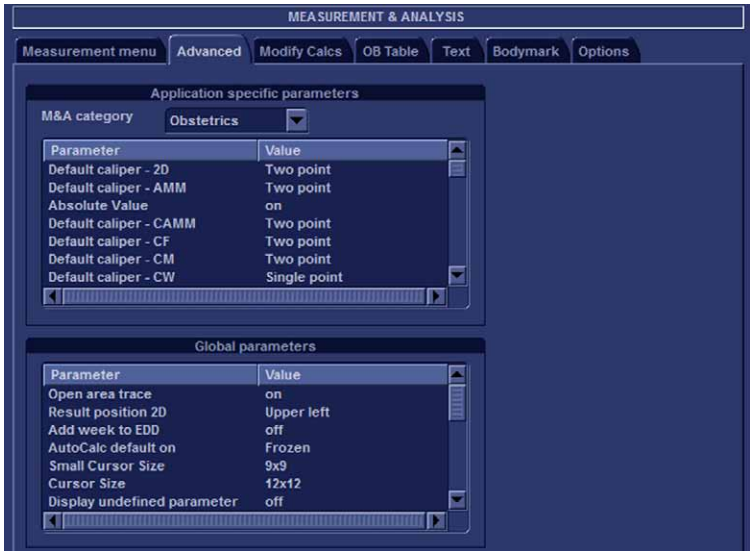


Figure 7-41. The Advanced sheet

1. If configuring application specific parameters, select an application from the *M&A category* pull-down menu.
2. Select the configuration value next to the parameter to configure.

   A pull-down menu is displayed.
3. Select a new value from the pull-down menu.

The Modify calculations sheet

The *Modify calculation* sheet is used to configure the calculations to be performed when doing a Doppler vascular measurements.

Figure 7-42. The Modify calculations sheet

The following example describes how to configure the Carotid Doppler calculations.

1. In the *Modify calculations* sheet, select **Vascular** next to *M&A Categories*.

   The *Vascular measurement category* is displayed.
2. Select **Carotid**.

   The available calculations are displayed.
3. Check the desired calculations to be performed.
4. Select **Save**.

The OB table sheet

The OB table sheet enables the creation and edition of user-defined OB tables.

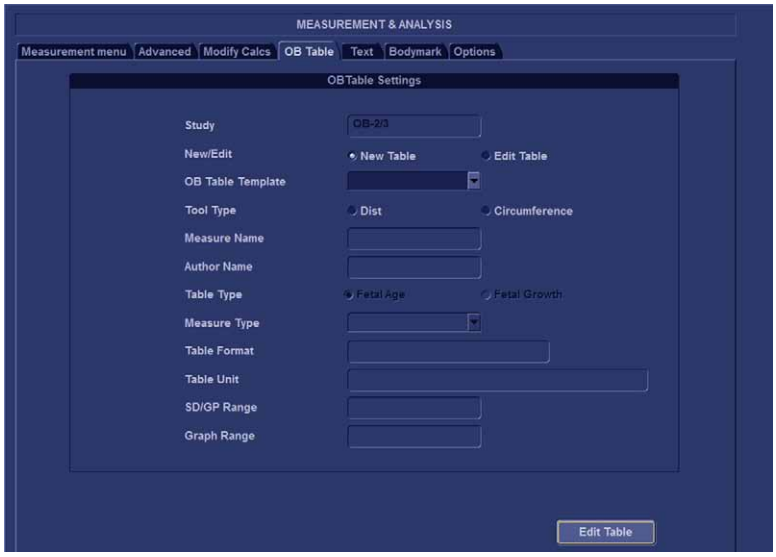


Figure 7-43. The OB table sheet

The following example describes how to create a fetal age OB-2/3 table based on Bi Parietal Diameter measurements.

1. In the *Measure/Text category*, select the **Measurement menu**.
2. In the *Measurement menu* sheet, select **2D** mode.
3. Select the **OB Table** sheet.
4. In the *Measurement* menu, select the category **Obstetrics** and the **OB-2/3** measurement study.
5. In the *OB table* sheet, check **New Table**.

The OB table sheet (continued)

6. Enter or select the following:
   - **OB Table Template**: when creating a new OB table, select Template (1 - 7) which you want to use as the basis of the user programmable OB Table (see page 7-73).

     When editing an existing user OB table, select the desired OB table to edit.
   - **Tool Type**: Select the type of measurement (e.g. Distance)
   - **Measure Name**: type the name of measurement that will display in the *Measurement* menu (e.g. My BPD Measure).
   - **Author Name**: Type the author's name (e.g. My Name).
   - **Table Type**: If necessary, select the table type (e.g. Fetal Age).
   - **Measure Type**: select the desired measurement (e.g. BPD).
7. Select **Edit Table**.

   The OB Table spreadsheet is displayed, showing the table template selected.
8. Enter the Min, Max and Interval values in the *Parameters* field.

   The system automatically fills in the *MEAS column*.
9. Enter the input values for the *MEAN* and *SD columns*.
10. Select **Exit to Save**.

The OB table templates

Template 1 (based on Hadlock)				
Fetal age	format:	MEAS	MEAN	SD
	Unit:	mm	week	week
	Table range:	1 SD		
	Graph range:	1 SD		
Measurement result	Value:	[cm]		
	GA:	[#w#d]		
	Min:	[#w#d]		
	Max:	[#w#d]		
Fetal growth	Format:	AGE	MEAN	SD
	Unit:	week	mm	week
	Others are same as above			

Template 2 (based on Tokyo)				
Fetal age	Format:	MEAS	MEAN	SD
	Unit:	mm	day	day
	Table range:	1 SD		
	Graph range:	1 SD		
Measurement result	Value:	[cm]		
	GA:	[#w#d]		
	SD:	[day (+/-)]		
Fetal growth	Format:	AGE	MEAN	SD
	Unit:	day	mm	day
	Others are same as above			

The OB table templates (continued)

Template 3 (based on Osaka)				
Fetal age	Format:	MEAS	MEAN	SD
	Unit:	mm	day	mm
	Table range:	1 SD		
	Graph range:	1 SD		
Measurement result	Value:	[cm]		
	GA:	[#w#d]		
	SD:	[(mv-pv)/sd]		
Fetal growth	Format:	AGE	MEAN	SD
	Unit:	day	mm	day
	Others are same as above			

Template 4 (based on several European tables)				
Fetal age	Format:	MEAS	MEAN	SD
	Unit:	mm	weekday	mm
	Table range:	5%–95%		
	Graph range:	5%–95%		
Measurement result	Value:	[cm]		
	GA:	[#w#d]		
	GP:	[%] Calculated by Fetal growth table. If Fetal growth table is not edited, GP is not calculated.		
Fetal growth	Format:	AGE	MEAN	SD
	Unit:	weekday	mm	day
	Others are same as above			

The OB table templates (continued)

Template 5 (based on several European tables)				
Fetal age	Format:	MEAS	MEAN	SD
	Unit:	mm	weekday	mm
	Table range:	1 SD		
	Graph range:	5%–95%		
Measurement result	Value:	[cm]		
	GA:	[#w#d]		
	GP:	[%] Calculated by Fetal growth table. If Fetal growth table is not edited, GP is not calculated.		
Fetal growth	Format:	AGE	MEAN	SD
	Unit:	weekday	mm	day
	Others are same as above			

Template 6 (based on several European tables)					
Fetal age	Format:	MEAS	MIN	MEAN	SD
	Unit:	mm	weekday	weekday	weekday
	Table range:	10%–90%			
	Graph range:	10%–90%			
Measurement result	Value:	[cm]			
	GA:	[#w#d]			
	GP:	[%] Calculated by Fetal growth table. If Fetal growth table is not edited, GP is not calculated.			
Fetal growth	Format:	AGE	MIN	MEAN	SD
	Unit:	weekday	mm	mm	mm
	Others are same as above				

The OB table templates (continued)

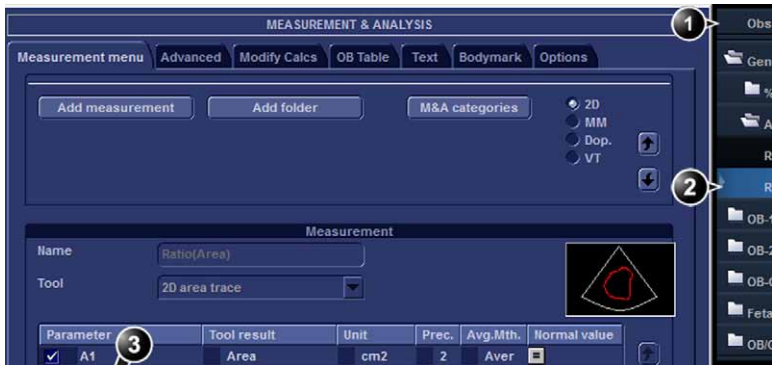
Template 7 (based on several European tables)				
Fetal age	Format:	MEAS	MEAN	SD
	Unit:	mm	weekday	mm
	Table range:	1 SD		
	Graph range:	10%–90%		
Measurement result	Value:	[cm]		
	GA:	[#w#d]		
	GP:	[%] Calculated by Fetal growth table. If Fetal growth table is not edited, GP is not calculated.		
Fetal growth	Format:	AGE	MEAN	SD
	Unit:	weekday	mm	mm
	Others are same as above			

Normal values

Normal values can be defined by the user for all parameters. A Normal value can be either a range or a threshold. Normal values entered are grouped by measurement category (e.g. Cardiac, Pediatrics...etc).

Normal values are displayed in the report if the report template used is configured to display normal values (see page 10-35).

To define a Normal value



1. Measurement category
2. Selected measurement
3. Parameters
4. Press to define Normal value

Figure 7-44. Adding Normal value

1. Press **Utility**/**Config** on the Touch panel and select the Config category **Meas/Text**.

   The *Measurement menu* sheet is displayed (Figure 7-44).
2. In the *Measurement* menu, browse to the measurement of interest.

   The parameters for the selected measurements are displayed in the *Measurement menu* sheet.

*NOTE: To change Measurement category, press the **Heading** in the Measurement menu and select another Measurement category.*

To define a Normal value (continued)

3. Select = in the *Normal value column*.
   The *Normal value* window is displayed.

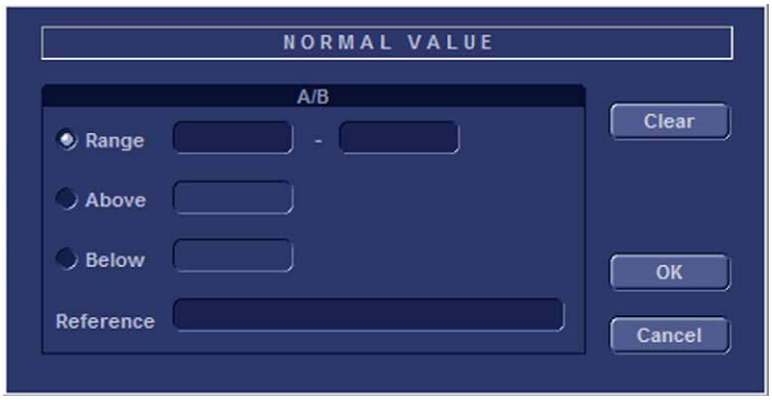


Figure 7-45. The Normal value window

4. In the *Normal value* window:
   - Select the Normal value type (Range, Above or Below).
   - Type in the Normal value.
   - Optionally enter a reference for the Normal value.
5. Select **OK**.

   The Normal value is displayed in the *Measurement menu* sheet.

To display Normal values and references in the Report, the Report template must be configured to show Normal values (see ‘Normal values’ on *page 7-76*). Measurements outside the Normal value are highlighted with an “!” in the report.

Measurement result table

The display of the *Measurement result* table can be minimized and moved to prevent the table obscuring parts of the ultrasound image.

Minimizing the Measurement result table

1. Select  on the heading of the *Measurement result* table.
   The *Measurement result* table is minimized to the heading bar.
   Repeat step 1 to maximize the *Measurement result* table.

Moving the Measurement result table

1. Select  on the heading of the *Measurement result* table.
2. Move the table with the trackball.
3. Press **Set** to anchor the table.

*NOTE: Alternative: adjust **Move Result Win** from the Touch panel to move the Measurement result table around the screen.*

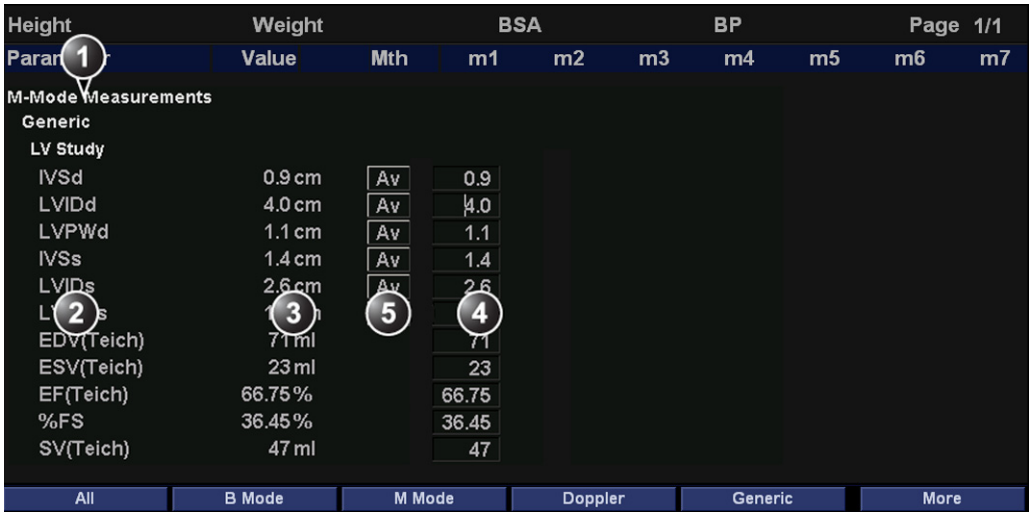
Deleting measurements

1. Select the measurement to delete in the *Measurement result* table.
2. Select **Delete measurement** in the context menu.

Worksheet

The worksheet function enables the user to review, edit, delete or print data independently of a report. All measurements and calculations taken during the examination can be viewed at any time using the worksheet.

Overview



1. Measurement type
2. Measurement parameter
3. Value calculated according to the value type selected.
4. Measured / calculated values
5. Value type: Averaging, Max, Min or Last

Figure 7-46. Worksheet screen

Using the Worksheet

1. Press **Worksheet** on the Control panel.
2. Select the Measurement type.
3. To browse through the measurements, select **Page Up** or **Page Down** or adjust **Page Change**.

To select a type of value

1. Select the relevant cell in the *Method* column.

   A pop-up menu is displayed showing the different options available.

1. Average of the measurements taken
2. Maximum measurement
3. Minimum measurement
4. Last measurement that was taken

Figure 7-47. Value options

2. Select the required option.

   The value is updated accordingly.

To exclude or include measurements

One or more measurement values from a set of measurements for a parameter can be excluded when doing average calculation.

1. Place the cursor over the measurement to exclude.
2. Press **Update/Menu**.
3. Select **Exclude Value**/**Include Value** from the context menu.

To delete measurements

1. Place the cursor over the measurement to delete.
2. Press **Update/Menu**.
3. Select:
   - **Delete Value** to delete the current value
   - **Delete Set** to delete the current set of values
   - **Delete All** to delete all values from the Worksheet.

To change a measurement value

1. Select the measurement to change.
2. Enter a new value.

NOTE: Changed measurements are marked with an asterisk (*).

Chapter 8

Quantitative Analysis

This chapter describes:

Introduction

NOTE: Quantitative Analysis is an option for Vivid T8.

NOTE: Quantitative Analysis is not available for Vivid T8 Pro.

The quantitative analysis (Q Analysis) software package is designed for analysis of TVI related (Tissue Tracking, Strain, Strain rate, TSI) and Contrast related raw data. Q Analysis is primarily intended for adult cardiac images.

The main features of these options are:

- Multiple Time-mode specific trace display from selected points in the myocardium.
- Arbitrary Curved anatomical M-Mode

Q Analysis overview

Starting Q Analysis

Starting Q Analysis in replay mode

1. Open an examination and select a TVI.
2. Press **Q Analysis**.

   The *Quantitative Analysis* screen is displayed (see Figure 8-1).

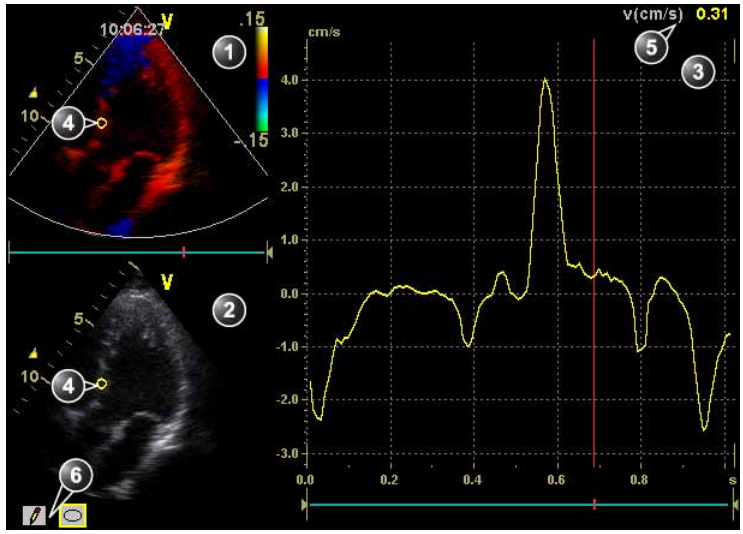
Starting Q Analysis in live

1. Press **Freeze**.
2. Press **Q Analysis**.

   The *Quantitative Analysis* screen is displayed (see Figure 8-1).

Q Analysis screen

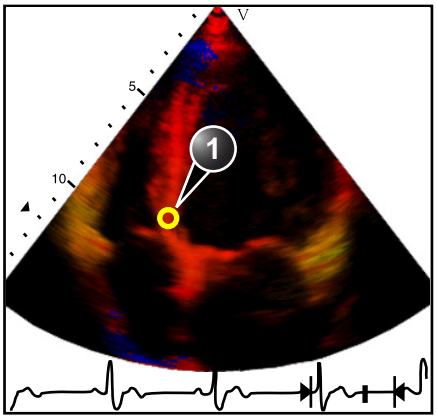
Overview



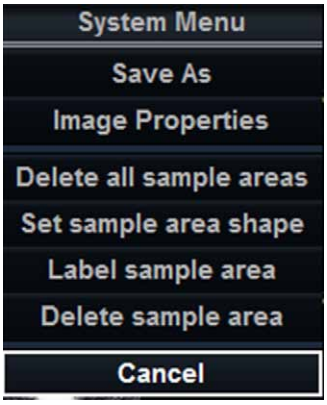
1. Color cineloop window
2. Tissue cineloop window
3. Analysis window
4. Sample area
5. Time and velocity at cursor position
6. Sample area tools

Figure 8-1. Quantitative analysis window (here with TVI data)

The Color cineloop window



Displays TVI, Tissue Tracking, Strain, Strain rate or color-coded data.
Sample area (1):
Indicates sampling position of the velocity (TVI), displacement (Tissue Tracking), percent deformation (Strain), deformation rate (Strain rate) or intensity (Contrast) trace. The sample area is color-coded: the first sample area is yellow, the second blue...etc.

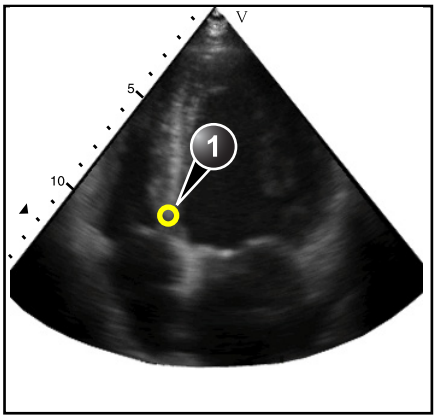


[a] Shown only when a sample area is selected (pointed at).
[c] Shown only when pointing at an anchored sample area.

The cineloop windows system menu
This menu is displayed by pressing **Update menu** when the cursor is in one of the *Cineloop* windows.

- **Delete all Sample areas**: removes all traces at once.
- **Set Sample area Shape**[a]: enables resizing of a selected sample area by setting height, width and tilt angle. The trackball marker must be pointed at an anchored sample area.
- **Label Sample area...**[a]: set a descriptive name to the sample area. The label is useful for identification of the sample area when exporting data.
- **Delete Sample area**[c]: delete the selected sample area.
- **Delete anchor**[c]: remove anchoring from a dynamic sample area (see also page 8-10 and page 8-12).
- **Cancel**: exits the *System* menu.

The Tissue cineloop window

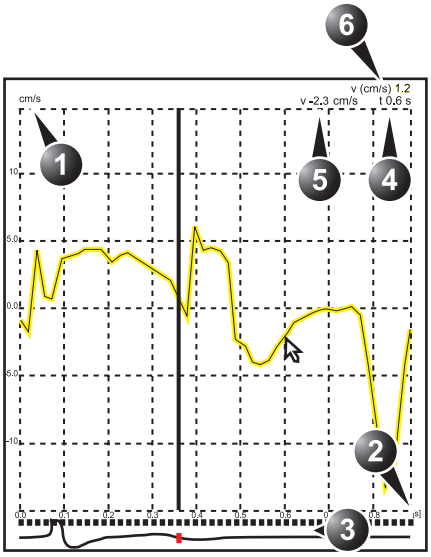


Displays 2D data
Sample area (1):
Indicates sampling position of the velocity (TVI), displacement (Tissue Tracking), percent deformation (Strain), deformation rate (Strain rate) or intensity (Contrast) trace. The sample area is color-coded: the first sample area is yellow, the second blue...etc.

Sample area tools:

-  : creates a sample area based on freehand drawing.
-  : creates a sample area with a pre-defined circular/ elliptic shape (configurable, see page 8-15)

The analysis window

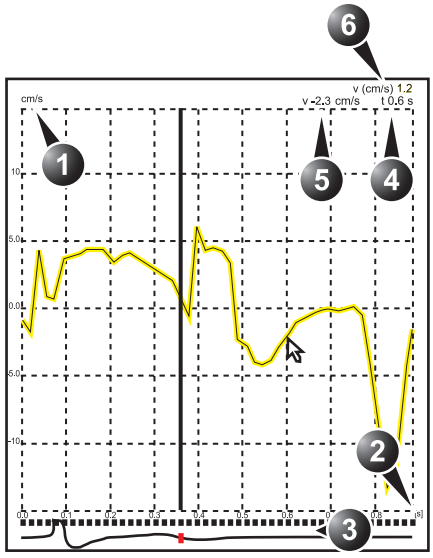


TVI:
Displays velocity trace
1. Y axis: velocity scale (cm/s)
2. X axis: Time (s)
3. ECG
4. Time at cursor position
5. Velocity at cursor position
6. Velocity at frame marker position (color coded)

Tissue Tracking:
Displays tissue displacement trace
1. Y axis: displacement scale (mm)
2. X axis: time (s)
3. ECG with Tracking start and Tracking end markers
4. Time at cursor position
5. Displacement at cursor position
6. Displacement at frame marker position (color coded)

Strain rate:
Displays Strain rate trace (rate of deformation (s^{-1}))
1. Y axis: s^{-1}
2. X axis: time (s)
3. ECG
4. Time at cursor position
5. Strain rate at cursor position
6. Strain rate at frame marker position

The analysis window (continued)

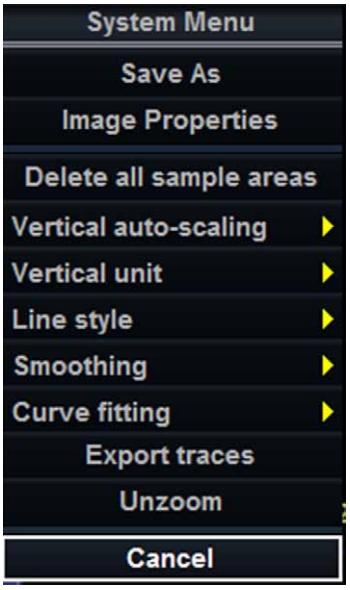


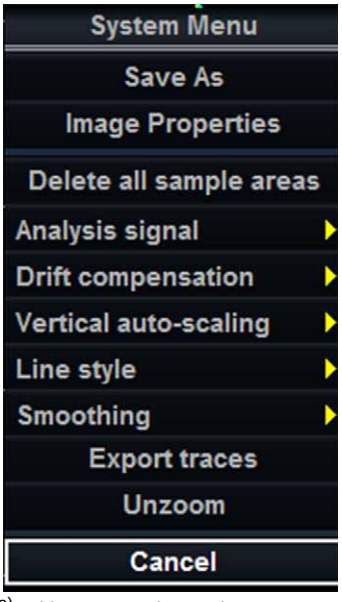
Strain:

Displays Strain trace (extent of tissue deformation (%))

1. Y axis: percent displacement
2. X axis: time (s)
3. ECG with Strain start and Strain end markers
4. Time at cursor position
5. % deformation at cursor position
6. % deformation at frame marker position (color coded)

The analysis window (continued)





a) With contrast data only.

b) Shown only in zoom mode.

The analysis window *System* menu:
This menu is displayed by pressing **Update menu** when the cursor is in the Analysis window.

- **Delete all Sample areas**: removes all traces at once.
- **Analysis signal**: toggles trace display between velocity, displacement, strain rate, stain or grayscale intensity curves.
- **Drift compensation**: compensates drifting of strain or Tissue Tracking curves by either resetting the curve to zero at the tracking start point (cycle resetting) or by linear compensation throughout the cycle (linear compensation)
- **Vertical auto-scaling**: selects between full unit range or a range according to the maximum and minimum values of the displayed trace(s).
- **Line style**: selects between solid line only or solid line with square markers at each data point.
- **Smoothing**: smooths the trace displayed by applying a filter over a defined time window. Both the filter type and time window are user-selectable. The type of filter available is depending on the analysis signal displayed.
- **Export traces**: saves trace data in ASCII format, readable in spreadsheet programs. If present, trace data for physiological traces are also exported.
- **Curve fitting**[a]: toggles between Wash-in, Wash-out and off.
- **Unzoom**[b]: restores full analysis window display when in zoom mode.
- **Cancel**: exits the *System* menu.

The Trackball assignments

	**QA:** Pointing tool in Quantitative analysis mode. **Scroll/Speed:** • When the cineloop is stopped, enables scrolling through the cineloop. • When the cineloop is running, enables control of the cine replay speed. Press the **Trackball** key to toggle the trackball assignment between **QA** and **Scroll/Speed**.

Using Q Analysis

Generation of a trace

Up to eight traces can be generated.

About the sample area

The sample area can be in three different states:

- **Free sample area**: freely moving sample area (QA cursor) before anchoring.

NOTE: The free sample area disappears when the QA cursor is moved over a static anchored frame.

- **Static sample area**: the free sample area is anchored by pressing **Set**.
- **Dynamic anchored sample area**: the sample area is anchored in two or more frames (see Manual tracking below). In these particular frames, the sample area is displayed with an anchor. The sample area moves smoothly between the anchored positions when playing/scrolling the cineloop.

To generate a trace

Trace from a pre-defined sample area

The shape of the pre-defined sample area is configurable (see page 8-15).

1. If the Trackball assignment is not on QA, press **Trackball** until **QA** is highlighted.
2. If necessary, select the sample area **Shape button**  .
3. Place the cursor in one of the *Cineloop* windows.

   The cursor is changed to a sample area (white circle).

   A preview of the trace is displayed in the *Analysis* window.
4. Press **Set** to anchor the sample area.

   In this frame the sample area is marked with an anchor.

   If the cineloop has more than one heart cycle a sample area will also be anchored in the corresponding frame in the next heart cycles.

   The trace is updated accordingly in the *Analysis* window.

NOTE: The trace and sample area are color-coded. First generated trace is yellow, second blue...etc.

The Strain cursor

In Strain and Strain rate modes, the sample area displays a Strain cursor showing the segment along the beam direction that is used for Strain and Strain rate calculations. Make sure that the Strain cursor is within the myocardium when anchoring the sample area.

Trace from a freehand sample area

1. Select the **Pencil button**  .
2. Place the cursor in one of the *Cineloop* windows.

   The cursor is changed to a cross.
3. Press and hold down **Set** while drawing a sample area with the trackball.
4. Release **Set**.

   The sample area is automatically closed.

   The trace is updated accordingly in the *Analysis* window.

Manual tracking of the sample area (dynamic anchored sample area)

The sample area can be moved within the loop to ensure that data in the trace is generated from the same anatomical location during the cyclic motion of the heart.

1. Freeze the image and place a sample area over a region of interest.

   Note the anatomical location of the sample area.
2. Scroll to a new frame.
3. Press **Trackball** until the **QA** trackball assignment is selected.
4. Place the cursor on the sample area.
5. Press **Set**.

   The sample area is unanchored.
6. Drag the sample area to the corresponding anatomical location in the new frame.

   When the sample area is anchored in more than one frame, linear interpolation is performed, so that the sample area is smoothly moved between the anchored positions in the selected frames when running the cineloop.

NOTE: *In the original frame and this particular frame the sample area is marked with an anchor.*

7. Press **Trackball** until the **Scroll** trackball assignment is selected.
8. Scroll through the cineloop and control that the sample area follows the moving anatomical structure.
9. Add anchored sample areas in several frames to obtain a more accurate displacement of the sample area.

To move a dynamic anchored sample area

1. Freeze the image.
2. Press **Trackball** until the **Scroll** trackball assignment is selected.
3. Scroll through the cineloop to display one of the frames where the sample area was anchored.

NOTE: In these frames the sample area is marked with an anchor.

4. Press **Trackball** until the **QA** trackball assignment is selected.
5. Place the cursor on the sample area to move, in one of the *Cineloop* windows.
6. Press **Set**.

   The sample area is unanchored.
7. Drag the sample area to a new location.
8. Press **Set** to anchor the sample area to the new location.

Zooming in the Analysis window

1. In the *Analysis* window, press and hold down the **Set** key while dragging the trackball cursor to define the zooming area.
2. Release the **Set** key.

   The selected area is displayed in the *Analysis* window.

To unzoom

1. In the *Analysis* window, press **Update menu**.

   The *System* menu is displayed.
2. Select **Unzoom**.

Deletion of a trace

The user can delete all traces at once or one at a time.

To delete all traces

1. If necessary, press **Trackball** until the **QA** trackball assignment is selected.
2. With the cursor in one of the *Cineloop* windows, press **Update menu**.

   The *System* menu is displayed.
3. Select **Delete all sample areas**.

To delete one specific trace

1. If necessary, press **Trackball** until the **QA** trackball assignment is selected.
2. Place the cursor on the sample area to delete.
3. Press **Update menu**.

   The *System* menu is displayed.
4. Select **Delete sample area**.

Saving/retrieving Q Analysis

1. Press **Store** to save the quantitative analysis session.
2. To recall the Quantitative analysis session, select the icon on the clipboard, and press **Q Analysis**.

Optimization

Optimizing the sample area

The sample area can be reshaped and labelled.

Reshaping a sample area

1. If necessary, press **Trackball** until the **QA** trackball assignment is selected.
2. Place the cursor on the sample area to reshape.
3. Press **Update menu**.

   The *System* menu is displayed.
4. Select **Set Sample area shape**.

   A *Dialogue* window is displayed where the user can adjust the height, the width and the angle of the sample area (see Figure 8-2).

Figure 8-2. The sample area reshaping window

5. Drag the sliders to adjust the shape of the sample area as desired.
6. Press **OK** to return to the *Quantitative analysis* window and use the settings for the current analysis only.

   OR

   Press **Set as default** to return to the *Quantitative analysis* screen and keep the settings as default.

Labelling a sample area

The sample area label is used to identify data associated to the sample area when exporting to a spreadsheet program.

1. If necessary, press **Trackball** until the **QA** trackball assignment is selected.
2. Place the cursor on the sample area to label.
3. Press **Update menu**.

   The *System* menu is displayed.
4. Select **Label Sample area...**.

   A *Dialogue* window with a free text field is displayed (see Figure 8-3).
5. Type a name for the sample area.
6. Press **OK** to return to the *Quantitative analysis* screen.

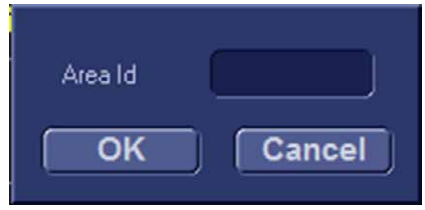


Figure 8-3. The sample area labelling window

Trace display

Y-axis

Auto-scaling

The system can be configured to display the full unit range or a range according to the maximum and minimum values of the displayed trace(s) (auto-scaling function). In addition, the auto-scaling function can be set to be live update (updates while the sample area is moved) or delayed (updated when the sample area is anchored).

1. If necessary, press **Trackball** until the **QA** trackball assignment is selected.
2. With the cursor in the *Analysis* window, press **Update menu**.

   The *System* menu is displayed.
3. Select **Vertical auto-scaling**.

   The *Vertical auto-scaling* menu is displayed.

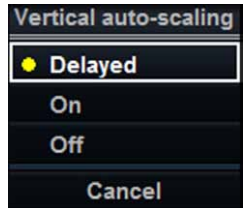


Figure 8-4. The Vertical Auto-scaling menu

4. Select the desired option:
   - **Delayed**: auto-scaling takes place after anchoring the sample area.
   - **On**: auto-scaling while moving the sample area.
   - **Off**: displays full scale.

Vertical units

When analyzing contrast data, the Y-axis can be set to display either logarithmic scale (dB) or linear, acoustical units (AU) for both tissue intensity (2D) or Angio intensity data.

1. If necessary, press **Trackball** until the **QA** trackball assignment is selected.
2. With the cursor in the *Analysis* window, press **Update menu**.

   The *System* menu is displayed.
3. Select **Vertical unit**.

   The *Vertical unit* menu is displayed.

Figure 8-5. The Vertical unit menu

4. Select the desired option.

Trace smoothing

The system can smooth the traces displayed by applying a filter over a defined time window. The type of filter available is depending on the analysis signal displayed.

1. If necessary, press **Trackball** until the **QA** trackball assignment is selected.
2. With the cursor in the *Analysis* window, press **Update menu**.

   The *System* menu is displayed.
3. Select **Smoothing**.

   The *Smoothing* menu is displayed.
4. Select a smoothing filter.

   The trace display is updated.

Cine compound

Cine compound calculates and displays cineloops generated from a temporal averaging of multiple consecutive heart cycles. The number of averaged cycles is displayed on the top left corner.

To apply cine compound:

1. Adjust **Cine compound** to set the number of heart cycles to average.

   The traces are updated showing averaged data. The number of heart cycles averaged is displayed on the top left corner.
2. Press **CC Zoom** to display the last recorded heart cycle.
3. Press **CC Zoom** again to unzoom.

Switching modes or traces

The user can toggle between TVI, Tissue Tracking, Strain rate or Strain modes to access to the mode specific controls or display alternative traces from within a selected mode.

To switch mode

1. Go to **Page 2** on the Touch panel.
2. Select the desired mode (TVI, Tissue Tracking, Strain rate, Strain or TSI).

To switch trace

1. If necessary, press **Trackball** until the **QA** trackball assignment is selected.
2. Place the cursor on the *Analysis* window.
3. Press **Update menu**.

   The *System* menu is displayed.
4. Select **Analysis signal**.

   The *Analysis signal* menu is displayed.

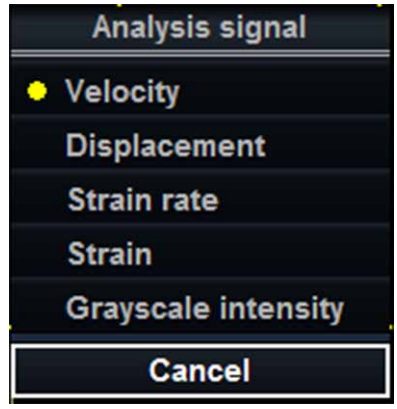


Figure 8-6. The Analysis signal menu

5. Select the desired trace.

   The *Analysis* window is updated with the selected trace.

Anatomical M-Mode

Introduction

M-Mode applied to TVI, Tissue Tracking, Strain rate, Strain or intensity data (Contrast) calculates and color/codes data accordingly along a path drawn by the operator.

Using Anatomical M-Mode

1. Press **Curved AMM**.
2. In one of the *Cineloop* windows, place the first point of the path.
3. Move the cursor to the location for the next anchoring point of the path and press **Set**.

   A path with two anchor points will give a straight anatomical M-Mode profile. By creating more than two anchor points, the user can bend the path and obtain a curved anatomical M-Mode profile.

NOTE: *To edit a path under construction, move the cursor backward and retrace the path.*

4. To end the trace press **Set** twice (double clicking).

   The color-coded display of the corresponding data calculated along the path is shown in the *Analysis* window.

NOTE: *Rotate **Horiz. Sweep** and scroll through the cineloop to optimize the display to the portion of interest.*

Optimizing Anatomical M-Mode

Edition of the curve

The drawn Anatomical M-Mode path can be edited by moving the anchor points.

To move an anchor point

1. Select the anchor point to move.
2. Move the anchor point to a new position.
3. Press **Set** to anchor the point to its new location.

Chapter 9

Archiving

This chapter describes:

Introduction

During an examination, the operator stores data, images and cineloops for immediate purposes. The Vivid T8/Vivid T8 Pro ultrasound unit includes an integrated patient archiving system for data and image storage.

The Vivid T8/Vivid T8 Pro ultrasound unit enables also storing of data and images to external databases (Network Server, removable media).

The dataflow concept

Communication between the Vivid T8/Vivid T8 Pro ultrasound unit and other information providers on the network takes the form of dataflows. Each dataflow defines the transfer of patient information and images from an input source to the unit, and from the unit to one or several output sources.

A dataflow is a set of pre-configured settings. Selecting a dataflow will automatically customize the unit to work according to the settings associated with this dataflow.

Dataflows available

NOTE: DICOM is an option for Vivid T8 and Vivid T8 Pro.

A set of pre-defined dataflows is available on the unit as listed in the table below.

NOTE: Not all dataflow listed below are visible by default. The list of dataflow available is configurable (see 'Dataflow adjustments' on page 9-79).

Dataflow	Description
LocalArchive-Int.HD	The local database is used for patient archiving. Images are stored to internal harddrive. The stored image files will consist of raw data only, together with a single-frame DICOM preview image (no DICOM multi-frame is stored).
LocalArchive - Int HD/DICOM Server	The local archive is used for patient archiving. Images are stored to the internal hard drive and to a DICOM server. Some of the measurements are stored if DICOM SR is turned on (see page 9-43).
RemoteArch-RemoteHD	A remote database (either on EchoPAC PC workstation or a server) is used for patient archiving. Images are stored to a network image volume (either internal HD on EchoPAC PC workstation or a server).

Dataflow	Description
Remote Archive - Remote HD/DICOM Server	A remote database is used for patient archiving. Images are stored to a network image volume and to a DICOM server. Some of the measurements are stored if DICOM SR is turned on (see page 9-43).
Worklist/LocalArchive-DICOMServer/Int.HD	Search in the DICOM Modality Worklist, the patient found is copied into local database. The patient information and the examination results are stored to the local the database. Images are stored to a DICOM Server and to an image volume on the local harddrive. Some of the measurements are stored if DICOM SR is turned on (see page 9-43).
Worklist/RemoteArchive-DICOMServer/RemoteHD	Search in the DICOM Modality Worklist, the patient found is copied into a remote database. The patient information and examination results are stored to a remote database. Images are stored to a DICOM Server and to an image network volume as pure DICOM in both locations. Some of the measurements are stored if DICOM SR is turned on (see page 9-43).
Worklist/Local Archive - LocalHD	Search in the DICOM Modality Worklist, the patient found is copied into the local database. The patient information and examination results are stored to the local database. Images are stored to the local hard disk.
Worklist/Remote Archive - Remote Storage	This dataflow is used in a network environment that includes Vivid HL7 Gateway. The patient list in the *Search/Create Patient* window is coming from Vivid HL7 Gateway through DICOM Modality Worklist. All patient data and images are stored to a server.
DICOM CD/DVD read	Read DICOM Media from the CD/DVD-drive. Read only dataflow, no data can be stored.
DICOM Server	Store pure DICOM images to a DICOM device. Some of the measurements are stored if DICOM SR is turned on (see page 9-43).
Query Retrieve	Retrieve images from a DICOM server
LocalArchive-Int.HD/eVue	The local database is used for patient archiving. Images are stored to internal harddrive and a MPEG exam is created to the configured destination.
RemoteArch-RemoteHD/eVue	A remote database (either on EchoPAC PC workstation or a server) is used for patient archiving. Images are stored to a network image volume (either internal HD on EchoPAC PC workstation or a server) and a MPEG exam is created to the configured destination.

Dataflow	Description
Worklist - DICOM Server	Search in the DICOM Modality Worklist. Images are stored to a DICOM Server. Some of the measurements are stored if DICOM SR is turned on (see page 9-43).
DICOM USB device read	Read DICOM data from an USB device. Read only dataflow, no data can be stored.
No Archive	Enables to perform an examination without storing the data to any archive.

Storing images and cineloops

Images and cineloops that are stored during a current examination are displayed as thumbnails on the clipboard. When an image is stored, all the additional information that is displayed is saved with it (e.i. probe and application selected, image setting, annotations or measurements).

The image archive is set by the dataflow selected (see page 9-3 about available dataflows).

Do not use the internal harddrive for long-term image storage. External storage media or network-based server solution is recommended for image long-term archive.

If working off-line with a dataflow pointing to a DICOM server, the images stored during the examination may have to be manually resent in the DICOM spooler when reconnecting the unit. Resend all jobs that are failed or on hold.

In addition, stored images and cineloops can be saved to a removable media in the standard formats JPEG, MPEG, AVI and DICOM (see page 9-8).

Storing an image

Images are displayed chronologically on the clipboard.

1. While scanning in any mode, press **Freeze**.
2. With the trackball, scroll through the cineloop and select the required image.
3. Press **Store**.

   The image is stored and a thumbnail is displayed on the clipboard. The number “1” in the upper right corner of the image indicates that the image stored is a single frame.

Storing a cineloop

A cineloop is a sequence of images recorded over a certain time frame. The time frame can be adjusted to cover one or more heart cycles. The stored cineloops are displayed chronologically on the clipboard. Cineloops can be stored at any time during the scanning session. The user can choose to preview the cineloop before storage or save the cineloop directly as described below.

Preview and storage of a cineloop

1. While scanning in any mode, press **Freeze**.
2. Select and adjust the cineloop to store using the cineloop controls (see ‘Cineloop’ on *page 3-14*).
3. Press **Pause** to run the cineloop.
4. Press **Store**.

   The cineloop is stored and a thumbnail is displayed on the clipboard.

NOTE: *Cineloop storage can be configured to store heart cycles with additional time before and after the R-wave (see ‘Global imaging settings’ on page 4-47).*

Direct storage of a cineloop

Depending on whether the system has been configured to enable or disable the **Preview Loop before store** function (see ‘Configuration – Imaging’ on *page 4-47*), the following procedures enable the cineloop to be stored directly.

Storing cineloop without preview

The function **Preview Loop before store** is disabled (see page 4-47).

1. While scanning, press **Store**.

   The last valid cineloop is stored in the archive and a thumbnail is displayed on the clipboard.

   Scanning resumes immediately.

Storing cineloop with preview

The function **Preview Loop before store** is enabled (see page 4-47).

1. While scanning, press **Store**.

   The last valid cineloop is previewed on the screen (but not stored).
2. If desired, select and adjust the cineloop to store using the cineloop controls (see ‘Cineloop’ on *page 3-14*).
3. Press **Store** to save the cineloop.

   A thumbnail is displayed on the clipboard.

Saving images and cineloops to a standard format

Images and cineloops can be saved to a removable media or a shared network folder in the following standard formats:

- **Still images**: JPEG, MPEG, DICOM and RawDICOM (Raw data + DICOM)
- **Cineloops**: AVI, MPEG, DICOM and RawDICOM (Raw data + DICOM)

Images can also be stored as MPEG format on a CD-R using the Export function as described on page 9-10.

1. In live: press **Freeze**.

   In replay: select an image thumbnail on the clipboard.
2. Press **Update** on the control panel.

   The *System* menu is displayed.

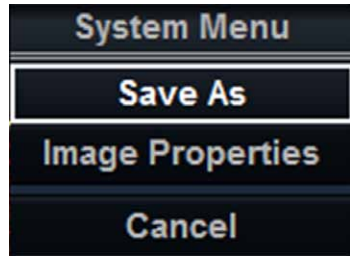


Figure 9-1. The System menu

Saving images and cineloops to a standard format (continued)

3. Select **Save as**.
   The *Save as* menu is displayed.

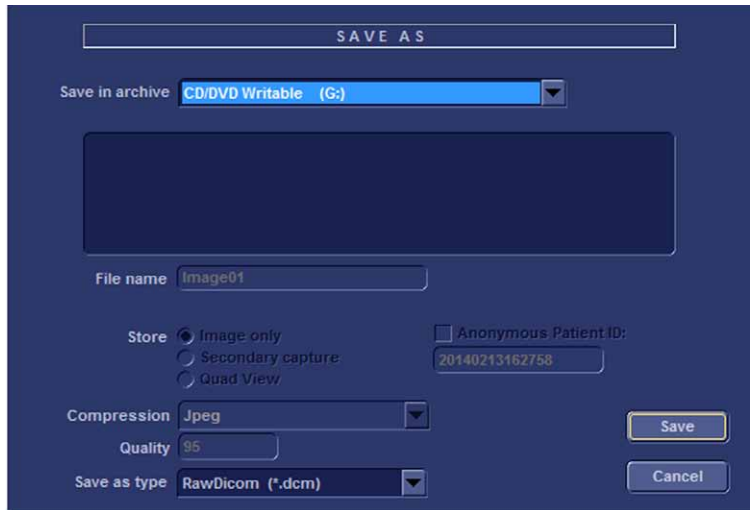


Figure 9-2. The Save as menu

4. Select the desired destination from the *Save in archive* pull-down menu.
5. Enter a file name in the *File name* field.
   If the image or cineloop is saved as DICOM or RawDICOM the file name is automatically generated to follow the DICOM standard.
6. Select between:
   - **Store image only**: saves the active image or cineloop only.
   - **Store secondary capture**: creates a screen capture of the entire screen.
     The secondary capture is not available when saving images as DICOM or RawDICOM.
   - **Quad view**: saves all images or cineloop when in quad view.
     Quad view is not available when storing RawDICOM.

Saving images and cineloops to a standard format (continued)

7. Select the image compression type (JPEG or RIe) or no compression.
8. Enter in the desired **Image quality** (between 10 and 100).

   A high quality setting will give a lower compression.
9. In the *Save as type* field select one of the following formats:
   - **RawDICOM**: saves the still image or cineloop in both GE raw format and DICOM format.
   - **DICOM**: saves the still image or cineloop in pure DICOM format.
   - **JPEG**: saves a still image in JPEG format.
   - **MPEG**: saves the still image or cineloop in MPEG format.
   - **AVI**: saves the cineloop in AVI format.
10. Press **Save**.

    A file is saved in the selected archive.

MPEGVue/eVue

MPEGVue/eVue enables the user to export or save an exam (images, measurements and reports) into MPEG format readable from a regular Windows computer together with a special MPEG viewer. The measurements performed during the exams are stored as an Excel file, the saved report as Compiled HTML format.

MPEG exported exams can be created using the Export function (MPEGVue) or by using the dataflows *Local Archive - Int. HD/eVue* (eVue) or *Remote Archive - Remote HD/eVue*.

The MPEGVue option is used to create MPEG exported exams on finished exams. The eVue option is used to create MPEG exported exams when performing the exam, upon saving the images.

NOTE: MPEGVue/eVue is an option for Vivid T8 and Vivid T8 Pro.

Creating a MPEG exam using the Export function (MPEGVue)

Refer to ‘Export/Import patient records/examinations’ on *page 9-49*.

Creating a MPEGVue exam using a eVue dataflow

The dataflow must be configured before first time use as follow:

1. Press **Utility**/**Config** on the Touch panel and log on as administrator.
2. Select the **Connectivity** category and **Dataflow** subgroup.

   The *Dataflow* sheet is displayed.
3. Select the dataflow **Local Archive - Int. HD/eVue** or **Remote Archive - Remote HD/eVue** in the *Name* pull-down menu.

   Make sure that the option **Hidden** is unchecked.

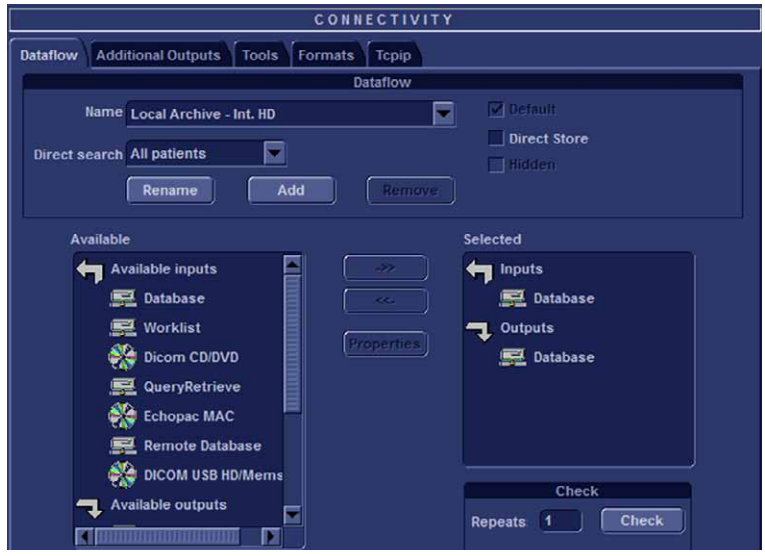


Figure 9-3. The Dataflow sheet

Creating a MPEGVue exam using a eVue dataflow (continued)

4. Select the **eVue** device in the *Selected devices pane* and press **Properties**.

   The *eVue properties* window is displayed.

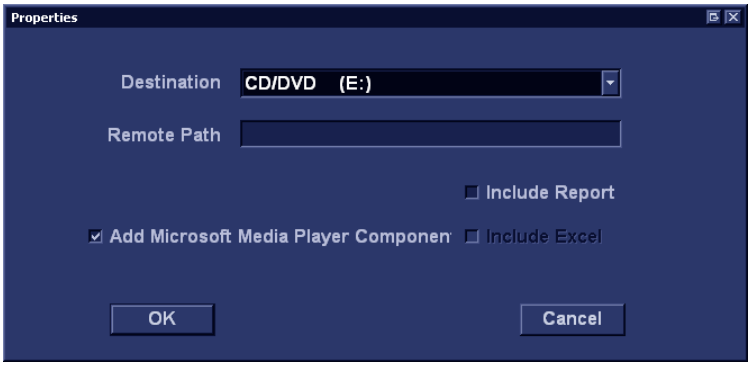


Figure 9-4. The eVue properties window

5. Select a network volume remote path as the destination in the *Destination* Pull-down menu.

NOTE: *Remote paths of network volumes must be entered once in the Remote path field before they can be selected from the Destination Pull-down menu (see 'Remote path setting' on page 9-81).*

6. Check the options as required.
7. Select **OK** and press **Config**.

To create an MPEG exam using an eVue dataflow

1. Press **Patient**.

   The *Search/Create patient* window is displayed.
2. Select the dataflow **Local Archive - Int. HD/eVue** or **Remote Archive - Remote HD/eVue**.
3. Perform an exam.

   When saving an image, it is stored as raw data to the local or remote archive (depending of the dataflow selected) and an MPEG copy is created and stored to the destination set during the configuration of the dataflow.

Reviewing a MPEG exported exam

A MPEG exam can be read from any computer with Windows 98/2000/XP/7, provided that DirectX 8.1 or later and Windows Media Player 7.1 or later are installed.

Retrieving and editing archived information

Searching for a patient record

1. Press **Patient** on the Control panel.

   If required, log on by typing the user ID and password.

   The *Search/Create patient* window is displayed (Figure 9-5).
2. In the *Search/Create patient* window select the desired dataflow.
3. Type the patient **Last Name**, and/or **ID** or another query that identifies a patient.

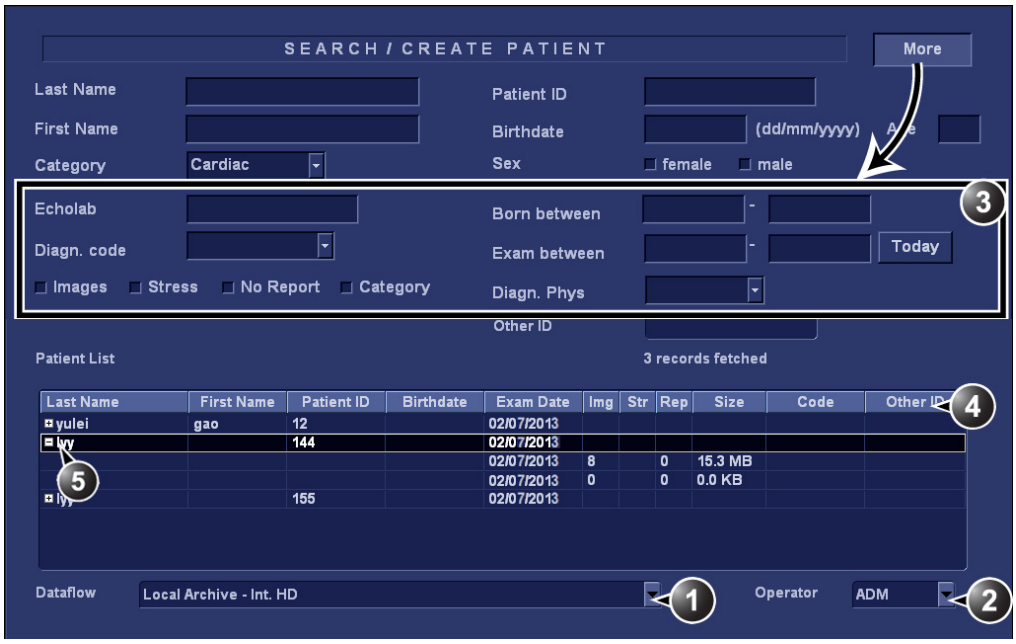
   When default configured, the system automatically searches to see if the patient is already in the archive. The result of this search is displayed in the *Patient list* field.
4. Highlight a patient record in the *Patient list* filed.

*NOTE: You can select **[+]** in front of the actual patient record to display the examinations belonging to the patient record.*

5. Press **Open Exam**.

   The *Examination List* window for the actual patient is displayed (refer to Figure 9-6).

Searching for a patient record (continued)



1. Select archive and other pre-defined services.
2. Change user.
3. Advanced search filters, the system can be configured to display the advanced search filters as default (see ‘Patient management presets’ on *page 9-77*).
4. Press one of the headings to sort the list accordingly (ascending/descending).
5. Expand Patient record to display belonging examinations

The Search/Create patient window may be slightly different depending on the Dataflow selected

Figure 9-5. The Search/Create Patient window

Advanced search

To restrain the search to a specific patient group, one or more filters may be applied to the search. The table below shows the filters applicable to a patient search.

Searching filter
Echolab
Diagnostic code
Born between
Examination date between
Current date
Images: patient records with examinations with images
Stress examinations: patient records with stress echo examinations
No Report: Patient record with examination(s) without stored reports
Category: displays only patient records for the selected category
Diagnosis Physician

NOTE: The list of searching filters may vary depending on the Dataflow selected

1. If not visible, press **More** in the *Search/Create Patient* window to display the advanced search filters.

   The unit can be configured to display the Advanced search options as default (see ‘Patient management presets’ on *page 9-77*)
2. Select the required searching filters.
3. Type the patient **Last Name**, and/or **ID** or another query that identifies a patient.

   The matching data is displayed in the *Patient list* when the automatic search function is turned on.

Printing patient list

1. Press **Print Patients**.

   A patient list with all patients matching the search criteria is printed.

Editing data in the archive

After selecting a patient record the *Examination List* window is displayed showing previous examinations and diagnosis information related to the selected patient.

1. The information displayed in the Patient list is configurable (see page 9-76).
2. Insert pre-defined text.
3. Edit Findings (see page 10-8).

Figure 9-6. The Examination list window

Editing Referral Reasons, Comments and Diagnosis

The user can edit the actual text in the *Examination List* window using the alphanumeric keyboard and by inserting pre-defined text input.

CAUTION

The user is responsible for patient demographic data, diagnostic information or any other patient related information entered in the database.

Editing text

1. In the *Examination list* window (Figure 9-6), place the cursor in the required field.
2. Using the alphanumeric keyboard, edit the information.

Inserting pre-defined text input

1. In the *Examination list* window, press the **Insert Text** button over the field.

   The *Insert text* window is displayed (see Figure 9-7).

   The pre-defined text list is organized in a three level hierarchy. Selecting one item in the first column displays pre-defined text entries related to the selected text in the second and third columns.
2. Navigate through the pre-defined text list by selecting items in the columns and double-click on the desired pre-defined text to be inserted. If an entry in the third column is inserted, the selected text in the second column is also inserted.

   Press **More>>** to display the full text for the selected entry.

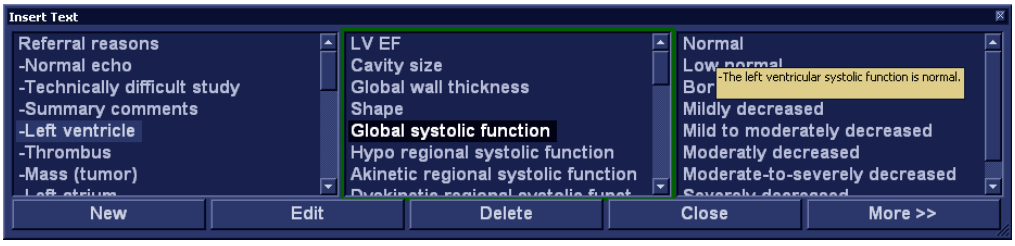


Figure 9-7. The Insert text window

Creating, editing and deleting text input

1. Press **Utility**/**Config** on the Touch panel to access the configuration package.
2. In the Configuration package, select the category **Report** and the Tab sheet **Comment texts**.

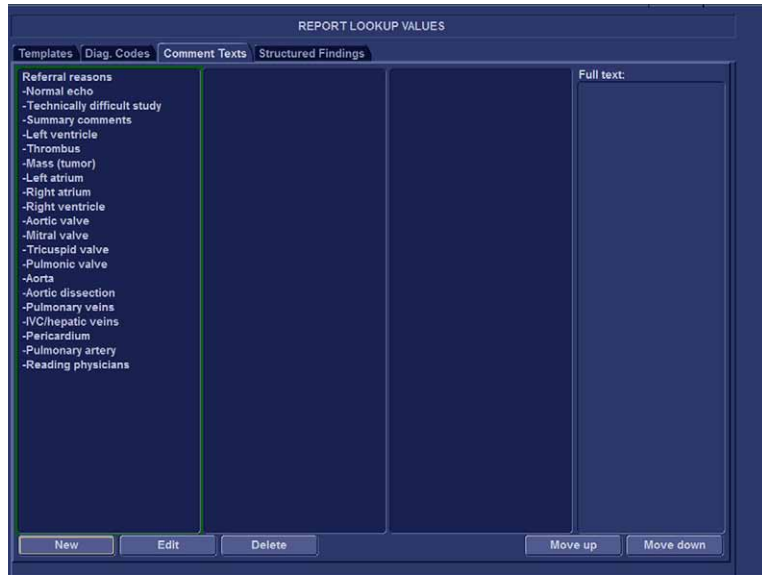


Figure 9-8. The Comment texts sheet

The pre-defined text list is organized in a three level hierarchy. Selecting one item in the first column displays pre-defined text entries related to the selected text in the second and third column.

Creating, editing and deleting text input (continued)

To create a new text input in the first level:

1. Select the first level and press **New**.
   The *Enter new text* window is displayed.

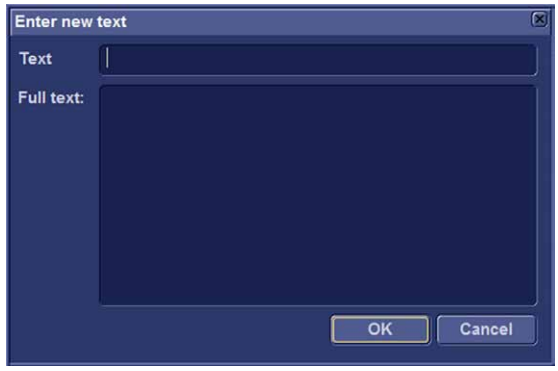


Figure 9-9. The Enter new text window

2. Enter a title in the *Text* field and a pre-defined text in the *Full text* field.
3. Select **OK**.

To create a new text input in the second and third level:

1. Select an item in the first column and press **New**.
   The *Enter new text* window is displayed.
   The pre-defined text input to be created in the second and third column will be related to this selection only.
2. Select the second or third column.
3. Enter a title in the *Text* field and a pre-defined text in the *Full text* field.
4. Press **OK**.

To edit a pre-defined text input:

1. Select the term to edit in one of the columns.
2. Press **Edit**.
   The *Edit text* window is displayed.
3. Edit the text in both the *Text* and *Full text fields*.
4. Press **OK**.

Creating, editing and deleting text input (continued)

To delete a pre-defined text input:

1. Select the item to delete in one of the columns.
2. Press **Delete**.

   A *Confirmation* window is displayed.
3. Press **Yes**.

   The selected text input is deleted including the belonging text inputs in the sub-levels.

Diagnosis code

Adding a Diagnosis code

1. In the *Examination list* window, select **Code** (see Figure 9-6).

   The *Entered Code* window is displayed.
2. Select **Add**.

   The *Code list* window is displayed.
3. Double-click the code to enter.
4. Select **Done** to exit.

   The Code selected is displayed in the *Examination list* window.

1. The Entered code window
2. The Code list window

Figure 9-10. Entering Diagnosis codes

Deleting an entered Diagnosis code

1. In the *Examination list* window, select **Code** (see Figure 9-6).

   The *Entered code* window is displayed.
2. In the *Entered code* window, select the code to delete and press **Delete**.

Creating a Diagnosis code

1. In the *Examination list* window, select **Code** (see Figure 9-6).

   The *Entered code* window is displayed.
2. Select **Add**.

   The *Code list* window is displayed.
3. Select **New**.
4. Enter the new code.
5. Select **Done** to exit.

Diagnostic codes can also be created and deleted from the configuration package:

1. Press **Utility**/**Config** on the Touch panel to access the configuration package.
2. In the Configuration package, select the category **Report** and the Tab sheet **Diag. Codes**.

Figure 9-11. The Diagnostic codes sheet

Creating a Diagnosis code (continued)

To create a diagnostic code:

1. Select **New code**.
2. In the *Code* field, enter a name for the diagnostic code.
3. In the *Full text* field, enter the code text.

To delete a diagnostic code:

1. In the *Code list* field, select the diagnostic code to delete.
2. Select **Delete**.

Editing Demographic details

1. Press **Patient info**.

   The *Patient information* window is displayed.

   The information available in the *Patient information* window is dependent of the examination category (i.e. cardiac, vascular...etc)
2. Using the alphanumeric keyboard, edit the information.

Do NOT use '\' or '^' in patient information fields, as these characters might cause problems with some DICOM devices.

3. Press either:
   - **Exam list** to display the *Examination list* window.
   - **Image list** to display the *Image browser screen*.

Deleting archived information

Only user logged in with full operator rights can delete patient records (see ‘System users’ on *page 3-29* for further information).

To delete a patient record

1. Press **Patient** on the Front panel.

   The *Search/Create Patient* window is displayed (Figure 9-5 *on page 9-15*).
2. Search and highlight the patient record to delete.
3. Press **Delete** in the *Search/Create Patient* window.

   A warning message is displayed asking the user to confirm the action to perform.
4. Select **OK**.

To delete an examination

1. Press **Patient** on the Front panel.

   The *Search/Create Patient* window is displayed (Figure 9-5 *on page 9-15*).
2. Search and highlight the patient record with the examination to delete.
3. Press **Select patient**.

   The *Examination list* window is displayed (Figure 9-6 *on page 9-17*).
4. Highlight the examination to delete.
5. Press **Del Exam** to delete the examination.

   A warning message is displayed asking the user to confirm the action to perform.
6. Select **OK**.

   An information window is displayed to confirm the operation.
7. Select **OK**.

To delete an image

1. Press **Patient** on the Front panel.

   The *Search/Create Patient* window is displayed (Figure 9-5 *on page 9-15*).
2. Search and highlight the patient record with the image to delete.
3. Press **Select patient**.

   The *Examination list* window is displayed (Figure 9-6 *on page 9-17*).
4. Highlight the examination with the image to delete.
5. Press **Review**.

   The images for the selected examination are displayed on the *Review screen* (Figure 9-13 *on page 9-29*).
6. Select the image to delete.
7. Press **Delete**.

   A warning message is displayed asking the user to confirm the action to perform.
8. Select **Yes**.

To delete an image from the clipboard

1. If in live, press **Freeze**.
2. Press **Trackball** until the Pointer tool is selected.
3. Move the pointer over the image to delete in the clipboard.
4. Press **Update menu**.
5. Select **Delete clipboard cell** from the *Update* menu.

   A warning message is displayed asking the user to confirm the action to perform.
6. Select **Yes**.

Moving examinations

An examination can be moved from one patient record to another. This feature should only be used if an examination was performed and stored to a wrong patient record.

CAUTION

When moving an examination, verify that the target patient record is correct.

1. In the *Search/Create Patient* window press **[+]** in front of the patient record containing the examination(s) to move (see Figure 9-5 *on page 9-15*).
2. Select the examination to move.
3. Press **More** in the lower, right-hand corner of the *Search/Create Patient* window.
4. Press **Move Exam**.

   The *Move exam* window is displayed.

Figure 9-12. The Move exam window

Moving examinations (continued)

5. Search and select the target patient record.
6. Press **Move Exam**.

   A warning message is displayed asking the user to confirm the action to perform.

Make sure that the patient record selected is correct.

7. Select **OK**.

   An information window is displayed to confirm the operation.
8. Select **OK**.

Review images in archive

There are two ways to access to archived images:

- Review the images from a selected examination.
- Select images from the *Image list screen* displaying all the images sorted by examination for the actual patient record.

Review the images from a selected examination

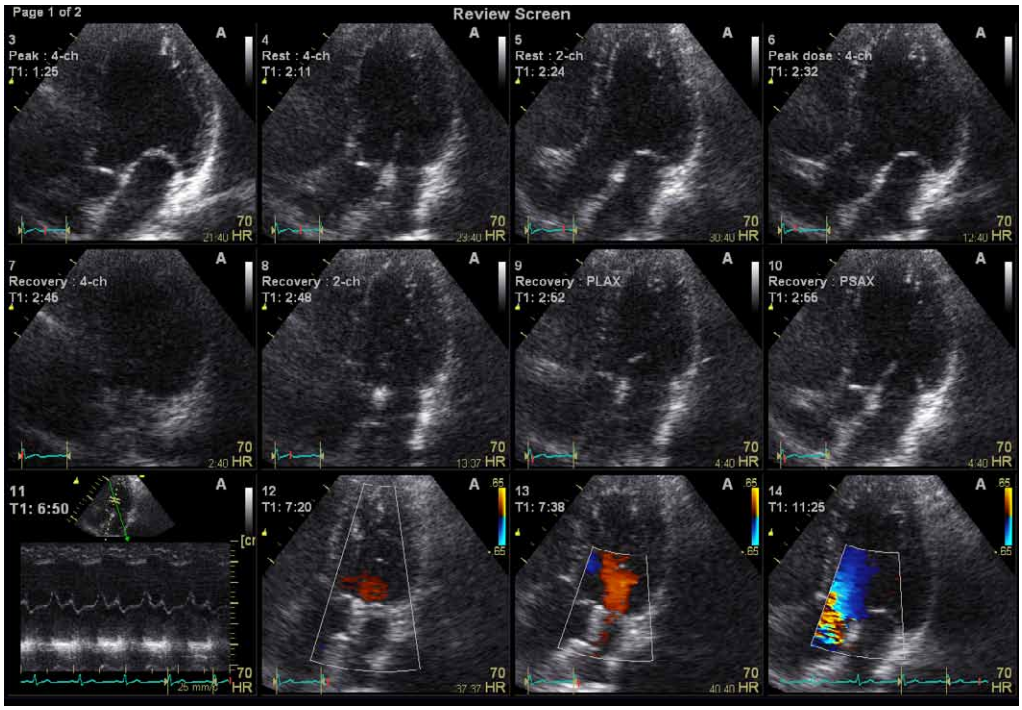
1. In the *Examination list* window (see Figure 9-6 *on page 9-17*), highlight the examination with images to review.
2. Press **Review** on the Control panel.

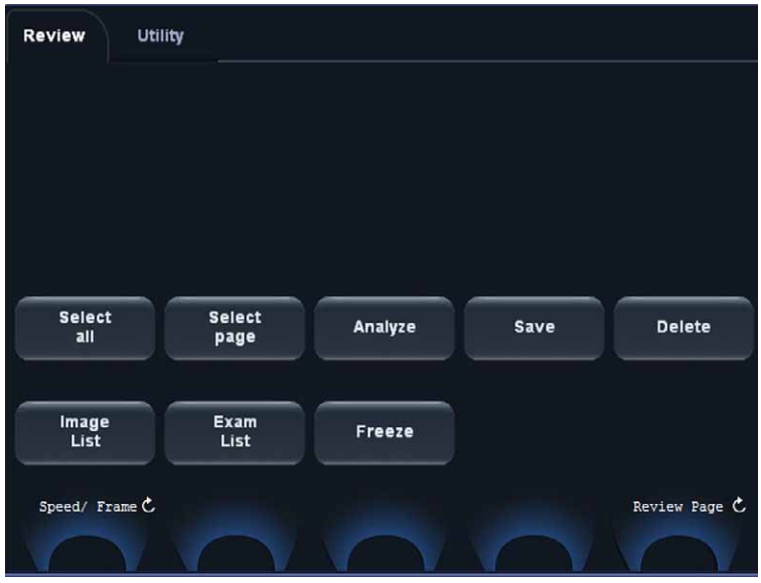
   The stored images for the selected examination are displayed in the *Review screen* (see Figure 9-13).

To analyze images:

1. Select the images to analyze.
2. Press **Analyze**.

Review the images from a selected examination (continued)





Analyze: analyses selected images.
Image list: displays the Image browser screen.
Change page: change page in the Review screen.
Exam list: displays the Examination list window (Figure 9-6 *on page 9-17*)

Figure 9-13. The Review screen

Select images from the Image list screen

The procedure described below enables the analysis of images belonging to different examinations for a selected patient record. If images are stored on multiple removable media, they have to be restored to the local hard drive prior to review as described below.

1. In the *Examination list* window (see Figure 9-6 *on page 9-17*), press **Image list**.

   The *Image list screen* is displayed (see Figure 9-16) showing thumbnails of stored images for the actual patient sorted by examination.

   If the images are stored on a removable media that is not mounted, the image thumbnail is replaced by a symbol.

2. Select the images to analyze or press **Analyze** to review all images.
   - If all images are available the images are displayed for review.
   - If some of the images are not available locally the *Restore images* window is displayed.

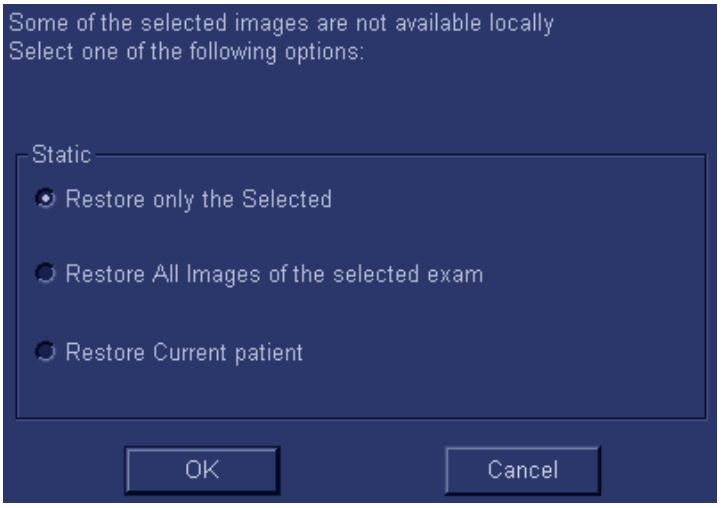


Figure 9-14. The Restore images window

3. Select between:
   - **Restore only the selected images**: only selected images that are not available locally are restored.

Select images from the Image list screen (continued)

- **Restore all images of the selected exam**: all images that are not available locally in the exams where an image was selected are restored.
- **Restore current patient**: restores all images in all examinations.

4. Press **OK**.

   The *Insert media* window is displayed.

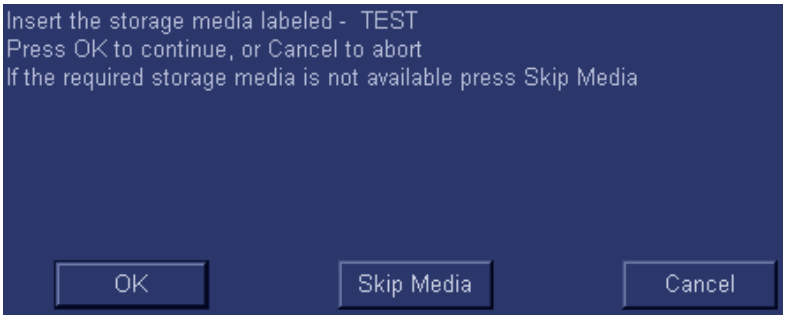
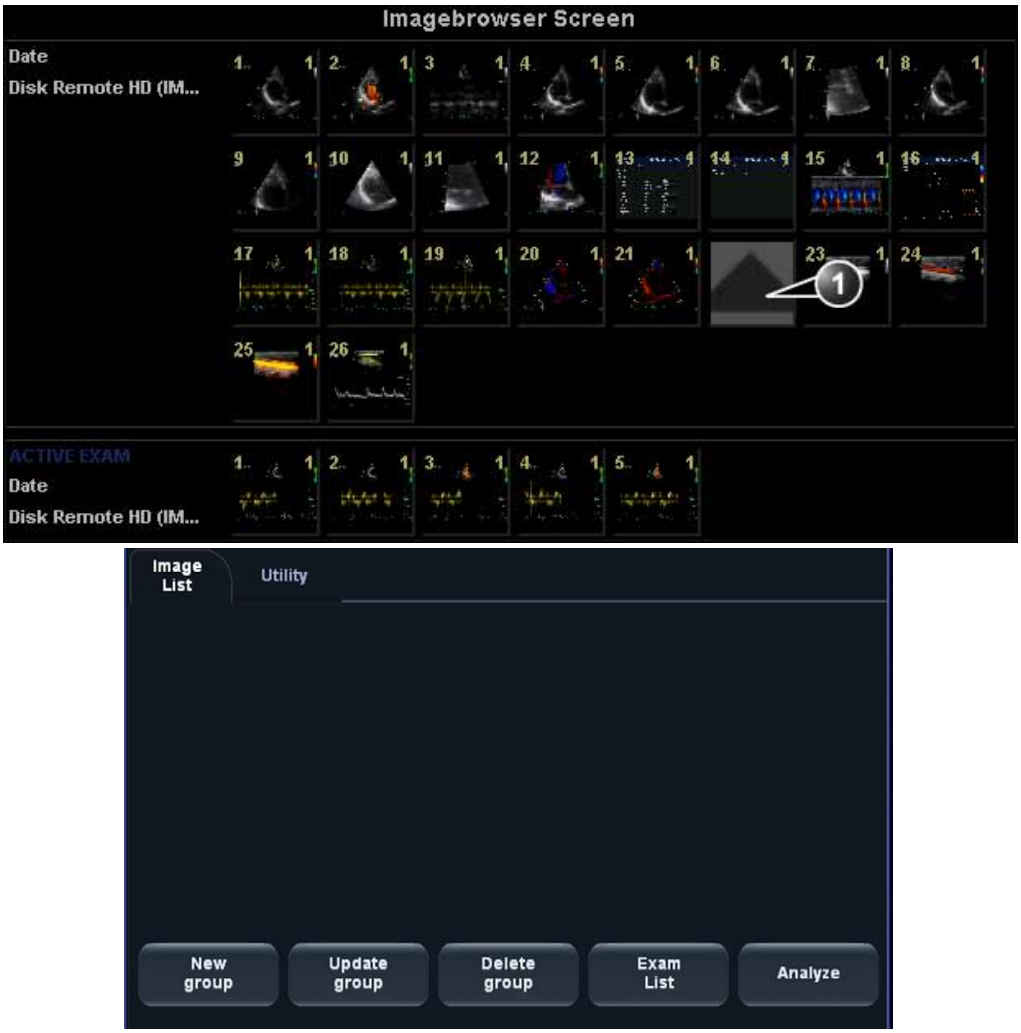


Figure 9-15. The Insert media window

5. Insert the required media.
6. Select between:

   - **OK**: the images on the mounted media are restored on the local hard drive. If not all the required images are on the inserted media, the user is prompted to insert another media until all required images are restored on the hard drive.
   - **Skip media**: the images stored on the inserted media are not restored. If not all the required images are on the inserted media, the user is prompted to insert another media until all required images are restored on the hard drive.
   - **Cancel**: no images are restored.

Select images from the Image list screen (continued)



1. Missing image

Figure 9-16. The Image browser screen

Connectivity

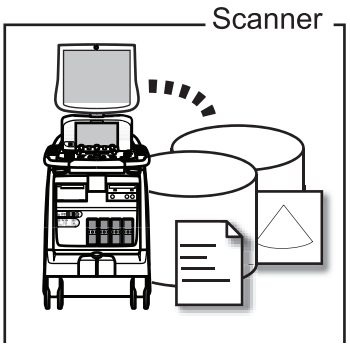
This section describes the communication and connection options for the Vivid T8/Vivid T8 Pro ultrasound unit with other devices in the hospital information system. This section covers the procedures for configuration and optimal data management from a Vivid T8/Vivid T8 Pro in the following scenarios:

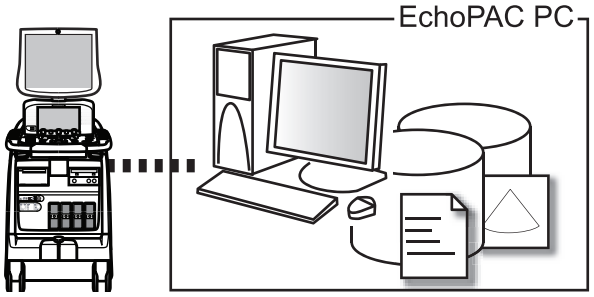
- A stand-alone Vivid T8/Vivid T8 Pro
- A scanner and a workstation in a direct connect environment
- A scanner and workstation in a network
- A scanner and a DICOM server in a network.

The dataflow concept

Communication between the Vivid T8/Vivid T8 Pro ultrasound unit and other information providers on the network takes the form of dataflows. Selecting a dataflow will automatically customize the ultrasound unit to work according to the services associated with this dataflow. Each dataflow defines the location and format of patient information. Patient information can include demographic data and images, as well as reports, measurement and analysis data. By utilizing dataflows, the user can configure the Vivid T8/Vivid T8 Pro ultrasound unit to optimally meet the connectivity needs of the facility, while keeping the user interface unchanged. The dataflow concept allows the flexibility of data to be obtained from various sources and allows data to flow to various output sources.

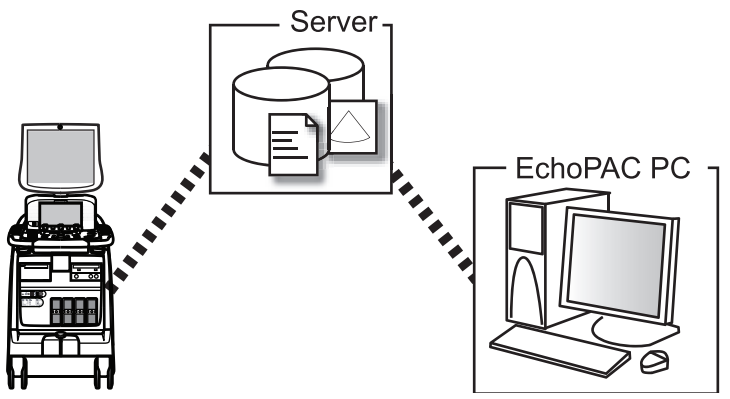
Dataflow examples

Stand-alone scanner	
	
Acquisition: Scanner dataflow: **LocalArchive-Int.HD**	Review: Scanner dataflow: **LocalArchive-Int.HD**
The local database is used for patient archiving. Images are stored to internal harddrive.	

Scanner and Workstation in a direct connect environment	
	
Acquisition: Scanner dataflow: **RemoteArch-Remote HD**	Review: Workstation dataflow: **LocalArchive-Int.HD**
In this scenario the data is transferred from the Vivid T8/Vivid T8 Pro to a dedicated EchoPAC PC workstation over the Ethernet (either in a peer-to-peer connection with a crossover cable, or in a network). The database from the EchoPAC PC is used as the master and images are stored directly to the EchoPAC PC internal harddrive. In this configuration the scanner is just an intermediate acquisition unit which after completion of a study, will not contain any patient information, measurements or images. Up to three scanners can be connected to one EchoPAC PC if the workstation has the EchoPAC Share option enabled.	

Dataflow examples (continued)

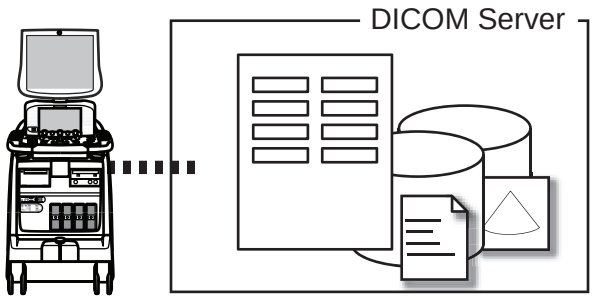
Scanner and Workstation in a network environment



Acquisition:	Review:
Scanner dataflow: **RemoteArch-Remote HD**	Workstation dataflow: **RemoteArch-Remote HD**

In this scenario the Vivid T8/Vivid T8 Pro is configured to work with an ImageVault patient demographics and image server in a network environment. Images are first saved on the local image buffer on the scanner and transferred to the server when saving the examination.

Scanner and DICOM server in a Network



Scanner DICOM dataflows:

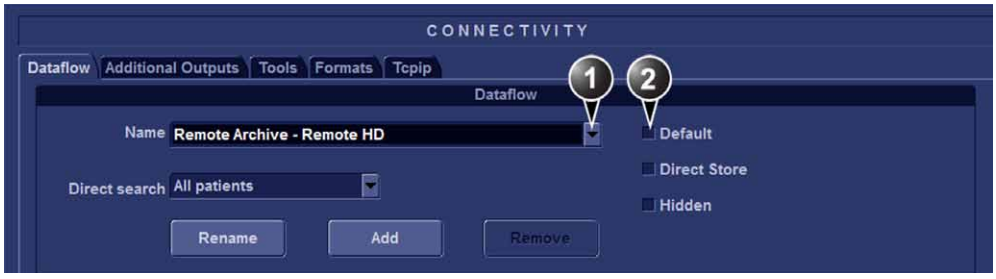
- **DICOM server**: images are stored to a DICOM server.
- **Local Archive - Int HD/DICOM Server**: the local archive is used for patient archiving. Images are stored to the internal harddrive and to a DICOM server.
- **Remote Archive - Remote HD/DICOM Server**: a remote database is used for patient archiving. Images are stored to a network image volume and to a DICOM server.
- **Worklist/Local Archive - DICOM Server/Int HD**: search in a DICOM Modality Worklist, the patient found is copied into local database. The patient information and the examination results are stored to the local database. Images are stored to a DICOM server and to an image volume on the local harddrive.
- **Worklist/Remote Archive - DICOM Server/Remote HD**: search in a DICOM Modality Worklist, the patient found is copied into a remote database. The patient information and the examination results are stored to a remote database. Images are stored to a DICOM server and to an image network volume as pure DICOM in both locations.
- **Query/Retrieve**: retrieve images from a DICOM server based on query parameters.

Dataflow selection

Select a dataflow from the *Search/Create Patient* window (see Figure 9-5 *on page 9-15*) or configure the system with a **default** dataflow from the Configuration management package as described below.

Default dataflow selection

1. Press **Utility**/**Config** on the Touch panel and log on as administrator if required.
2. Select the **Connectivity** category and **Dataflow** subgroup.
   The *Dataflow* sheet is displayed (see Figure 9-17).
3. Select the desired dataflow in the *Name* pull-down menu and check the option **Default**.
4. Press **Config** to exit the Configuration management package.



1. Select a dataflow
2. Default option for the selected dataflow

Figure 9-17. Default dataflow setting

Scanner connectivity configuration

Scanner in a network environment

To be able to use the network functions when connected to a hospital network, the scanner must have a proper network address. Typically source for this information is the network administrator.

Scanner's TCP/IP settings

1. Press **Utility**/**Config** on the Touch panel and log on as administrator.
2. Select the **Connectivity** category and **TCP/IP** subgroup.
   The *TCPIP subgroup* is displayed.

1. Computer name: not editable
2. IP settings
3. Remote archive setup: remote archive IP address and name (EchoPAC PC, EchoServer, ImageVault)
4. Save TCP/IP settings. The changes will be effective after the system is rebooted.

Figure 9-18. TCP/IP setting

Scanner's TCP/IP settings (continued)

3. Select **Network settings** to configure:
   - The IP address for the system
   - The subnet mask for the system
   - The IP address for the Default Gateway
4. In the *Remote archive setup area* enter:
   - The IP address for the remote archive
   - The name of the remote archive
5. Press **Save settings** and reboot the system.

Scanner in a network environment with a DICOM server

The scanner's TCP/IP settings must be configured as described in 'Scanner's TCP/IP settings' on *page 9-37*.

In addition, to work against the DICOM server the following information has to be entered in the scanner:

- The DICOM server IP address
- The DICOM server port number
- The DICOM server AE title (the server's name)

Typically source for this information is the network administrator.

DICOM dataflow selection

1. Press **Utility**/**Config** on the Touch panel and log on as administrator.
2. Select the **Connectivity** category and **Dataflow** subgroup.

   The *Dataflow* sheet is displayed.
3. Select the DICOM dataflow to configure from the *Name* pull-down menu (Figure 9-19).

DICOM devices configuration

Depending on the DICOM dataflow selected, one or several DICOM devices may have to be configured.

1. Select a DICOM device in the *Selected devices pane* and press **Properties** (see Figure 9-19).

1. Select a DICOM dataflow
2. Select the DICOM device.
3. Press Properties.

Figure 9-19. The Dataflow sheet

DICOM devices configuration (continued)

The *Properties* window for the selected DICOM device is displayed (Figure 9-20).

Figure 9-20. DICOM worklist properties window

2. Select the DICOM server from the *IP-address* pull-down menu.

   Follow the steps below if the IP address settings for the DICOM server need to be modified or created:

   - Select **<Modify>** from the *IP-address* pull-down menu.

     The *IPs* window is displayed.
   - Select the DICOM server and press **Modify** in the *IPs* window (or press **Add** if creating a new IP address).

     The *Enter name and IP* window is displayed.

DICOM devices configuration (continued)

- Enter the name and/or IP address of the server and press **OK** to return to the ***Properties*** window.

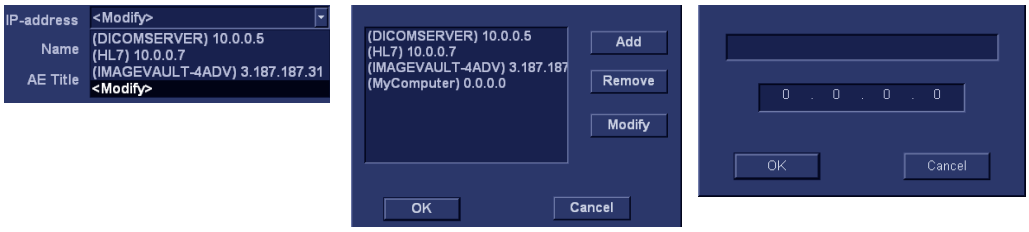


Figure 9-21. Modifying/Creating the IP address

3. In the *Properties* window, enter:
   - The DICOM server **AE title**. This entry is case sensitive and must match exactly.
   - The DICOM server **port**

   For some DICOM servers, the default **Timeout** setting may be too low.
4. When configuring the DICOM storage device, the following image settings should be entered in the *Properties* window (Figure 9-22):
   - Check **DICOM SR** if required (see below).
   - Keep **Reopen per image** unchecked.
   - Keep **Allow raw data** unchecked.
   - Set **Max Frame rate** to 30.
   - Keep **Only Black and White** unchecked.
   - Set **Compression** to JPEG.
   - Set **Quality** to 95.
   - Check **Allow multiframe**.

NOTE: *Setting **Compression** to None may result in long transfer time and cineloop with more than 500 frames will be truncated. If **Compression** is set to None, set **Max frame rate** to either 25 or 30 frames per second to reduce the risk of truncating loops.*

DICOM devices configuration (continued)

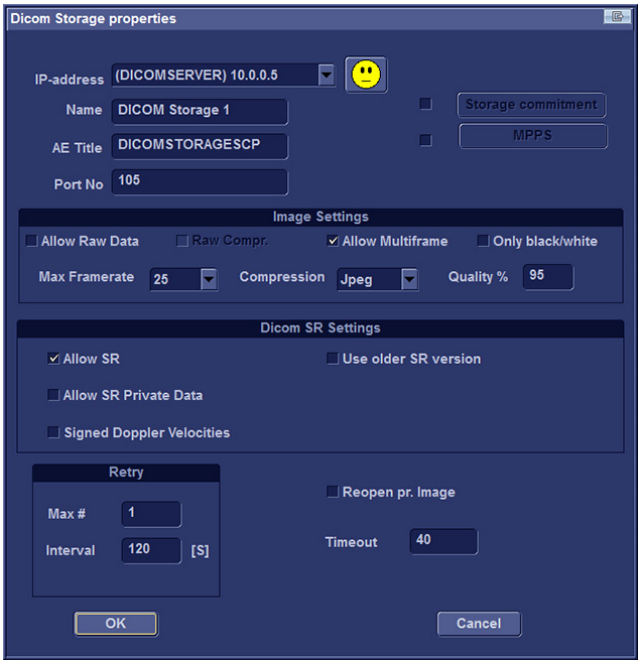


Figure 9-22. DICOM storage properties window

Adjusting the Search criteria

When selecting a DICOM Worklist dataflow or Query/Retrieve, search criteria can be set for the system to use when searching the database.

1. Press **Utility**/**Config** on the Touch panel and log on as administrator.
2. Select the **Connectivity** category and **Dataflow** subgroup.

   The *Dataflow* sheet is displayed (see Figure 9-19 *on page 9-39*).
3. Select a DICOM Worklist dataflow or the Query/Retrieve dataflow.
4. Select the Worklist or Query/Retrieve device in the *Selected devices pane* and press **Properties**.

   The *Properties* window for the selected DICOM device is displayed.
5. Press **Search criteria**.

   The *Search criteria* window is displayed (Figure 9-23).
6. Select a Search criteria from the *Select tag* pull-down menu.

Adjusting the Search criteria (continued)

7. Enter a value if required or leave blank if not to be used. This entry is case sensitive and must match exactly.
8. Press **Add to list**.
9. Press **OK** to close the *Search criteria* window.

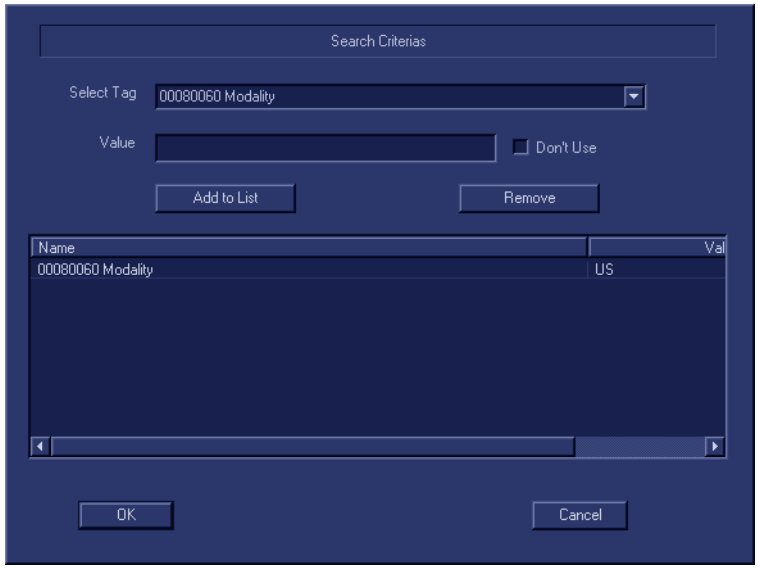


Figure 9-23. The Search criteria window

DICOM SR

DICOM Structured Reporting (SR) is a standardized format for medical results. Vivid T8/Vivid T8 Pro supports the specialized form for Adult Echo Ultrasound (“TID 5200 Echocardiography Procedure Report”) and Vascular Ultrasound (“TID 5100 Vascular Ultrasound Procedure Report”) for M&A results.

With the DICOM SR support, M&A for an exam can be sent at the end of the exam or when exported from local archive. The destination can be either a server on the network (Storage SCP) or a removable media (DICOM Media) depending on the DICOM dataflow selected.

“TID 5200 Echocardiography Procedure Report” is sent if the exam contains M&A from category Cardiac or Pediatric (Heart). “TID 5100 Vascular Ultrasound Procedure Report” is sent if the exam contains M&A from category Vascular or Abdominal. If the exam contains M&A from both Cardiac/Pediatric (Heart) and Vascular/Abdominal categories, two SR documents are sent.

DICOM SR (continued)

"TID 5200 Echocardiography Procedure Report" and "TID 5100 Vascular Ultrasound Procedure Report" do not support all M&A results from Vivid T8/Vivid T8 Pro. They are limited to the following:

- No unassigned measurement.

  Refer to the Vivid T8/Vivid T8 Pro Reference manual for a complete list of supported parameters.
- The following modes: 2D, M-mode, Color Flow, PW Doppler, CW Doppler, 3D and TDI.
- Not Modified Simpson method or Bullet methods.

  Refer to the Vivid T8/Vivid T8 Pro Reference manual for a complete list of supported methods.
- Basic derivations (Average, Last, Min and Max), no references between the derived measurements and the ones they were made from.
- Wall Motion Scoring: individual segment scores only according to 16-segment model, no graded Hypokinesis (only Hypokinesis is used).

DICOM SR must be activated for each DICOM device.

1. Press **Utility**/**Config** on the Touch panel and log on as administrator.
2. Select the **Connectivity** category and **Dataflow** subgroup.

   The *Dataflow* sheet is displayed (see Figure 9-19 *on page 9-39*).
3. Select the DICOM dataflow to configure in the *Name* pull-down menu.

DICOM SR (continued)

4. Select a DICOM storage device in the *Selected devices pane* and press **Properties**.

   The *Properties* window for the selected DICOM storage device is displayed.

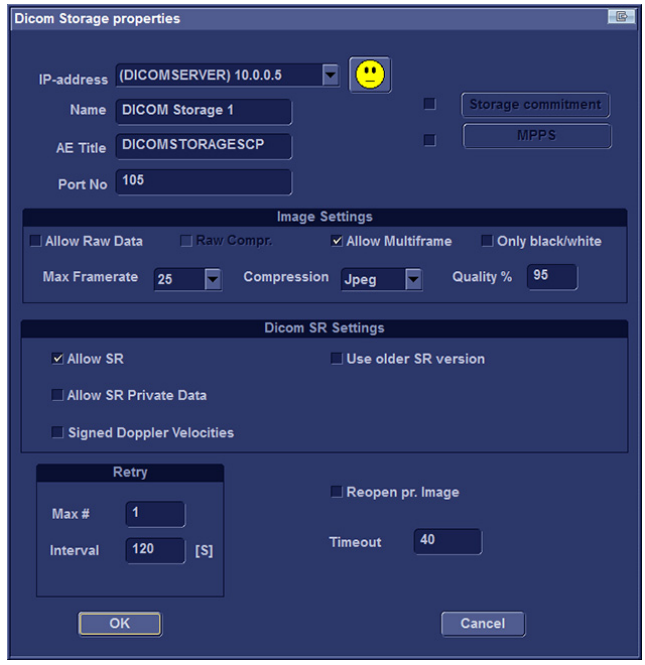


Figure 9-24. DICOM storage properties window

5. Check the option **Allow SR** to enable DICOM SR.

   The following additional options are available:

   - **Allow SR private data**: send the current exam data in a private format. This option is by default unchecked and should only be used with DICOM storage devices that can handle private data format.
   - **Signed Doppler velocities**: send signed Doppler velocities.
   - **Use older SR version**: when checked a *Use older SR version* pull-down menu is displayed. The current exam data will be sent in the same format as the selected SR version. Details about format and content of the SR version can be found in the corresponding user manual of the selected version.

DICOM SR (continued)

These settings apply to both “TID 5200 Echocardiography Procedure Report” and “TID 5100 Vascular Ultrasound Procedure Report”

6. Select **OK**.

DICOM spooler

DICOM spooler displays the current DICOM output jobs. The jobs may be Storage, Print, Modality Performed Procedure Step or Storage Commitment. The DICOM spooler is used for checking the current job's status when a job is saved or when the total spooler status on the right of the *Archive* window displays an error.

From the DICOM spooler the user can also:

- **Delete** non-active jobs
- **Resend** a job that has failed or is in hold
- **Send** a job that has failed or is in hold, to a new destination
- **Hold** a job that is not active.

The job's status displayed in the *DICOM spooler* window can be:

- **Pending**: the job is complete, waiting to be active.
- **Hold**: the job is complete, but suspended, waiting for an user action.
- **Append**: the job is incomplete, waiting for more images (Direct store function).
- **Active**: the job is complete and connected to the destination device.
- **Failed**: the job is complete but one or more images failed to transmit to the destination device.
- **Done**: the job is saved to the destination device. The jobs that are done are removed from the spooler after a few minutes.

DICOM spooler (continued)

To start the DICOM spooler:

1. Do one of the following:
   - Press **Utility** and **Spooler** on the Touch panel
   - Press **F4** on the alphanumeric keyboard
   - Press **Alt** + **S** on the alphanumeric keyboard

   The *DICOM spooler* window is displayed (see Figure 9-25).

   The *DICOM spooler* window is automatically updated. Press **Refresh** to update the information displayed at any time.

Figure 9-25. The DICOM job spooler window

To delete a job:

1. Select the job(s) to delete in the *DICOM job spooler* window.

NOTE: Only non-active jobs can be deleted.

2. Press **Delete**.

To resend a job:

1. Select the job(s) to re-send in the *DICOM job spooler* window.

NOTE: Only jobs that failed or are in hold can be resent.

2. Press **Resend**.

DICOM spooler (continued)

To send a job to a new destination:

1. Select the job(s) to send in the *DICOM job spooler* window.

NOTE: Only jobs that failed or are in hold can be sent to a new destination.

2. Press **Send to...**.

   A dialogue window is displayed.

3. Select the new destination from the *Destination* pull-down menu.
4. Press **Send**.

To hold a job:

1. Select the job(s) to hold in the *DICOM job spooler* window.

NOTE: Only inactive jobs can be set on hold.

2. Press **Hold**.
3. To undo hold, press **Resend**.

Export/Import patient records/ examinations

Patient records/examinations from the local archive on one system (Vivid T8/Vivid T8 Pro) can be exported to the local archive on another system via a removable media. Patient records/examinations from the local archive can also be exported directly to a remote archive (an ImageVault server, a DICOM server or EchoPAC PC). In addition patient records/ examinations from a remote archive (an ImageVault server or EchoPAC PC) can be exported to a removable media or to a DICOM server.

Similarly, patient records/examinations from the local archive on one system can be imported to the local archive on another system via a removable media. No data is deleted from the source archive when importing data. In addition patient records from a removable archive can be imported to a remote archive (ImageVault server).

CAUTION

If an examination is opened, it must be closed before performing Export/Import of patient records/examinations.

Exporting patient records/examinations

1. If exporting to a removable media, Insert the media in the drive.
2. Press **Patient**.

   The *Search/Create Patient* window is displayed (see Figure 9-5 *on page 9-15*).
3. Select the source archive in the *Dataflow* field:
   - **LocalArchive-Int.HD**: exports data from the local archive.
   - **RemoteArch-RemoteHD**: exports data from the configured remote archive.
4. Press **Export**.

   The *Export dialogue* window is displayed.

Figure 9-26. The Export Dialogue window

5. Select one of the following available destinations from the *Destination* drop-down menu:
   - **CD/DVD Archive**: exports raw and DICOM data to a CD/DVD.
   - **DICOM CD/DVD**: export DICOM data only to a CD/DVD-R/W.
   - **Remote Import/Export Archive**: exports raw and DICOM data to an ImageVault server or EchoPAC PC.
   - **Excel file**: exports demographics, measurements and reporting data to a spreadsheet. The export destination must be configured (see page 9-83).

Exporting patient records/examinations (continued)

- **DICOM Print**: prints images to a DICOM printer via DICOM spooler.
- **MPEGVue**: exports examinations to MPEGVue format readable from a regular computer. Ultrasound images are stored as MPEG, measurements as an Excel file and saved reports as CHM-files. The export destination must be configured (see page 9-83).
- **USB Harddisk/Memstick Archive**: exports raw and DICOM data to an USB device. Only available when an USB device is mounted.
- **DICOM Storage**: export DICOM data only to a DICOM server via DICOM spooler

6. Press **OK**.

   The following situations may occur:

   - The system is checking that the removable media is inserted. If not, a dialogue window is displayed prompting the user to insert a media.

Figure 9-27. Insert media window

Insert the media and select **Retry**.

Exporting patient records/examinations (continued)

- The system is checking if the destination media is empty and needs to be formatted. If yes an *Information* window is displayed asking the user whether or not to format the media.

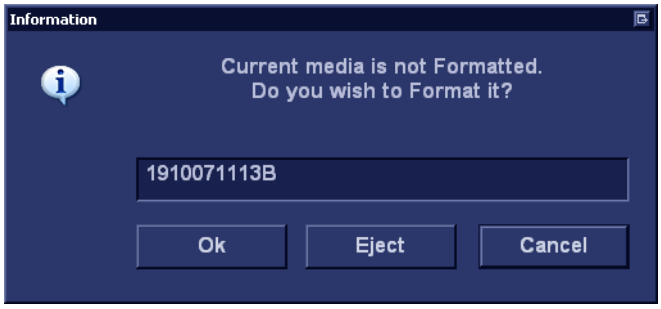


Figure 9-28. Media formatting window

Enter a new label and select **OK**.

NOTE: Only the following characters and signs can be used when labelling a media: A - Z, a - z, 0 - 9, "_" and "-". Do not use more than 11 characters or signs. Do not use space.

- If the media is not empty, the *Add files* window is displayed.

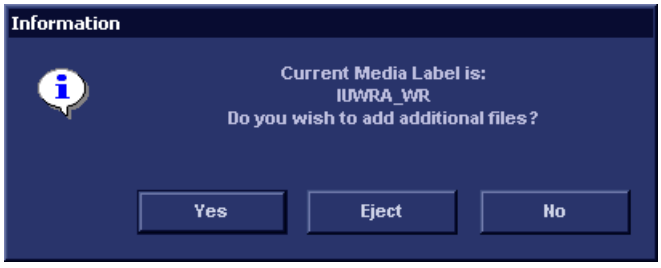


Figure 9-29. Add files windows

Select **Yes**.

The system is preparing the media to allow addition of new files.

*NOTE: If **Eject** is selected, the user is prompted to insert another media. If **No** is selected, the Export Dialogue window is displayed (Figure 9-26), where the user can select another destination.*

Exporting patient records/examinations (continued)

The *Export patient* window is displayed (see Figure 9-30).

Figure 9-30. The Export patient window

7. Search and select the patient records/examinations to export in the *Patient list*. All searching criteria can be used to find the patient records to export.

   The following selection methods can be used:

   - Press and hold down **Shift** while selecting patient records/examinations to select several consecutive items at a time.
   - Press and hold down **Ctrl** while selecting patient records/examinations to select several discrete items.
   - Press **Select all** to export all patient records.
   - Press **Today** in the *Export patient* window to display today's examinations and select the actual examinations.

NOTE: *Select **More** to display the extended Export patient window if necessary.*

Exporting patient records/examinations (continued)

- Fill in the *Exam between* field to display the patient records done during a specific time period and select the actual records.
- Fill in the *Born between* field to display the patient records of patients born during a specific time period and select the actual records.

8. Adjust the following settings (if available) as desired:
   - **Delete selected patient(s) after copy**
   - **Copy images**
9. Press **Copy**.

   If one or more patient examination is already present in the destination archive the *Export/Import conflict* window is displayed (see Figure 9-31). For each conflicting item, select:
   - **Keep**: to keep the existing examination in the destination archive.
   - **Replace**: to replace the existing examination with the corresponding item in the source archive.

Figure 9-31. The Export/Import conflict window

Press **OK** to resume export.

A progress indicator is displayed. When done a status window is displayed showing the number of patient records that have been successfully exported.

Exporting patient records/examinations (continued)

10. Press **OK**.

    A check mark is displayed in the *Copied* field in the *Export patient* window for each item exported.

    A status message is displayed for each item exported. Make sure that the operation was successful for each item exported.

11. Press **Done** to complete the process.
12. If exporting to a removable media, press **Alt** + **E** to eject the media.

NOTE: Do not eject the CD using the button on the CD drive.

The *Eject device* menu is displayed.

13. Select the relevant media.

    The selected removable media is ejected.

Importing patient records/examinations

1. Insert the removable media of the source archive in the corresponding drive.
2. Press **Patient** on the Front panel.

   The *Search/Create Patient* window is displayed (Figure 9-5 *on page 9-15*).
3. Select destination archive in the *Dataflow* field:
   - **LocalArchive-Int.HD**: imports data to the local archive.
   - **RemoteArch-RemoteHD**: imports data to an ImageVault server or an EchoPAC PC.
4. Press **Import**.

   The *Import dialogue* window is displayed (see Figure 9-32).

Figure 9-32. The Import Dialogue window

5. Select one of the following available source archive from the *Source* drop-down menu:
   - **CD/DVD Archive**: imports raw and DICOM data (if present) from a CD/DVD-R.
   - **DICOM CD/DVD**: imports DICOM data only from a CD/DVD-R.
   - **Remote Import/Export Archive**: imports raw and DICOM (if present) data from an ImageVault server or EchoPAC PC.
   - **Query retrieve**: imports data from a DICOM server.
   - **USB Harddisk/Memstick Archive**: imports raw and DICOM data from an USB device. Only available when an USB device is mounted.
   - **DICOM USB Harddisk/Memstick**: imports DICOM data only from an USB device. Only available when an USB device is mounted.

Importing patient records/examinations (continued)

6. Press **OK**.
   The *Import patient* window is displayed (see Figure 9-33).

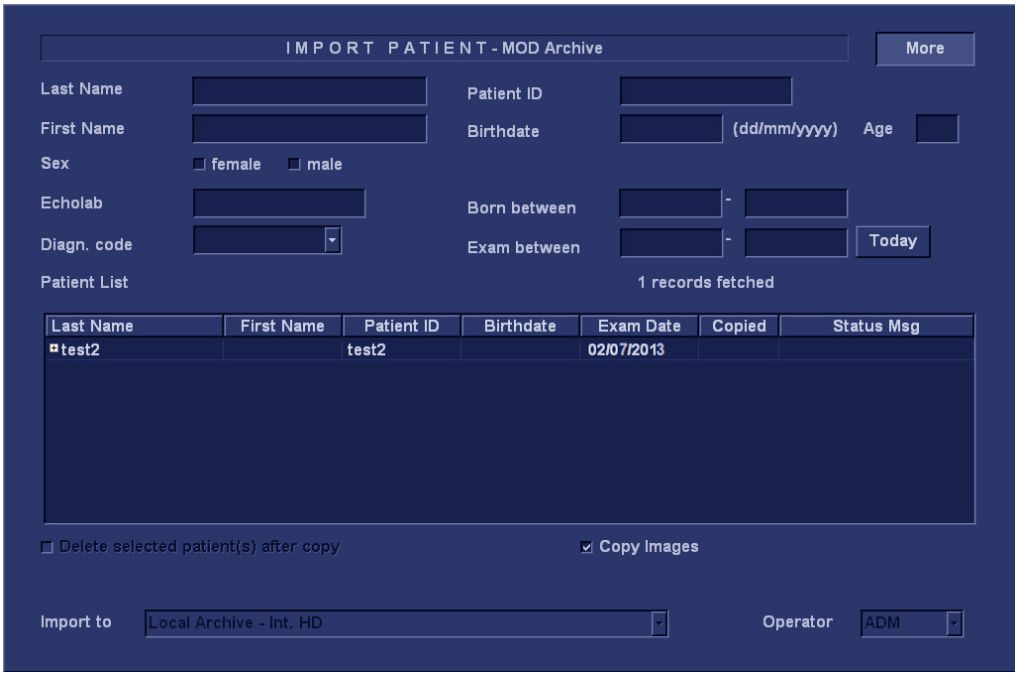


Figure 9-33. The Import patient window

7. Search and select the patient records to import in the *Patient list*. All searching criteria can be used to find the patient records to import.
   The following selection methods can be used:
   - Press and hold down **Shift** while selecting patient records/examinations to select several consecutive items at a time.
   - Press and hold down **Ctrl** while selecting patient records/examinations to select several discrete items.
   - Press **Select all** in the *Import patient* window to export all patient records.

NOTE: *Select **More** to display the extended Import patient window if necessary.*

Importing patient records/examinations (continued)

- Press **Today** to display today's examinations and select the actual examinations.
- Fill out the *Exam between* field to display the patient records done during a specific time period and select the actual records.
- Fill out the *Born between* field to display the patient records of patients born during a specific time period and select the actual records.

8. Press **Copy**.

   If one or more patient examination is already present in the destination archive the *Export/Import conflict* window is displayed (see Figure 9-31 *on page 9-54*). For each conflicting item, select:

   - **Keep**: to keep the existing examination in the destination archive.
   - **Replace**: to replace the existing examination with the corresponding item in the source archive.

   Press **OK** to resume import.

   A progress indicator is displayed. When done a status window is displayed showing the number of patient records that have been successfully imported.

9. Press **OK**.

   A check mark is displayed in the *Copied* field in the *Import patient* window for each item imported.

   A status message is displayed for each item imported. Make sure that the operation was successful for each item imported.

10. Press **Done** to complete the process.

Disk management

Disk Management Introduction

The Disk management function allows the user to manage hard disk space while maintaining the patient database on the system. The Disk management function can be used to move, copy or delete images and move or copy reports from the oldest patient records. The Disk management function has also an auto-purge feature that will automatically delete images and reports that have already been copied if the local hard disk is getting full.

Three different disk management scenarios are possible depending on the system configuration:

- Disk management is set to **move** files: the user runs the Disk management function on a regular basis to move images and reports from older patient records to removable media or to a network volume. Using this setting, moved images and reports are deleted from the local hard drive and copied to the specified destination. This scenario prevents the local disk to fill up and keeps images and reports from the most recent patient records on the local disk. Using this scenario, the user can control what should remain on the system while keeping the disk free space at an operational level.
- Disk management is set to **copy** files: the user runs the Disk management function on a regular basis to copy images and reports from older patient records to removable media or to a network volume. To prevent the local disk to fill up, the auto-purge function automatically deletes files that were previously copied when the disk free space has reached the minimum allowed limit. This scenario lets the system automatically manage the disk space on the system.

Disk Management Introduction (continued)

NOTE: When using this setting, the images location displayed in the Examination list screen will be the selected destination for the copy operation, even if the images are still present on the local hard drive. When reviewing the exam, the original images will be retrieved from the local hard drive as long as they are available there. When the images are deleted from the local hard drive by the auto-purge function, the copied images will be retrieved.

- Disk management is set to **delete** files: the user runs the Disk management function on a regular basis to delete images from older patient records.

NOTE: Ensure that you have established a data management protocol for your office/institution. The user MUST manage the removable media used when running Disk management by keeping a log and by creating a media filing system.

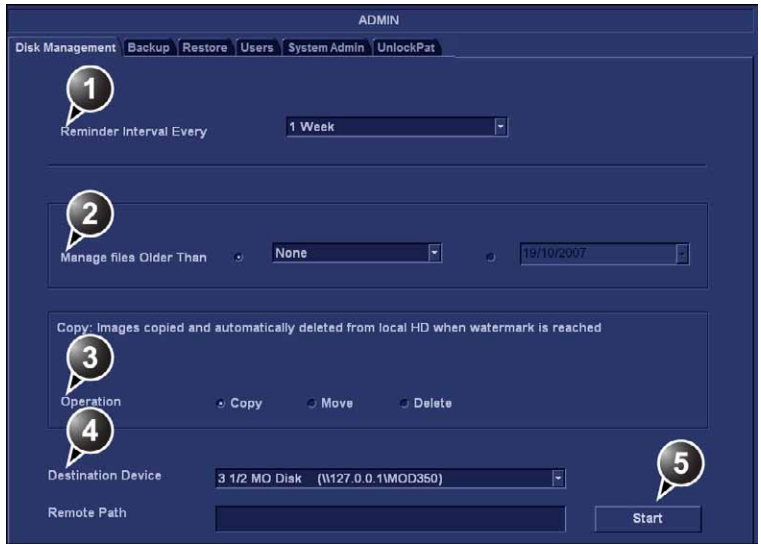
A person should be in charge of performing the process. The Disk management system can be set up so that a reminder is displayed at a regular intervals.

Configuring the Disk management function

Configuration of the Disk management system can only be done by user with administration rights.

1. Press **Utility**/**Config** on the Touch panel.

   If required log on as administrator.
2. Select the category **Admin**.
3. In the *Admin* category, select the sheet **Disk management**.



1. Sets the reminder time interval for running Disk management.
2. Sets the files to be managed based on the examination dates.
3. Sets the Disk management to copy, move or delete images.
4. Sets the destination device.
5. Starts Disk management

Figure 9-34. The Disk management sheet

Disk management schedule setting

1. Next to **Reminder interval**, specify the number of days/ weeks you want the system to prompt you to perform disk management.

   This setting should be set based on the activity of your office/institution. If **None** is selected, no reminder will be displayed.

Data management settings

1. Select a number of days, weeks or months or a specific date next to **Manage files older than**. Only files older than the specified setting will be copied or moved.

   If **None** is selected, all files will be copied or moved.

2. Next to **Operation** check:

   - **Copy**: the images and reports from the examinations older than the specified setting defined in step 1 are copied to the specified destination. Using this setting, the files will exist in two locations, the local hard drive and the destination.
   - **Move**: the images and reports from the examinations older than the specified setting defined in step 1 are copied to the specified destination, verified and then deleted from the local hard drive. Using this setting, the files will exist in one location, the destination media. They are removed from the local hard drive.
   - **Delete**: the images from the examinations older than the specified setting defined in step 1 are deleted from the hard drive.

Destination device setting

1. Next to **Destination device**, select a removable media or a network share folder.

NOTE: *To be able to select a network share folder in the Destination device field, its path must have been entered in the Remote path field.*

CAUTION

If using removable media, it is recommended to use dedicated media to the Disk management process. Removable media used for data backup must not be used when performing Disk management.

Do not use the same removable media on several systems.

Running the Disk management function

The Disk management function can be run at any time. In addition, the user may be prompted to run Disk management if the time since the last Disk management operation performed has reached the setting for the Reminder interval (see page 9-61), or if the local hard drive is about to be full.

Disk management can be run from the *Search/Create patient* window (see below) or from **Config**/**Admin**/**Disk management** (Figure 9-34 *on page 9-61*).

Manual start of Disk management

1. Press **Patient**.

   The *Search/Create patient* window is displayed.

2. Press **Disk manag** on touch panel.

   The *Disk management welcome* screen is displayed (Figure 9-35).

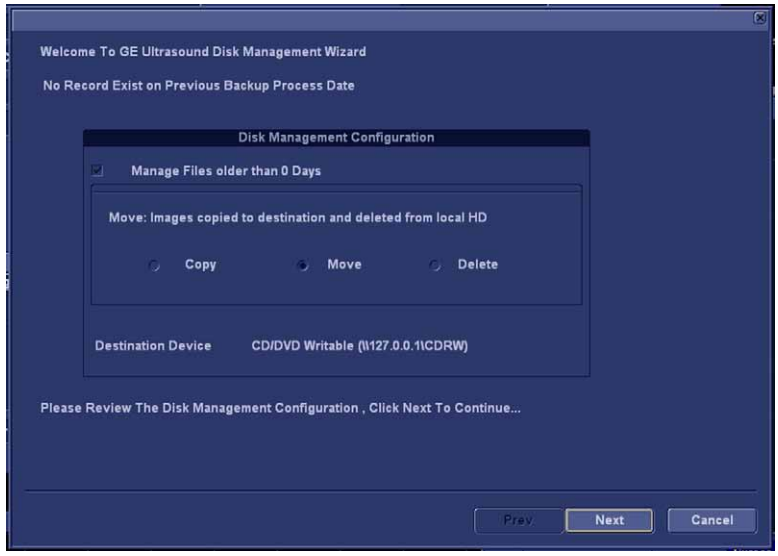


Figure 9-35. The Disk management welcome screen

The Disk management operation will either copy, remove or delete files from the local archives depending on the Disk management configuration (see page 9-61). Make sure that the correct configuration is set.

3. Press **Next**.

   The *Storage size information* window is displayed (Figure 9-36).

   Verify the information displayed. If using removable media, the operation may require several media as specified on the screen. Make sure that the specified number of disks are available.

Manual start of Disk management (continued)

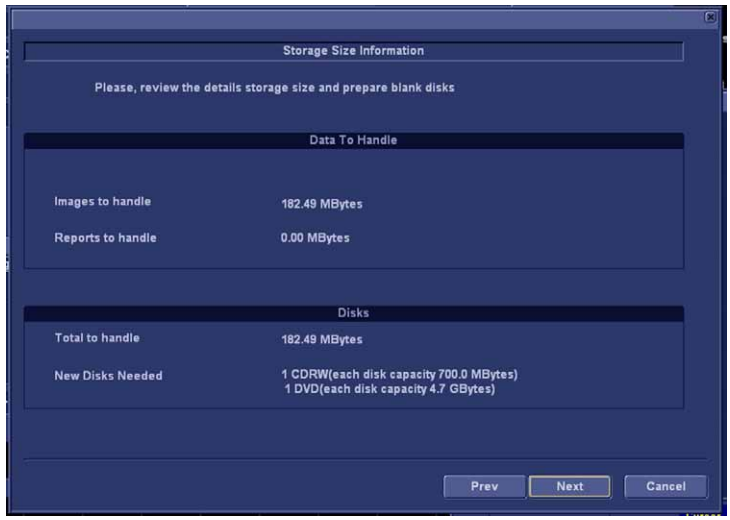


Figure 9-36. The Storage size information window

4. Insert a removable media in the specified drive.
   The disk does not need to be formatted.
5. Press **Next**.
   The *Copying files* window is displayed (Figure 9-37).

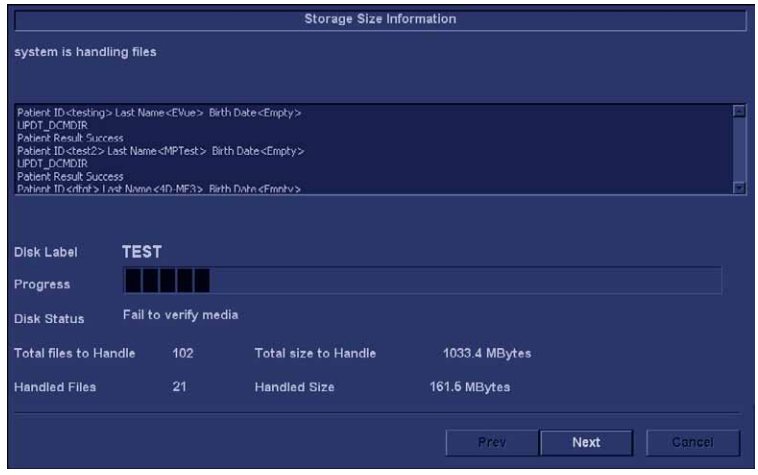


Figure 9-37. The Copying files window

Manual start of Disk management (continued)

The system automatically formats and labels new disks. If the media contains data from an export session, a warning window is displayed.

Select between:

- **Cancel**: the Disk management process is stopped.
- **Eject**: the media is ejected, a new media must be inserted to resume the Disk management process.
- **OK**: the data on the disk is deleted and the Disk management process is resumed.

The information displayed on the *Copying files* window is updated while the files are being copied.

NOTE: If the media contains data from a backup session it is ejected and the user is asked to use another media.

6. If more than one media is necessary the filled media is ejected and a dialogue window is displayed asking the user to label the ejected disk and insert a new media.

   Press **OK** after the new media is inserted.

   The operation is resumed.

   When all the files are copied, the media is automatically ejected.

7. The *Summary* window is displayed (Figure 9-38), showing a list of the disks used.
   - Select **Print summary** to print the list for archiving purpose.
   - Select **Detailed summary** to display the list of the patient records copied.

Manual start of Disk management (continued)

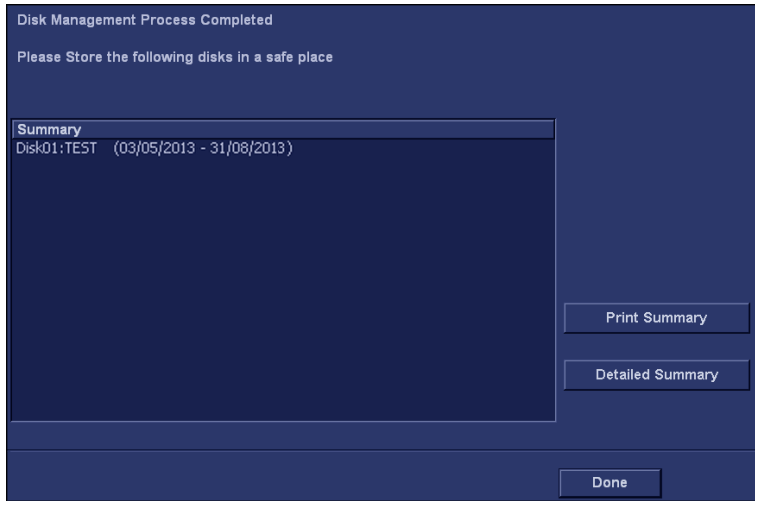


Figure 9-38. The Summary window

8. Make sure that all media are physically labelled according to the list displayed in the *Summary* window. The media label should also have an identification of the system the Disk management was run from.
9. Press **Done** to complete the Disk management operation and file the media.

Data Backup and restore

The Backup/Restore function enables the user to:

- Copy/Restore the patient archive.
- Copy/Restore the system configuration. The Copy/Restore system configuration feature enables the user to configure several units with identical presets, providing that the units have the same software version.

To minimize accidental loss of data, perform backup of the patient archive stored on the local harddrive at least **once a week**.

GE is not responsible for lost data if the suggested backup procedures are not followed and will not aid in the recovery of lost data.

There is no backup function for the images or reports (no creation of a safety copy). For long-term storage, images and reports should be moved to a USB HD or to a network shared folder using the Disk management procedure (see page 9-59).

DO NOT use the local harddrive for long-term image storage.

Only users with administration rights have access to the backup/ Restore function.

Backup procedure

1. Press **Patient**.
2. In the *Search/Create patient* window, select the dataflow **Local Archive - Int. HD**.

Figure 9-39. Dataflow selection for backup

3. Press **Utility**/**Config** on the Touch panel.
4. Select the category **Admin**.
5. Select the **Backup** sheet.

Figure 9-40. The Backup sheet

6. In the *Backup* sheet select as needed:
   - **Patient archive** to backup the patient records.
   - **System configuration** to copy system settings and user presets.
7. Select a removable media or a shared network folder as destination.

NOTE: *To be able to select a network share folder, the path (of type: \\server-name\share-name) must have been entered in the Remote path field.*

Backup procedure (continued)

8. If the backup is done to a removable media, insert a dedicated media in the drive.
9. Select **Start backup**.

   The following situations may occur:

   - The system is checking that the removable media is inserted. If not, a dialogue window is displayed prompting the user to insert a media.

Figure 9-41. The Insert media window

   Insert the media and select **OK**.

   - The system is checking if the media needs to be formatted. If yes, a dialogue window is displayed prompting the user to enter a media label.

Figure 9-42. The Enter media label window

   Type in a label for the media and select **OK**.

Backup procedure (continued)

NOTE: Only the following characters and signs can be used when labelling a media: A - Z, a - z, 0 - 9, "_" and "-". Do not use more than 11 characters or signs. Do not use space.

*NOTE: If you select **Eject** you can perform the backup using another removable media. If you select **Cancel** the backup operation is stopped.*

- The system is checking if there is already a backup or a Disk management copy on the media. If the following error message is displayed, the disk is ejected and the user is asked to use a new media that does not contain any backup or Disk management data.

Figure 9-43. The Replace current media window

Insert a new media and select **OK**.

NOTE: To reuse a Backup media when performing a new archive backup, the media has to be re-formatted first.

10. During backup, progress windows are displayed showing the current operation being performed.

Figure 9-44. The Backup progress windows

Backup procedure (continued)

11. At the end of the process, the media is ejected and the *Backup completed* window is displayed.

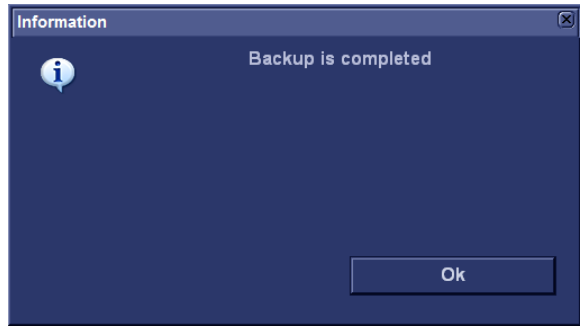


Figure 9-45. The Backup completed window

Select **OK**.

The Backup result is displayed on the *Backup* sheet.

12. Make sure to physically label the media. An identification of the system should also be noted on the media and a backup log should be kept.

File the media in a safe place.

Restore procedure

1. Press **Utility**/**Config** from the Touch panel.
2. Select the category **Admin**.
3. Select the **Restore** sheet.

Restore procedure (continued)

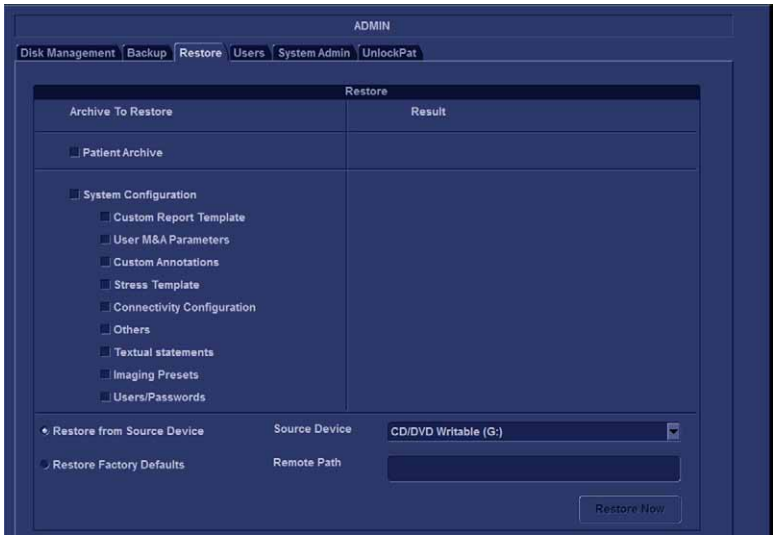


Figure 9-46. The Restore sheet

4. In the *Restore* sheet select as needed:
   - **Patient archive** to restore the patient archive.
   - **System configuration** to restore all system settings and user presets.

     OR
   - One or several **system configuration items** to restore parts of the system settings and user presets (see Figure 9-46).
5. Make sure that **Restore from Source Device** is selected.
6. Select the appropriate **Source device**.

c CAUTION

The Restore procedure will OVERWRITE the existing data on the local harddrive. Make sure to select the correct source device.

w WARNING

DO NOT backup the system configuration in one machine and restore the settings to the other Vivid T8/Vivid T8 Pro machine. Otherwise, the restored machine can not connect to the local archive.

Restore procedure (continued)

7. If restore is done from a backup on a removable media, insert the media in the drive.

CAUTION

The Restore procedure will OVERWRITE the existing data on the local harddrive. Make sure to insert the correct media.

8. Select **Restore now**.

   Depending on the selection, one or two restore confirmation windows are displayed:

Figure 9-47. The Restore confirmation window

9. Ensure that the correct source is selected an select **OK**.

   The selected items are copied to the systems.

10. If connectivity configuration settings are restored the following information window is displayed.

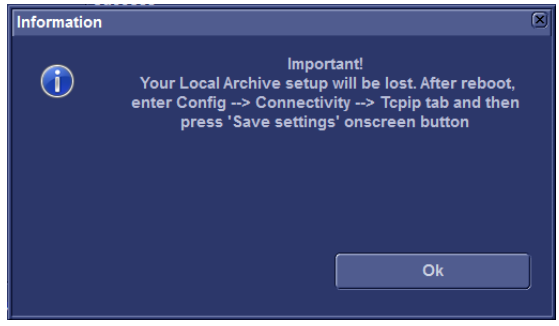


Figure 9-48. Information window

Restore procedure (continued)

11. Select **OK**.
    The *System shutdown* window is displayed.

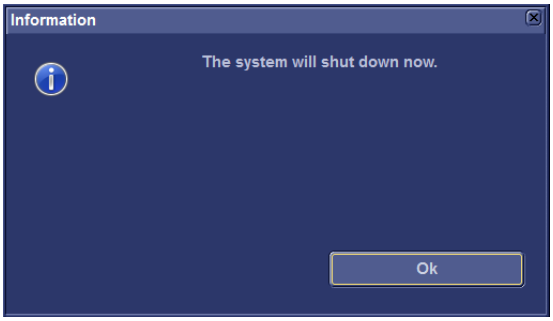


Figure 9-49. The System shutdown window

12. Select **OK** to shut down the system.
13. Restart the system.

    If connectivity configuration settings have been restored, make sure to save the TCP/IP settings: select **Config**/**Connectivity**/**TCPIP** and select **Save settings**. The system needs to be restarted again.

Configuration – Archiving

Archiving presets

1. Press **Utility**/**Config** from the Touch panel and log on as administrator if required.
2. Select the **Connectivity** category and **Formats** subgroup.

   The *Format* sheet is displayed.

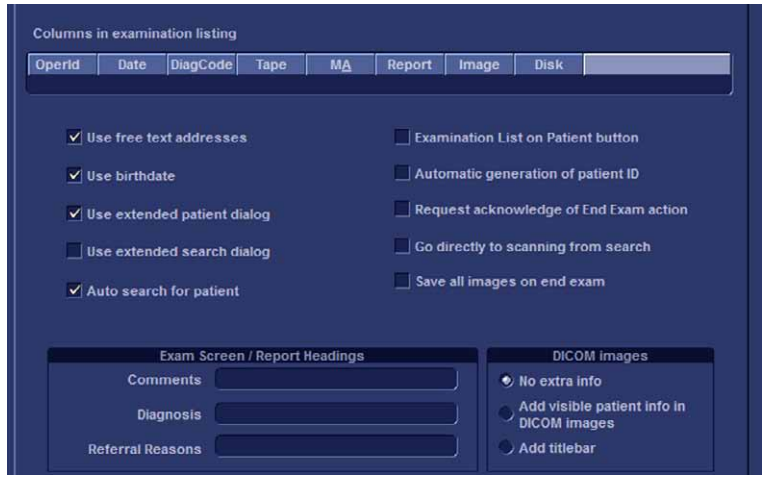


Figure 9-50. The Formats sheet

Configuration of the Examination list window

1. In the *Formats* sheet, select the column to edit.

   A sub-menu is displayed.
2. Select the action to perform:
   - **Insert**: creates a new column
   - **Delete**: removes selected column
   - Select the desired information to be displayed in the selected column.

Patient management presets

The following settings related to patient management can be adjusted:

Setting	Description
Use free text addresses	In the *Patient information* window: ☑: The address information (e.g. street, city...etc.) is entered in type-specific fields. ☐: The address information is entered in a single field (free text).
Use birthdate	In the *Patient information* window, enter either the patient age or the birthdate: ☑: Enter age (Birthdate field not available) ☐: Enter birthdate, the age is calculated.
Use extended patient dialog	In the *Patient information* window: ☑: The entire patient information data is displayed. ☐: Patient information data displayed is restricted to a minimum (i.e. name and Patient ID). When unchecked, press **More** to display the entire patient information data.
Use extended search dialog	In the *Search/Create Patient* window (see Figure 9-5 *on page 9-15*) and *Patient information* window, ☑: All the searching filters are displayed as default. ☐: The searching criteria are restricted to a minimum. When unchecked, press **More** to display all the searching filters.
Auto search for patient	In the *Search/Create Patient* window (see Figure 9-5 *on page 9-15*), ☑: The system searches automatically through the patient archive selected while entering patient information. ☐: The system searches through the patient archive after pressing **Enter** on the alphanumeric keyboard.
Examination list on Archive button	When a patient is selected, pressing **Patient** will: ☑: Open the *Examination list* window for the selected patient. ☐: Open the *Patient Information* window for the selected patient.
Automatic generation of patient ID	In the *Search/Create Patient* window (see Figure 9-5 *on page 9-15*), ☑: Patient ID is not required when entering a new patient in the archive. The system generates automatically an ID number. ☐: Patient ID is required when entering a new patient in the archive.

Setting	Description
Request acknowledge of End Exam action	☑: The user is asked to confirm action when ending an examination.
Go directly to scanning from search:	☑: The unit goes directly to the *Scanning screen* after creating a patient record. ☐: The unit displays the *Patient information* window after creating a patient record for further information entry. The user must press **Begin Exam** to enter the *Scanning screen*.
Save all images on end exam	☑: All images on the clipboard are automatically saved when ending an examination. ☐: A dialogue window is displayed when ending an exam where the user can select between: • Store all images • Select images to store • Store no images.
Exam screen/Report headings	Enter user-defined headings for Comments, Diagnosis and Referral reasons fields in the *Examination list* window and report.
DICOM images	Select between: • **No extra info** • **Add visible patient info in the DICOM images**: displays patient information (name, date of birth and ID) on DICOM images. • **Add titlebar**: adds the Titlebar to the DICOM images.

TCP/IP configuration

To be able to use the network functions when connected to a hospital network, the system must have a proper network address. See ‘Scanner’s TCP/IP settings’ on *page 9-37* for more information.

Dataflow

Communication between the Vivid T8/Vivid T8 Pro and other information providers on the network takes the form of dataflows. Each dataflow defines the transfer of patient information and images from an input source to the unit, and from the unit to one or several output sources. Input/output devices cannot be added/removed to/from the pre-defined dataflows. However the settings for the devices can be adjusted.

See ‘Dataflows available’ on *page 9-3* for a complete list and description of dataflows available.

Dataflow adjustments

1. Press **Utility**/**Config** on the Touch panel and log on as administrator if required.
2. Select the **Connectivity** category and **Dataflow** subgroup.

   The *Dataflow* sheet is displayed.

1. Select a dataflow to configure.
2. Use selected dataflow as default (see page 9-36).
3. Store data directly to archive.
4. Hide selected dataflow from the list of available dataflow.
5. Option for the search function. In the Search/Create patient window select between None, All patients and Today's patient.
6. Input/output devices assigned to the current dataflow.
7. Adjust the settings for the selected assigned device.

Figure 9-51. The Dataflow sheet

Adjusting the assigned devices

1. Select the device in the *Selected devices* field.
2. Press **Properties**.
   The *Properties* window is displayed.
3. Adjust the device specific parameters as desired (see table below). Not all the settings listed below apply to all devices.

General settings	Definition
Name	Free text: give a descriptive name for the device.
IP address	Select from drop-down menu
Db (Database) Name	Automatically selected according to the IP address
File destination	Automatically selected according to the IP address
Removable	Check the entry is the media is removable.
MPPS	Modality Perform Procedure Step: send information (typically to a HIS) that a scheduled exam has been started, performed or interrupted.

Image settings	Definition
Allow raw data	☑: Save data in both raw and DICOM format. ☐: Save data in DICOM format only.
Raw Compression	Enables compression of raw data images upon storage and export. Raw compression is active only if the setting *Allow raw data* is checked.
Max Frame rate	Select 25, 30 or Full (original acquisition) from the pop-up menu.
Compression	Select compression type or no compression.
Quality	Set picture quality from 1 to 100%. A low picture quality level allows high data compression, while a high picture quality restrains the compression.
Allow Multiframe	☑: Allow cineloop storage.

Connection settings	Definition
Retry	Set maximum number of connection retries, time interval between tentative and time-out.

Adjusting the assigned devices (continued)

DICOM settings	Definition
AE Title	The Application Entity Title is set during DICOM configuration. Refer to the network specifications.
Port No	The Port no. is allocated during DICOM configuration. Refer to your network specifications.
Verification	Verify the connection to another DICOM application
Storage commitment	Send a request to a PACS, asking it to permanently archive image(s)
MPPS	Modality Perform Procedure Step: send information (typically to a HIS) that a scheduled exam has been started, performed or interrupted.
DICOM SR settings	• **Allow SR**: enable DICOM SR. • **Allow SR private data**: send the current exam data in a private format. This option is by default unchecked and should only be used with DICOM storage devices that can handle private data format. • **Signed Doppler velocities**: send signed Doppler velocities. • **Use older SR version**: when checked a *Use older SR version* pull-down menu is displayed. The current exam data will be sent in the same format as the selected SR version. Details about format and content of the SR version can be found in the corresponding user manual of the selected version. See also ‘DICOM SR’ on *page 9-43*.

Remote path setting

The user can define a default remote path for a network shared folder (\\server-name\share-name). The remote path can then be selected as a destination archive for the following operations:

- Export traces function in Q-Analysis
- Export of system error log file
- Export of report templates
- Save as function for images
- Save as function for reports

NOTE: To export or save with Local USB Stick, please input \\127.0.0.1\MEMSTICK in remote path.

NOTE: To export or save with DVDRW, please input \\127.0.0.1\CDRW in remote path.

Remote path setting (continued)

To define a remote path:

1. Press **Utility**/**Config** on the Touch panel and log on as administrator if required.
2. Select the **Connectivity** category and **Tools** subgroup.

   The *Tool* sheet is displayed.

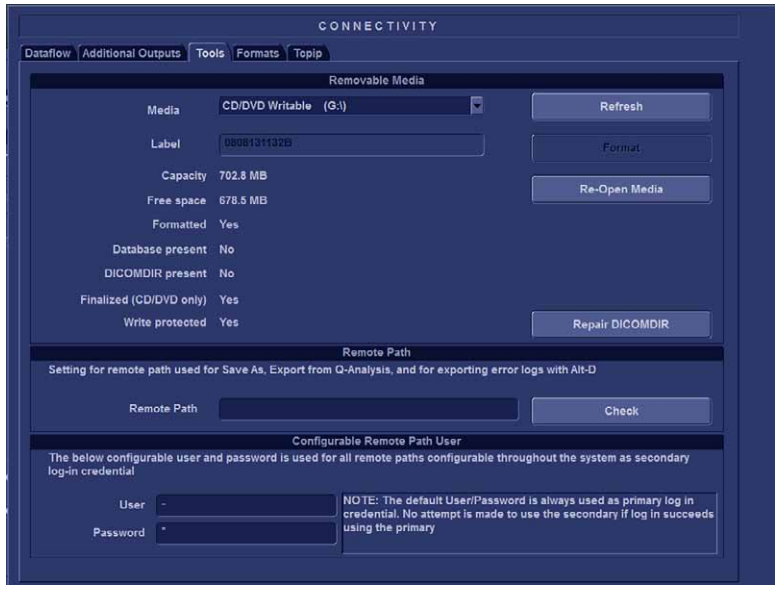


Figure 9-52. The Tools sheet

3. Enter a remote path of a shared folder on the network.

   To check the connection, press **Check**.

Export configuration

The destination for Export of patient records to Excel and MPEG must be configured prior to use. See ‘Exporting patient records/ examinations’ on *page 9-50* for a description of the Export function.

To configure the Export function:

1. Press **Utility**/**Config** on the Touch panel and log on as administrator.
2. Select the **Connectivity** category and **Dataflow** subgroup.

   The *Dataflow* sheet is displayed (Figure 9-53).
3. Select the dataflow **Misc. Export** in the *Name* pull-down menu.

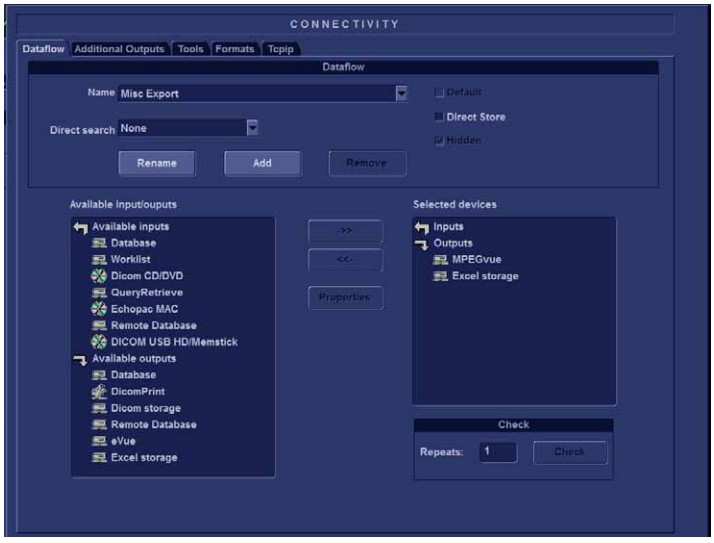


Figure 9-53. The Dataflow sheet

Export to Excel configuration

1. Select the **Excel storage** device in the *Selected devices pane* and press **Properties**.

   The *Excel properties* window is displayed.

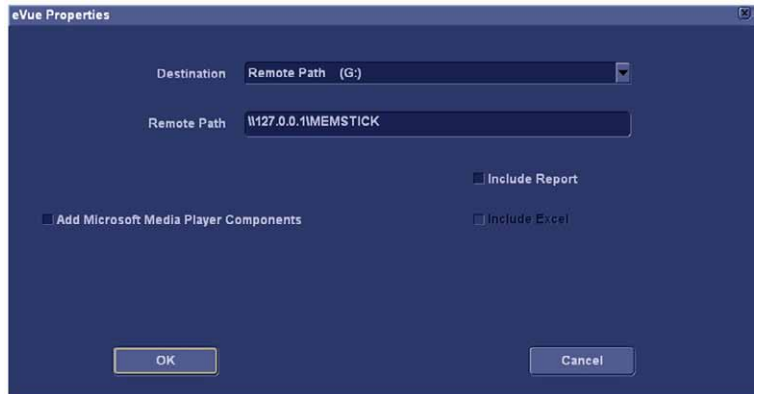


Figure 9-54. The Excel properties window

2. Select a network volume remote path as the destination in the *Destination* pull-down menu.

NOTE: *Remote paths of network volumes must be entered once in the Remote path field before they can be selected from the Destination pull-down menu. See 'Remote path setting' on page 9-81 for more information.*

3. Select **OK** and press **Config**.

Export to MPEGVue configuration

1. Select the **eVue** device in the *Selected devices pane* and press **Properties**.

   The *eVue properties* window is displayed.

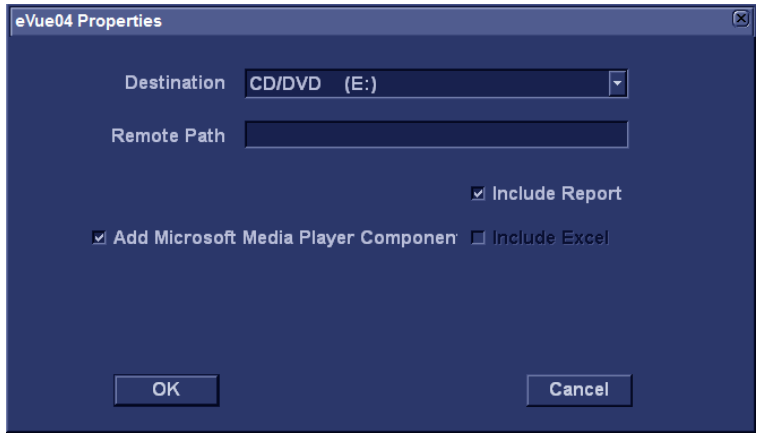


Figure 9-55. The MPEGVue properties window

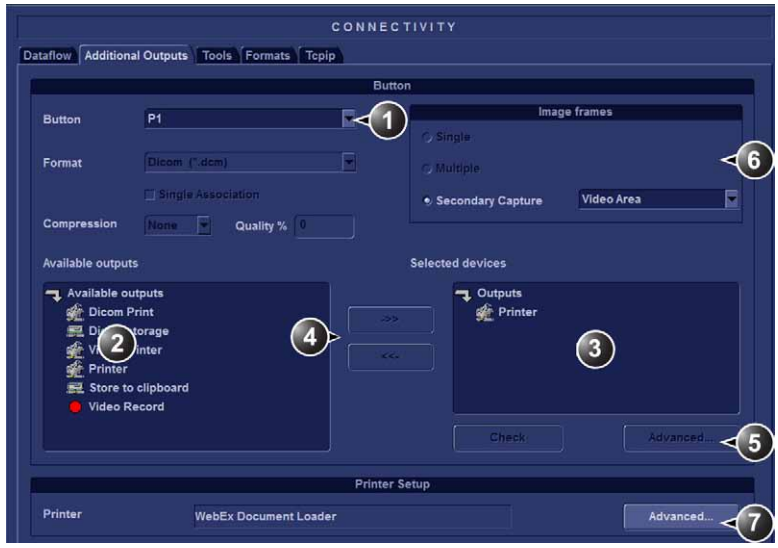
2. Select a removable media or a network volume remote path as the destination in the *Destination* pull-down menu.

NOTE: *Remote paths of network volumes must be entered once in the Remote path field before they can be selected from the Destination Pull-down menu.*

3. Check the options as required.
4. Select **OK** and press **Config**.

Additional Outputs

The *Additional Outputs* sheet deals with configuration of the **P1** and **P2** buttons on the Control panel. Several outputs (e.g. Video Print, Laser print, DICOM storage...etc.) can be associated to the buttons (i.e. pressing **P1** can result in printing to a printer and storage to a DICOM media).



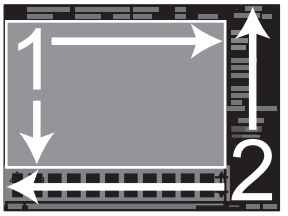
1. Select between **P1** and **P2** buttons.
2. Available output devices that can be assigned to the current button.
3. Output devices assigned to the current button.
4. Add or remove selected device to/from the current button.
5. Adjust the device settings for the selected assigned device.
6. Select the type of images to produce and adjust image settings.
7. Printer configuration (see ‘Printer configuration’ on *page 12-5*)

Figure 9-56. The Additional Outputs sheet

P1 / P2 button configuration

1. In *Button* field select **P1** or **P2**.
2. Select an output device in the *available outputs* field and press the **Right arrow** button to assign the device to the selected button.

   The *Properties* window for the selected device is displayed.
3. Adjust the device specific parameters and select **OK**.
4. Adjust the image specific parameters (see table below).

Configuration parameter	
Format	Select between: • Raw DICOM • DICOM
Image compression	Select compression mode from the pop-up menu.
Quality	When JPEG compression is selected, adjust the picture quality between 1 and 100%. A low picture quality level allows high data compression, while a high picture quality restrains the compression.
Image frames	Select between: • **Single**: stores single frame only • **Multiple**: stores cineloop • **Secondary Capture**: screen shot
Capture Area	Select between: • Video Area (1) • Whole Screen (2) 

To remove a device, select the device in the *Selected devices* field and press the **Left arrow** button.

Unlock patient record

If for any reason an examination is not properly finished, the patient record is locked and cannot be opened again unless it is unlocked.

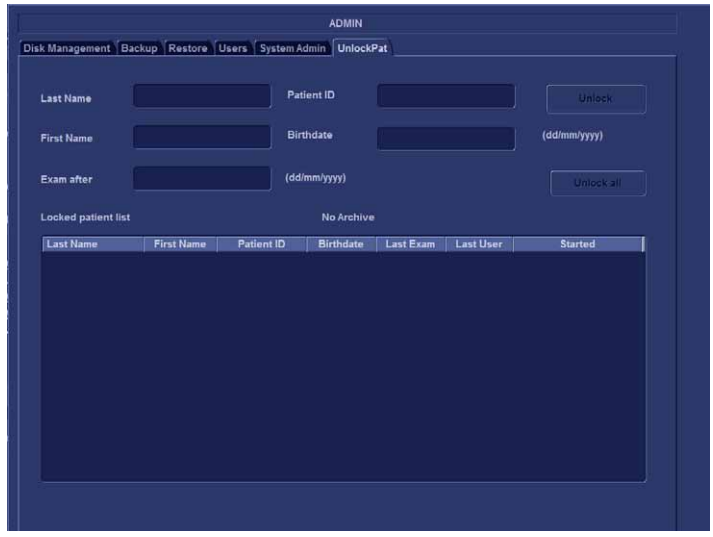


Figure 9-57. The Unlock patient sheet

To unlock patient records:

1. Press **Utility**/**Config** on the Touch panel.
2. Select the category **Admin**.
3. In the *Admin* category, select the sheet **Unlock Patient**.
4. In the *Unlock Patient* sheet, select the patient record(s) to unlock.

   You can search for a specific patient record or a group of patient record using the searching filters.
5. Select **Unlock** to unlock the selected patient record(s) or select **Unlock all** to unlock all patient records.

   A *Confirmation* window is displayed.
6. Select **OK**.

Chapter 10

Report

This chapter describes:

Introduction

The system enables the creation of patient and examination reports containing measurements, images and analysis that were made during the examination. The layout of the reports is defined by generic templates delivered with the system. Custom templates can also be made.

Saved reports are *read-only*. Therefore it is recommended that the data is carefully reviewed before the report is saved. Use the worksheet (see page 7-80) to facilitate the review and adjustment of data before generating a report. The final report can be printed on a regular printer.

NOTE: Report is an option for Vivid T8 Pro.

Creating a report

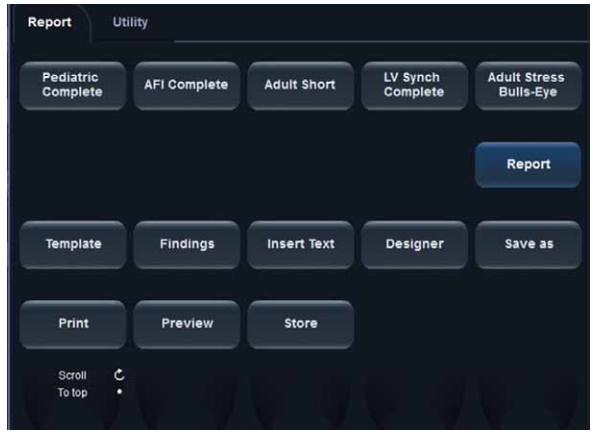
Reports summarize data obtained in the examination. They can contain data and images.

Once generated, the report can be viewed, images can be added, wall segment diagrams can be assigned and text can be entered in the free text fields. All other information must be changed from the *Patient information* window, the *Worksheet* screen or the *Structured Findings* screen.

Working with the report function

1. Press **Report** (available from the *Patient*, *Worksheet*, Control Panel or *Utility* Tab sheet on the Touch panel).

   The default template for the current examination is displayed (see Figure 10-1). The information entered during the examination is automatically filled in (e.g. demographic, Diagnosis, Comments...etc.).



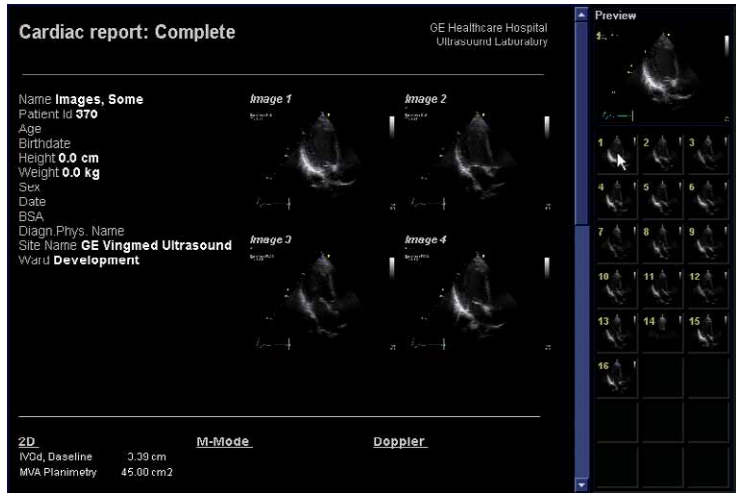


Figure 10-1. The Report screen

To choose another report template

1. Press **Template**.

   The *Template selection* menu is displayed showing the available report templates organized by application.

NOTE: The Template selection menu can be configured to display only the templates of interest (see page 10-45).

2. Do one of the following:

   - Select a template from the current application template list.
   - Select another application and select the desired template from the sub-menu displayed.

   The selected template is displayed on the screen.

NOTE: The five last used templates can be selected directly from the Touch panel.

To change patient information

1. Select the heading of the information to change.

   The *Patient information* screen is displayed.
2. Change the information as required.
3. Press **Report** when completed.

   The user is asked to confirm the changes.
4. Select **OK** to confirm or **Cancel** to abort.

Images in the report

1. To add an image to the report, place the pointer over an image in the clipboard and double-click the **Set** key.

   The image is inserted into the first free image container in the report.
2. To move an image in the report, select and drag the image to move it to a new image container.
3. To replace an image in the report, select and drag an image from the clipboard over the image to replace in the report.
4. To remove an image from the report, select and drag the image to remove outside the report page.

To print a report

Only members of the user group “Cardiologist” are allowed to print a report (see ‘System users’ on *page 3-29*).

1. Press **Print**.

   The report is printed on the default printer. A status window is displayed showing the printing process.

   For printer configuration, see ‘Printer configuration’ on *page 12-5*.

To store a report

Only members of the user group “Cardiologist” are allowed to store a report (see ‘System users’ on *page 3-29*).

1. Press **Store** on the touch panel.

   The report is stored in the Report archive.

Alternative storage

Reports can also be saved in a user-defined locations in the following formats:

- **Compiled HTML (.CHM) files**: readable from any web browser.
- **Portable Document Format (.PDF) files**: readable with Adobe Acrobat reader.
- **Text (.TXT) files**: only text data is saved; readable with a text editor.

1. Press **Save as**.

   The *Save as dialogue* window is displayed.

2. Select the destination folder from the *Save in archive* pull down menu.

NOTE: *To configure the default remote path, see ‘Remote path setting’ on page 9-81.*

3. Select **PDF**, **CHM** or **TXT** format.
4. Press **Save**.

Retrieving an archived report

1. Press **Retrieve**.

   A list of the available reports for the actual examination is displayed.

   The default name for a report is of type:
   <template type>_<store date>_<store time>.
2. Select the report to retrieve.

*NOTE: To display the current report, select **Show active exam**.*

Deleting an archived report

Only members of the user group “Cardiologist” are allowed to delete a report (see ‘System users’ on *page 3-29*).

1. Press **Delete**.

   A list of the available reports for the actual examination is displayed.

   The default name for a report is of type:
   <template type>_<store date>_<store time>.
2. Select the report to delete.

Structured Findings

Structured Findings is a feature that enables the user to insert pre-configured structured diagnostic statements and codes (e.g Billing, Accreditation) in the patient report and create a conclusion based on the inserted statements.

Prerequisite

To be able to insert structured diagnostic statements and create a conclusion in a patient record, the report template used must have assigned fields for the structured findings, the codes and the conclusion.

NOTE: Factory templates have Findings and Conclusion fields.

To create the assigned fields in a user-defined report template:

1. Press **Report** (available from the *Patient*, *Worksheet*, Control Panel or *Utility* Tab sheet on the Touch panel).
2. Press **Template** and select the desired report template.
3. Press **Designer**.

   The *Report designer* screen is displayed.
4. Select the location in the report template where to insert the Structured findings fields.
5. Select **Insert** and **Archive Information**.

   The *Archive information* box is displayed (Figure 10-2).
6. Double-click on **Select All** under all three parameter fields in the *Archive information* box to deselect all parameters.
7. Select **Structured findings**, **Findings conclusion Indication codes** and **Billing codes** in the *Exam Information* field (Figure 10-2).
8. Select **OK**.
9. Save the Report template and exit the Report designer.

Prerequisite (continued)

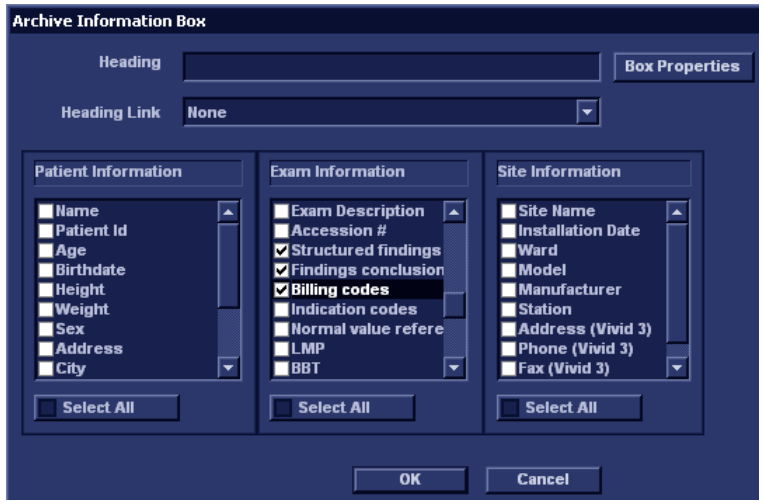


Figure 10-2. The Archive information box

Starting Structured Findings

1. Press **Report**.

   Make sure the current template has a Structured Findings field and a Conclusion field defined or select another template if necessary.

2. Press **Findings** or select the header of the Findings box in the report.

   The *Structured Findings* window is displayed (Figure 10-5).

Structured Findings structure

The diagnostic statements are organized in tab folders (see Figure 10-3). Each tab folder may contain:

- Underlying tab folders that contain Tab sheets.
- Tab sheets that contain diagnostic statements.

1. Tab folder with underlying tab sheets
2. Tab sheet

Figure 10-3. Structured findings structure

There are three types of diagnostic statements (see Figure 10-4):

- Check box statement: when selected the statement is included in the report.
- Combo box statement: create a statement by selecting one alternative text among several choices.
- Statement group: create several statements by selecting multiple check box statements.

1. Check box statement
2. Combo box statement

Figure 10-4. Diagnostic statement types

Using Structured Findings

1. Start Structured Findings (see page 10-9).
2. Browse to the tab sheet containing the statements of interest.
3. To insert a statement in the report (Findings field):
   - Check box statement: select the statement.
   - Combo box statement: select an alternative text in the combo box next to the statement.
   - Statement group: select the statements of interest within the group.

   A preview of the selected statement(s) is displayed in the *Findings preview* field (see Figure 10-5). The statement text in the preview field can be edited. This will apply only for the current report.

   Once a statement is selected an asterisk is displayed on the tab of the current sheet and folder.

NOTE: *Select **Normal** to select only normal statements from the current tab sheet (see page 10-17 for more information on how to define normal statements).*

NOTE: *Select **Clear** to deselect all statements from the current tab sheet.*

To insert a conclusion statement in the report:

- Press the Conclusion button.

A preview of the selected conclusion statement is displayed in the *Conclusion preview* field (see Figure 10-5). Conclusion statements are displayed in a numbered list.

The list can be reordered: triple-click on the conclusion statement to move in the *Conclusion preview* field and use the **Arrow up** or **Arrow down** key to move the statement up or down.

The conclusion text in the preview field can be edited. This will apply only for the current report.

To display the changes in the report, select **Refresh report**.

NOTE: *Pressing the Conclusion button in front of a statement that was not previously selected results in simultaneously inserting the finding statement and create the conclusion.*

Using Structured Findings (continued)

4. Press **Close**.

   The report for the current patient is displayed with the selected findings, conclusion statement(s) and associated codes (if any).

NOTE: Some diagnostic statements have measurements values in the body text referred by a tag (e.g the {EF} tag refers to EF measurement). These statements require that the actual measurement is done to display correctly in the report.

1. Statement inserted in the Conclusion and Findings field.
2. Statement inserted in the Findings field only.
3. Findings preview field
4. Conclusion preview field
5. Remove all selections.
6. Insert normal findings for the current tab sheet.
7. Create and add a statement. The statement will be available only for the current examination.

Figure 10-5. Structured Findings window

Global selection of normal statements

It is possible to select all normal statements from all tab sheets belonging to the current top tab sheet.

1. Place the cursor in the *Statement* field, press **Update menu** on the control panel and select **Normal**.

   All statements defined as normal are selected from all the tab sheets. An asterisk is displayed on the tab of all the tab sheets that contain normal statements.

NOTE: This operation will remove any other "non-normal" previously selected statements.

2. To remove all statements at once, place the cursor in the *Statement* field, press **Update menu** and select **Clear**.

Structured Findings configuration

Structured Findings configuration is used to:

- Create, edit or delete finding statements, conclusion statements and codes.
- Organize the diagnostic statements in the *Structured Findings* screen.
- Define the normal diagnostic statements.

Accessing the Structured Findings configuration screen

1. Press **Utility**/**Config** on the Touch panel and select the **Report** category.
2. Select the **Structured Findings** tab.

   The *Structured Findings* configuration screen is displayed (Figure 10-6).

Or from within Structured Findings:

1. Press **Update menu** on the control panel and select **Config**.

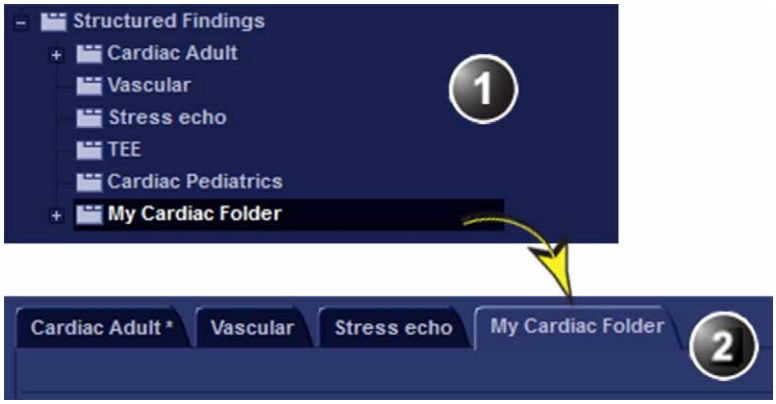
Accessing the Structured Findings configuration screen (continued)

1. Structured Findings structure tree:
   - Tab folder
   - Tab sheet
   - Check box statement
   - Combo box statement
   - Statement group
2. Tab or statement label
3. Findings text
4. Conclusion text
5. Codes for the selected statement
6. Create, move, copy or delete statement
7. Create folder, Combo box or statement groups
8. Enter a variable in statement or conclusion text
9. Hide selected tab or statement from the Structured Finding window
10. Set the selected statement as normal
11. Rest factory default findings
12. Export/import findings.

Figure 10-6. Structured Findings configuration screen

Creation of a tab folder

The following procedure describes how to create a new top level tab folder.



1. Configuration window
2. Structured findings window

Figure 10-7. New tab folder

1. In the *Structured Findings* configuration window (Figure 10-6), select the Structured Findings tab folder.
2. Select **Add**.

   A new entry is created in the Structured Findings tab folder. The new entry is by default a tab sheet ( ).
3. Select **Enable one more tab level** to change the new entry to a tab folder ( ).

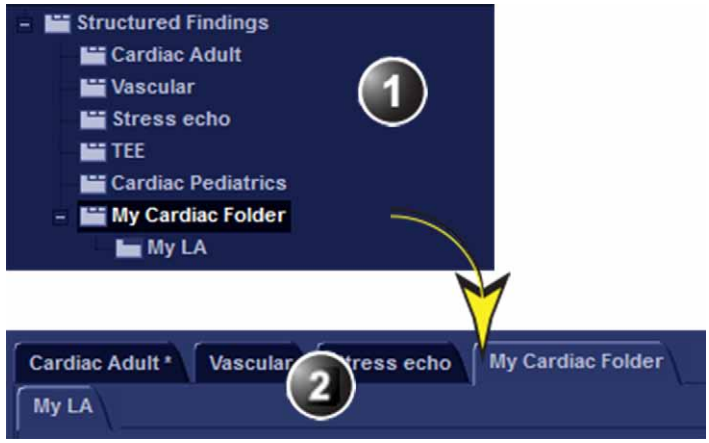
   If a warning message is displayed, select **Yes**.
4. With the new entry selected, follow the following steps:
   - Enter a name in the *Label* field (tab name).
   - Enter a description in the *Findings text* field. The description will be displayed in the report as a heading when selecting a statement from the underlying tab sheets. The system is always using the Findings text from the highest item in the structure as a heading for the selected underlying statements.
   - Enter the appropriate codes.

NOTE: To enter several codes separate each code by a space.

5. Press **Up** or **Down** to move the tab in the structure tree (or do drag and drop).

Creation of a tab sheet

The following procedure described how to create a tab sheet in a tab folder.



1. Configuration window
2. Structured findings window

Figure 10-8. New tab sheet

1. Make sure that the tab folder is selected and press **Add**.

   A new entry is created in the tab folder. The new entry is by default a tab sheet ( ).
2. With the new entry selected, follow the following steps:

   - Enter a name in the *Label* field (tab name).
   - Enter a description in the *Findings text* field.

   If required:

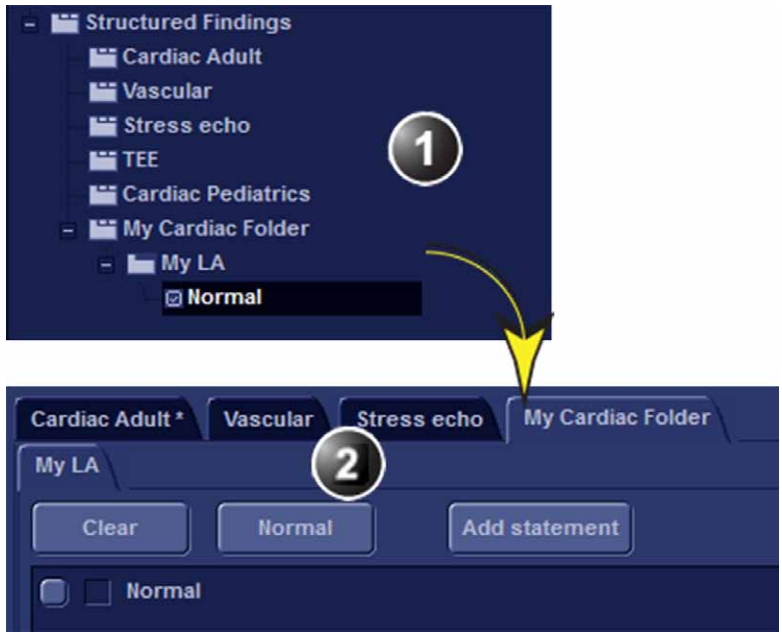
   - Enter the appropriate codes.

NOTE: To enter several codes separate each code by a space.

Adding statements in the tab sheet

Check box statement

The following procedure describes how to create a check box statement.



1. Configuration window
2. Structured findings window

Figure 10-9. New check box statement

1. Make sure that the tab sheet is selected and press **Add**.

   A new entry is created in the tab sheet. The new entry is by default a check box statement ( ).
2. With the new entry selected, follow the following steps:
   - Enter a name in the *Label* field (statement name).
   - Enter the full statement in the *Findings text* field.
   - Enter a conclusion in the *Conclusion text* field (optional).

NOTE: *If the Conclusion text field is left empty, the statement text will be used as conclusion when selected.*

Check box statement (continued)

If required:

- Enter the appropriate codes.

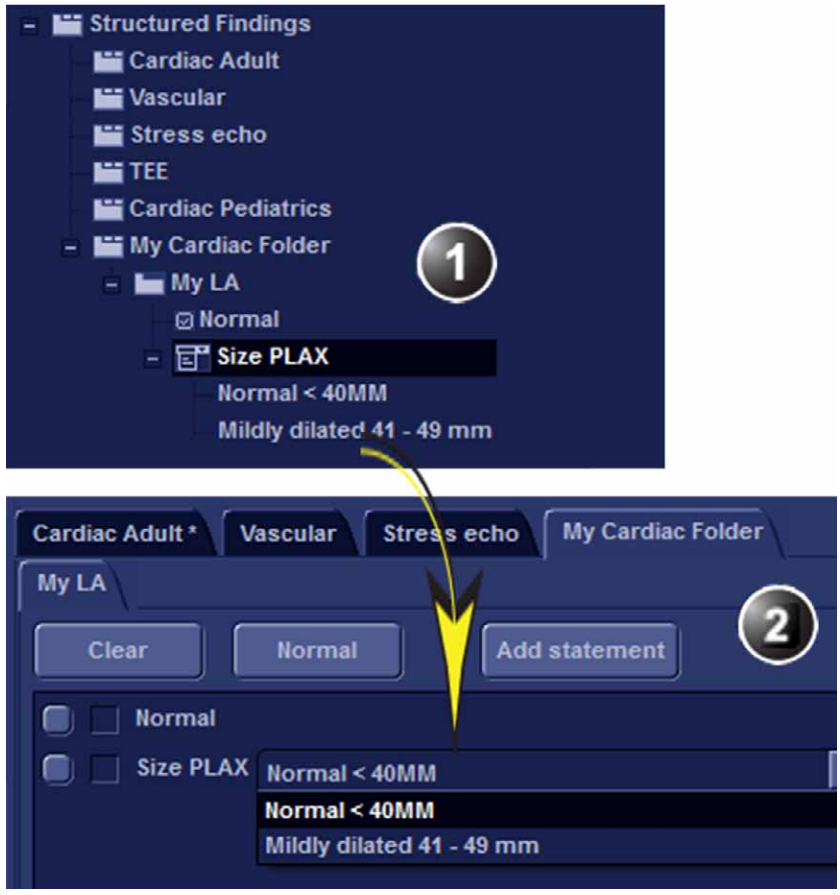
NOTE: To enter several codes separate each code by a space.

- Check **Include findings in normal report** to define the statement as normal.

  All statements within the selected tab sheet that have this option checked will be included in the report when **Normal** is selected in the *Structured Findings* window (see ‘Using Structured Findings’ on *page 10-11*).

Combo box statement

The following procedure describes how to create a combo box statement.



1. Configuration window
2. Structured findings window

Figure 10-10. New combo box statement

Combo box statement (continued)

1. Create a new statement as described above. A check box statement is created by default.
2. With the new statement selected, press **Add**.

   A new underlying entry is created and the parent statement is changed to a Combo box statement ( ).
3. With the new underlying entry selected, follow the following steps:
   - Enter a name in the *Label* field.
   - Enter a text in the *Findings text* field.
   - Enter a conclusion in the *Conclusion text* field (optional).
4. Repeat the procedure from step 2 to create as many underlying statements as necessary. Each underlying statement will be a selectable entry in the combo box.

Statement group

Statement groups are created by changing a combo statement to a statement group.

1. Create a combo box statement as described above.
2. Make sure the combo box statement is selected and deselect the option **Enable pull-downs**.

   The combo box statement is changed to a statement group ( ). Each underlaying entries are changed to check box statements.

Editing a statement

Tab label, statements and statement alternative texts can be edited.

1. In the *Structured Findings* configuration window (Figure 10-6), select the item to edit.
2. Make the required changes.

Inserting variable parameters in a statement

Variable parameters such as patient name, institution name, measurement values...etc can be inserted in a statement as tagged information.

To insert variable parameters in a statement:

1. Place the cursor at the required position in the *Findings text* field (or *Conclusion text* field).
2. Press **Insert parameter**.

   The *Insert parameter* window is displayed (see Figure 10-11).

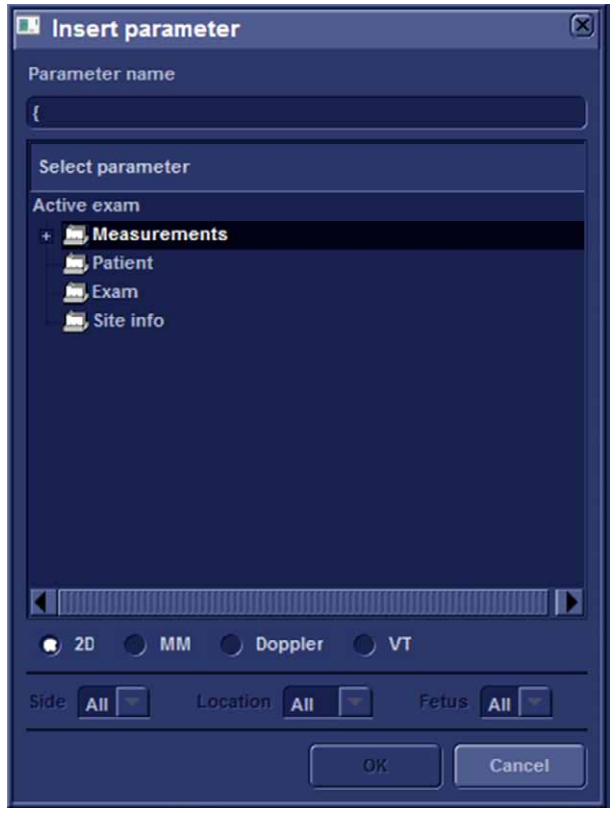


Figure 10-11. Insert parameter window

Inserting variable parameters in a statement (continued)

3. Browse and select the actual parameter to insert.

NOTE: For measurement values, select first the scanning mode.

4. Press **OK**.

NOTE: To display correctly in the report, the actual parameter value must exist, e.g. if a measurement value is included in a statement as a variable parameter, a measurement value must exist for the current patient, otherwise the parameter name is displayed.

5. If the selected parameter can be measured/calculated by different methods, the user is asked to select the preferred parameter to insert (Figure 10-12). Move the preferred parameter as first item in the list displayed and select **OK**.

   The selected parameter is inserted in the statement as a tag (e.g the {EF} tag refers to EF measurement)

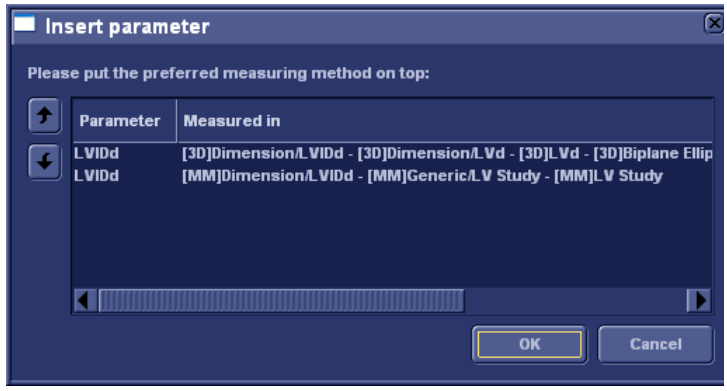


Figure 10-12. The parameter list

Copy of a statement

Tab folders, tab sheets and statements can be copied from one location to another. The word “Copied” is added to the copied item name.

1. In the *Structured Findings* configuration window (Figure 10-6), select the item to copy.
2. Select **Copy**.
3. Select the item to contain the copy.
4. Select **Paste**.

NOTE: If the item to copy cannot be copied in the selected location, the operation is ignored.

*NOTE: Copy can be done by drag-and-drop, while holding **Ctrl** depressed.*

Deletion of a statement

Tab folders, tab sheets and statements can be deleted.

Deletion cannot be undone.

1. In the *Structured Findings* configuration window (Figure 10-6), select the item to delete.
2. Select **Delete**.

   The selected item is deleted.

Factory reset

All statements can be reset back to the factory default.

Factory reset cannot be undone.

1. Select **Reset**.
   The *Reset statements* window is displayed.
2. Select:
   - **Yes** to reset all statement to the factory default (No undo).
   - **No** to cancel the operation.

Exporting/Importing statements

Diagnostic statements can be exported from one system and imported on another system.

Exporting statements

1. In the *Structured Findings* configuration window (Figure 10-6), select **Export**.
   A browsing window is displayed.
2. Browse to a destination and select **Save**.

Importing statements

1. In the *Structured Findings* configuration window (Figure 10-6), select **Import**.
   A browsing window is displayed.
2. Browse to a destination and select **Open**.
3. Select one of the following options
   - **Insert**: the statements are imported in a new top tab sheet, keeping the current statements in place.
   - **Replace**: the imported statements replace the existing ones.
   - **Cancel**: cancel the import.

Direct report

Direct report enables the user to insert comments at any time during the examination that will be part of the final report.

Direct report provides also an overview over the measurements completed.

Creating comments

1. Press **Freeze**.
2. Press **Utility**.
3. Select **Direct report**.
4. In the *Direct report* screen, select the comment type.
5. Type your comments in the *Text* field.
6. To add a measurement in the comment, double-click a measurement in the *Measurement overview* field.

1. Select the type of information
2. Create/insert pre-defined text
3. Text field
4. List of measurements completed
5. Exits the Direct report

Figure 10-13. The Direct report

Inserting pre-defined text input

1. Select the insertion point in the *Text* field.
2. Select **Insert text**.

   The *Insert text* window is displayed (see Figure 10-14).

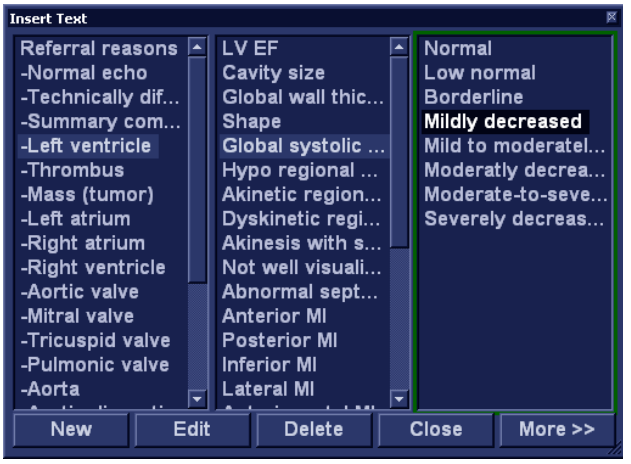


Figure 10-14. The Insert text window

   The pre-defined text list is organized in a three level hierarchy. Selecting one item in the first column displays pre-defined text entries related to the selected text in the second and third column.

3. Navigate through the pre-defined text list by selecting items in the columns and double-click on the desired pre-defined text to be inserted. If an entry in the third column is inserted, the selected text in the second column is also inserted.

   Press **More>>** to display the full text for the selected entry.

Creating pre-defined text inputs

This feature is described in ‘Creating, editing and deleting text input’ on *page 9-19*.

Report designer

The Report designer software package enables the user to create report templates that best suit its needs.

Designing a report template consists of choosing the information to display in the report (e.g. header, footer, logo, patient information, images, measurements...etc.) and arrange it in the report viewer.

The Report designer function is based on the information container concept: each type of information is included within a container with parameters that can be configured (size, color, font properties, information to display...etc.).

Accessing the Report designer

1. Press **Report** on the Control Panel.

   or

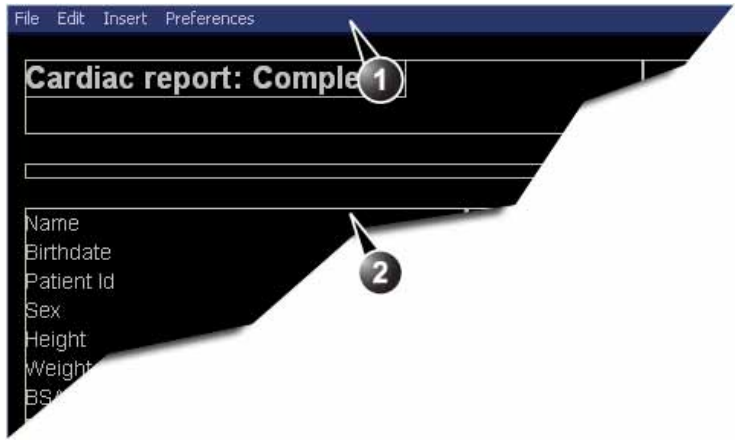
   Press **Utility/Report** on the Touch Panel.

   The *Report* screen is displayed.
2. Press **Designer**.

   The *Report designer* screen is displayed with the selected template in the *Report template design area* (see Figure 10-15).

Report designer overview

The Report designer screen



1. Menu bar
2. Report template design area

Figure 10-15. The Report designer screen

The menu bar

Menu	Description
File	• **New**: start working on an new template. • **Save**: save the template using the same name. Factory report templates cannot be overwritten. • **Save as**: save the template using a new name. • **Page setup**: define printing orientation and header/footer for the printed report. • **Print Preview**: display a print preview of the report template. • **Exit**: exit the Report designer and returns to the report function. The user can choose whether to save the updates or restore the original template.

Menu	Description
Edit	• **Delete**: remove the selected object from the report template. • **Undo**: restore the previous state of the report template.

Menu	Description
Insert	• **Page Break**: insert a new page in the report template. • **Table**: configure and insert a table in the report template. • **Logo**: select and insert a logo to the report template. • **Archive info**: select and insert data from the following categories: Patient information Exam information Site information • **Anatomical graphics**: select and insert an anatomical graphic (cardiac, vascular or TEE). • **Image**: create a container for the display of ultrasound images. • **Wall motion analysis**: insert a container for the display of Stress Echo analysis results (cut planes Bull's eye and scoring table). • **OB/GYN**: insert OB graph. • **Measurements**: insert a container for the display of measurements and calculations. When creating a measurement container, the user is prompted through a configuration procedure enabling the selection of mode specific measurements and/or calculations. • **Text field**: insert a container where the user can write in the report. • **Fixed text**: insert a container with static text. The text typed during the creation of the container will be displayed in the report.

Menu	Description
Preferences	• **Page Color**: sets the default background color for the template page.

Designing a report template

Starting template designing

1. Start the Report designer (see page 10-27).
2. Press **File** and select **New** to display a blank page or use the current report template as basis template.

Setting the layout preferences

Adjusting the report page color background

1. Press **Preferences** and select **Page Color**.
   The *Color selection* window is displayed.
2. Select the desired color.
3. Press **OK**.

Header and footer in the printed report

This function is described on page 10-41.

Inserting an information container in the report template body

The different types of information to be included in a report are grouped in information containers. Designing a report template consists in inserting and configuring the different information containers in the template page in an ordered manner.

Information containers can be inserted either:

- Directly into the report template body: this procedure does not allow side-by-side insertion, the information container will normally cover the width of the report template page.
- Within a table: this procedure allows side-by-side insertion of several information containers.

Inserting a table

1. Place the cursor at the desired insertion point in the *Report template design area*.
2. Press **Insert** and select **Table**.

   The *Container properties* window is displayed (see Figure 10-16).
3. Adjust the parameters as desired.
4. Press **OK**.

   The table is displayed in the template.

NOTE: To modify an inserted table, double-click in an empty area in the table. A selection menu is displayed where the user can add, delete a row or a column or open the Table properties window.

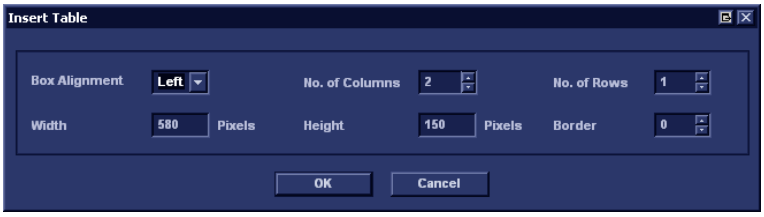


Figure 10-16. The Table properties window

Inserting a logo

1. Provide the hospital logo in JPEG or Bitmap format onto a removable media.
2. Select the location where to insert the logo (a table cell or directly in the report template).
3. Select **Insert** and **Logo**.

   The *Logo* box is displayed.

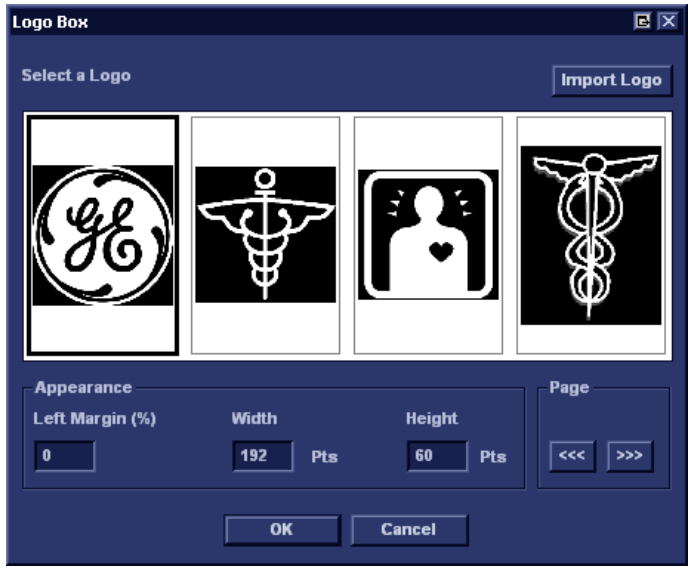


Figure 10-17. The logo box

4. Select a logo, or if not available, select **Import logo**.

   Browse and select the logo and select **OK**.
5. Specify the appearance.
6. Select **OK**.

Inserting fixed text

Fixed text is an entry that cannot be changed in the report (e.g. hospital information).

1. Select the location where to insert the fixed text (a table cell or directly in the report template).
2. Select **Insert** and **Fixed text**.

   The *Fixed text* box is displayed.

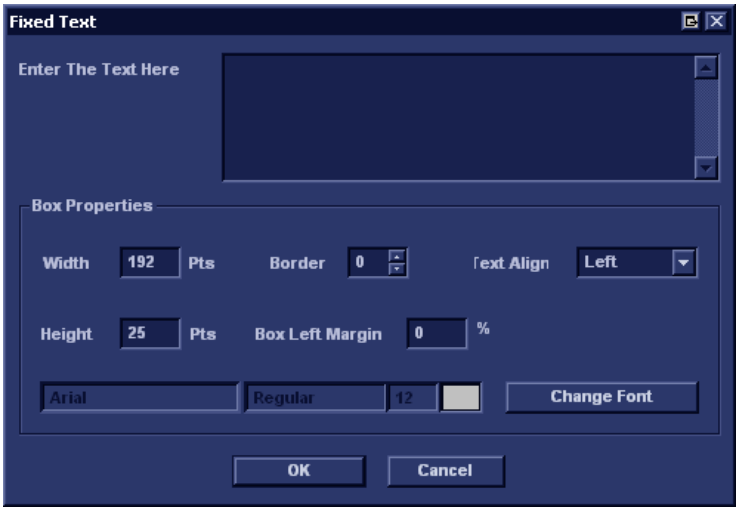


Figure 10-18. The Fixed text box

3. Enter the text and specify the appearance.
4. Select **OK**.

Inserting archive information

Archive information contains all the objects of the different information menus (Patient, Exam, Study and Site Information).

You may display the archive information over two columns using a table container as described below.

1. Insert a table for the archive information to the desired location (a table cell or directly in the report template).
2. Select the first table cell.
3. Select **Insert** and **Archive information**.

   The *Archive information* box is displayed.

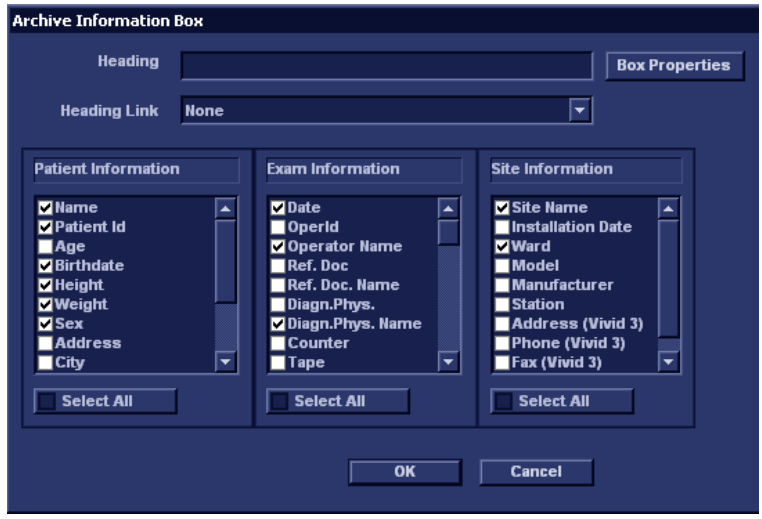


Figure 10-19. The Archive information box

4. If desired, enter a heading and select a heading link from the pull-down menu.
5. Select the Information parameters to be displayed in the first cell.

   Select **Box properties** to change the font, alignment, appearance, etc.
6. Select **OK**.
7. Select the next table cell and repeat steps 3 to 6 to enter the remaining archive information.

Inserting an Image container

- Select the location where to insert the fixed text (a table cell or directly in the report template).
- Select **Insert** and **Image**.

  The *Ultrasound image* box is displayed.

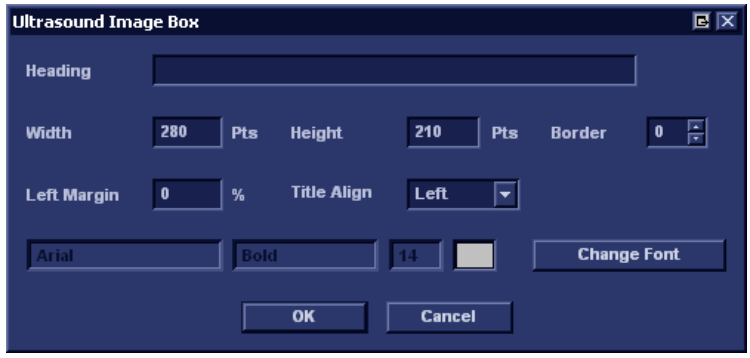


Figure 10-20. The Ultrasound image box

- If desired, enter a heading, set the container size and specify the text appearance.
- Select **OK**.

Inserting a measurement container

You may display the measurements over several columns using a table container as described below.

1. Insert a table for the measurements to the desired location.
2. Select the first table cell.
3. Select **Insert** and **Measurements**.

   The *Measurements* box is displayed.

Inserting a measurement container (continued)

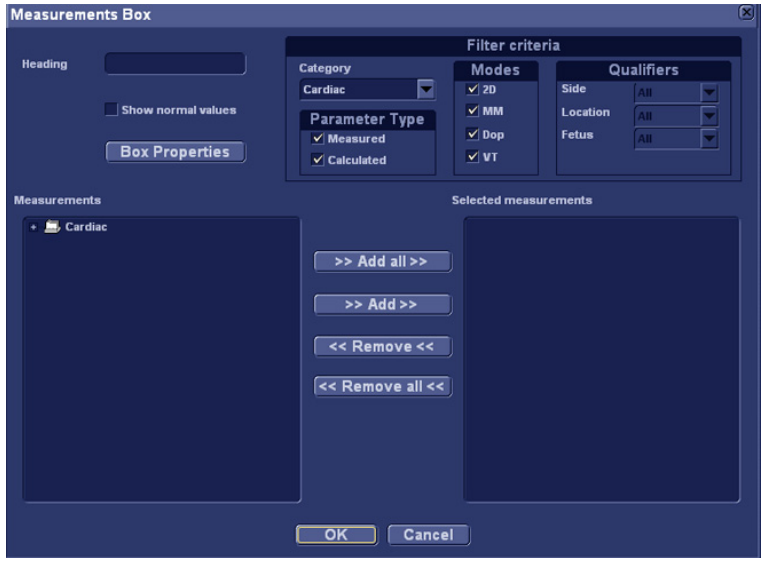


Figure 10-21. The Measurements box

4. Enter a heading (e.g. 2D).
5. Using the *Filter criteria*, define the type of measurements to be displayed (e.g. Cardiac, 2D, measured and calculated).

   Select **Show normal value** to display user-defined Normal value next to the measurements in the Report (see 'Normal values' on *page 7-76* for more information).

NOTE: *References for the normal values can be displayed in the report by checking **Normal value references** from **Insert** -> **Archive Info** (see page 10-34).*

   The *Measurement* list on the left side is updated.
6. From the measurement list, select the measurement to insert and press **Add**. Both single measurements or a folder may be added.
7. The list of the inserted measurements is displayed in the *Selected measurement* list on the right side.
8. Press **OK**.
9. Select the next table cell and repeat steps 3 to 8 to insert several measurements.

Inserting Text fields

Text fields are:

- Containers for Referral reasons, Comments and Diagnosis information.
- Containers for free text, where the user can type information in the report.

1. Select the location where to insert the text field container (a table cell or directly in the report template).
2. Select **Insert** and **Text field**.

   The *Text field* box is displayed.

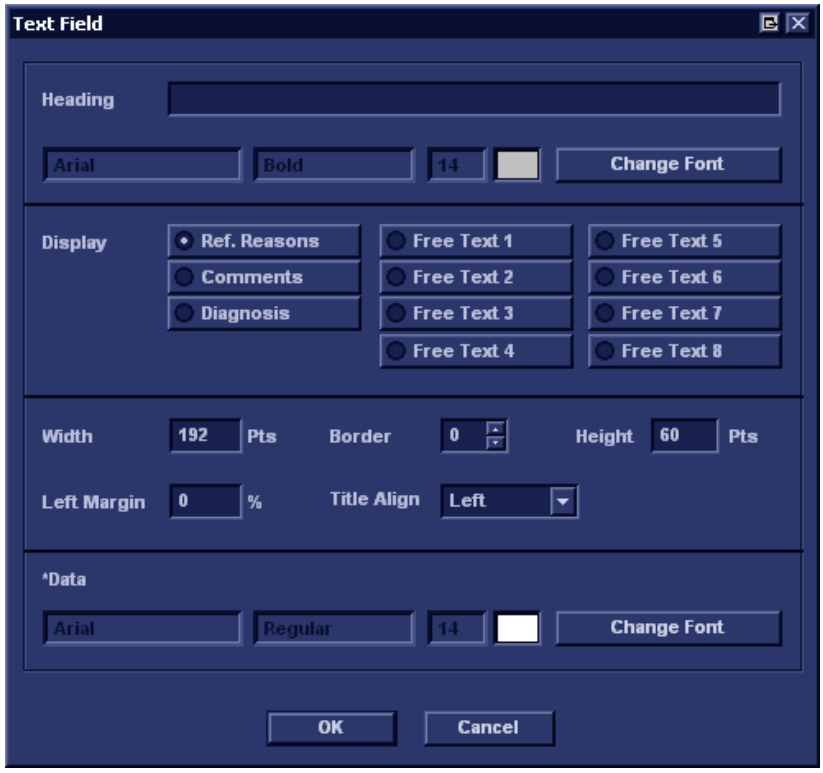


Figure 10-22. The Text field box

Inserting Text fields (continued)

3. Enter a heading.
4. From the *Display* field, select between:
   - **Referral reasons**: displays the information entered in the Direct report (see page 10-25) or in the *Examination list* window.
   - **Comments**: displays the information entered in the Direct report (see page 10-25) or in the *Examination list* window.
   - **Diagnosis**: displays the information entered in the Direct report (see page 10-25) or in the *Examination list* window.
   - **Free text 1-8**: creates an empty free text container.
5. If desired, adjust the font settings for the header and data.

Inserting Wall motion scoring analysis containers

Two different containers must be inserted for the Wall motion scoring analysis:

- A Wall motion scoring diagrams container (Cut planes or Bull's eyes)
- A Wall motion scoring table

Inserting Wall motion scoring diagrams container

1. Select the location where to insert the free text container (a table cell or directly in the report template).
2. Select **Insert**, **Wall motion analysis** and select between **Cut planes** and **Bull's eye**.

   The corresponding *Wall motion scoring* box is displayed.

Figure 10-23. The Wall motion scoring box (Cut planes)

3. Adjust the parameters and select **OK**:

   The scoring diagrams are inserted in the report template

Inserting Wall motion scoring table container

1. Place the cursor right below the *Wall motion scoring diagrams* container.
2. Select **Insert**, **Wall motion analysis** and select **Score table** box.

   The *Score table* box is displayed.

Figure 10-24. The Score table box

3. Adjust the layout parameters in the *Score table* box and select **OK**.

   The Score table is inserted in the report template.

Editing the information container

Resizing the information container

1. Move the cursor over the border of the container to resize.

   The mouse cursor is changed to a cross ✣.
2. Press **Set**.

   The container is displayed with anchor squares on the sides and at the corners.
3. Resize the container by dragging from the anchor points.

Editing the information container properties

1. Double-click in the container to edit and select **Properties**.

   The *Properties* window is displayed.
2. Adjust the parameters specific to the selected container.

NOTE: *Some information containers have additional parameters that may be adjusted by selecting **Box properties**.*

Inserting a new page

1. Place the cursor at the desired insertion point in the *Report template design area*.
2. Press **Insert** and select **Page Break**.

Inserting header and footer

Header and footer may be defined to be displayed in the printed report. The header and footer are not visible in the on screen report.

To insert header and footer in the printed report:

1. Select **File** and **Page setup**.
   The Page setup box is displayed.

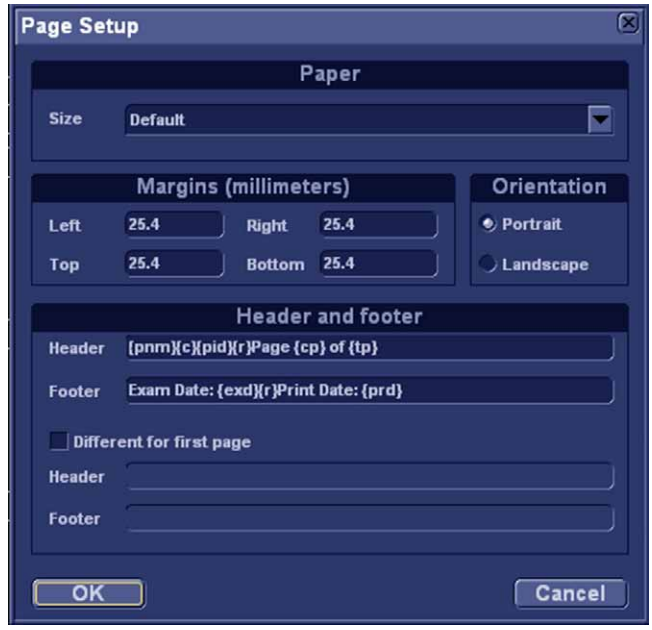


Figure 10-25. The Page setup box

2. Adjust the printing orientation.
3. Define the header and footer for the printed report, by typing text and entering the required variables listed in the table below.
   Check **Different on first page** and create a specific header/ footer for the first page.

Inserting header and footer (continued)

4. Select **OK**.

   To check the display of the header and footer, select **File** and **Print preview**.

Variable	Description
{pid}	Patient ID
{pnm}	Patient name
{pdb}	Patient date of birth
{exd}	Examination date
{prd}	Current date (printing date)
{prt}	Current time (printing time)
{cp}	Current page
{tp}	Page count
{c}	Subsequent entries are centered
{r}	Subsequent entries are right aligned

Saving the report template

Replace an existing template

Factory templates cannot be overwritten.

1. Press **File** and select **Save**.

   A dialogue window is displayed asking for confirmation.
2. Select:

   - **Yes** to save the report template
   - **No** to discard the report template
   - **Cancel** to go back to the Report designer without saving the report template.

Save existing template with a new name

1. Press **File** and select **Save as**.
   The *Save as template* window is displayed.

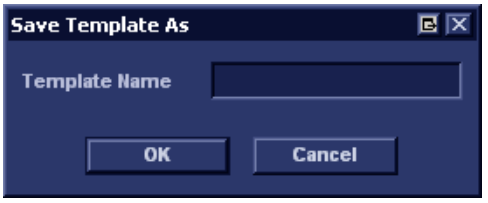


Figure 10-26. The Save as template window

2. Enter a name for the template.
3. Press **OK**.
   The template is saved.

To exit the Report designer

1. Select **File** and **Exit**.
   The *Exit* window is displayed.
2. In the *Exit* window, select:
   - **Yes**: to save the report template and exit the application.
   - **No**: to exit the application without saving the changes made in the report template.
   - **Cancel**: to return to the application.

Report templates management

This section describes:

- Configuration of the *Template selection* menu.
- Deletion of user-defined report templates.
- Export/import of user-defined report templates.

The report templates management is done from the *Report templates* sheet in the system configuration package.

To access to the *Report templates* sheet:

1. Press **Utility**/**Config** on the Touch panel and select the **Report** category.

   The *Report category* sheet is displayed.

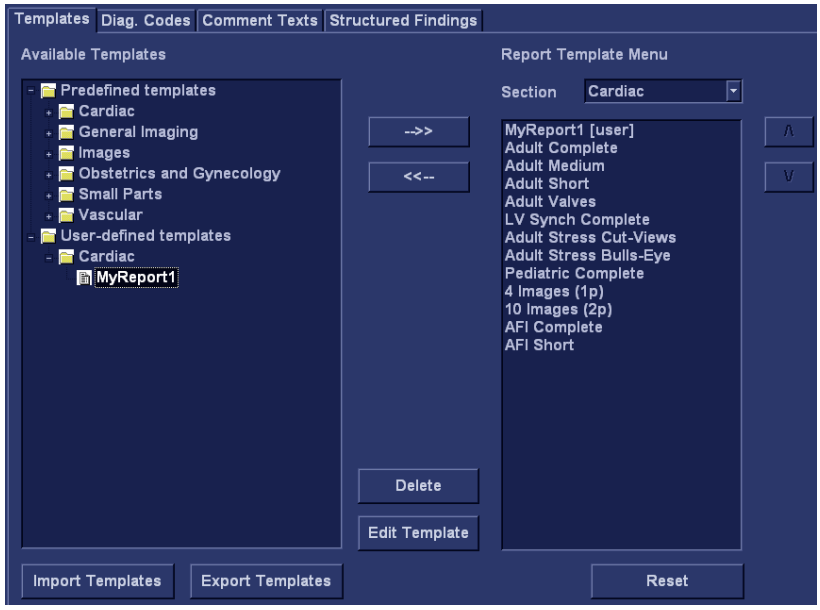


Figure 10-27. The Report templates sheet

Configuration of the Template selection menu

The *Template* selection menu displays the application specific report templates that can be selected when creating a report. The *Template* selection menu can be configured to display only the templates of interest.

Inserting a template in the Template selection menu

1. Press **Utility**/**Config** on the Touch panel and select **Report**.
   The *Report templates* sheet is displayed (Figure 10-27)
2. In the *Available templates* field (left field), select the template to insert in the *Template* selection menu.
3. Next to *Section*, select the appropriate application.
4. Press the **Right arrow button** [->>].
   The selected template is inserted in the *Template* selection menu.

NOTE: Double-clicking on a template in the Available template field will also insert the template in the Template menu.

Removing a template from the Template selection menu

1. In the *Report template menu* field (right field), select the template to remove.
2. Press the **Left arrow button** [<<-].
   The selected template is removed from the *Template* selection menu.

NOTE: Double-clicking on a template in the Report template menu field will also remove the template from the Template menu.

Sorting the templates in the Template selection menu

1. In the *Report template menu* field, select the template to move.
2. Press the **Up** or **Down arrow buttons** [^] [v].
   The selected template is moved accordingly in the *Template* selection menu.

Deleting a report template from the system

Only user-defined report templates can be deleted from the system.

1. In the *Available templates* field (left field), select the report to delete (Figure 10-27).
2. Press **Delete**.

   A Confirmation window is displayed.
3. Select **Yes** to delete the report template.

Export/Import of Report templates

User-defined report templates can be exported to a removable media and imported from the removable media into another system.

Export of Report templates

1. Insert a removable media in the in the drive.
2. Press **Utility**/**Config** on the Touch panel and select **Report**.

   The *Report templates* sheet is displayed (Figure 10-27 *on page 10-44*).
3. Select **Export Templates**.

   The available user-defined templates are displayed in the *Export templates* window.

Figure 10-28. The Export templates window

4. Select the template(s) to export. Multiple selection can be done using the **Shift** or **Ctrl** key.
5. Select the desired removable media under *Select target device*.

NOTE: *To export to a shared folder on a network, a remote path must be defined (see 'Remote path setting' on page 9-81).*

6. Press **OK**.

   A Confirmation window is displayed.
7. Press **OK**.

   The selected template(s) are exported to the removable media.
8. Press **Utility**/**Eject** on the Touch panel and select the media to eject.

Import of Report templates

1. Insert the removable media with the report template(s) to import.
2. Press **Utility**/**Config** on the Touch panel and select **Report**.

   The *Report templates* sheet is displayed (Figure 10-27 *on page 10-44*).
3. Select **Import Templates**.

   The *Import templates* window is displayed.

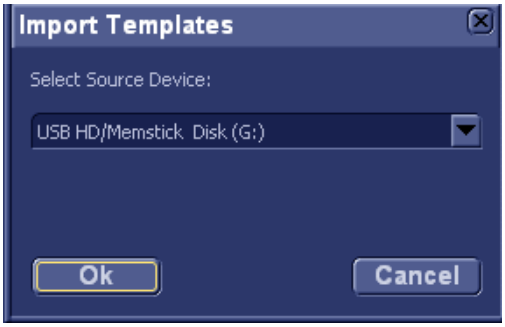


Figure 10-29. The Import template window

4. Select the source device from the pull-down menu.
5. Press **OK**.

   A Confirmation window is displayed.
6. Press **OK**.

   The templates are imported into the system.
7. Press **Utility**/**Eject** on the Touch panel and select the media to eject.

Chapter 11

Probes

This chapter describes:

Probe overview

Supported probes

Phased Array Sector probes

Table 11-1: 3Sc-RS Probe

Probe	Mode	Technical data
3Sc-RS	2D MM 2D+MM duplex 2D+AMM 2D+Color+AMM Curved AMM Curved AMM+Color CMM 2D+CMM 2D+CFM 2D+Angio 2D+BFI 2D+BFI Angio 2D+B-Flow PW HPRF 2D+PW duplex 2D+PW+CFM triplex CW 2D+TVD 2D+TVM TT TSI TVI TVI+TVD SI SRI	Frequency: 1.3–4.0 MHz Foot print: 18.4 x 23.7 mm

Phased Array Sector probes (continued)

Table 11-2: 6S-RS Probe

Probe	Mode	Technical data
6S-RS	2D MM 2D+MM duplex 2D+AMM 2D+Color+AMM Curved AMM Curved AMM+Color CMM 2D+CMM 2D+CFM 2D+Angio 2D+BFI 2D+BFI Angio 2D+B-Flow PW HPRF 2D+PW duplex 2D+PW+CFM triplex CW 2D+TVD 2D+TVM TT TSI TVI TVI+TVD SI SRI	Frequency: 2.7–8.0 MHz

Linear Array probes

Table 11-3: L6-12-RS Probe

Probe	Mode	Technical data
L6-12-RS	2D MM 2D+MM duplex 2D+AMM 2D+Color+AMM Curved AMM Curved AMM+Color CMM 2D+CMM 2D+CFM 2D+Angio 2D+BFI 2D+BFI Angio 2D+B-Flow PW HPRF 2D+PW duplex 2D+PW+CFM triplex	Frequency: 6-13 MHz

Curved Array (Convex) probes

Table 11-4: 4C-RS Probe

Probe	Mode	Technical data
4C-RS	2D MM 2D+MM duplex 2D+AMM 2D+Color+AMM Curved AMM Curved AMM+Color CMM 2D+CMM 2D+CFM 2D+Angio 2D+BFI 2D+BFI Angio 2D+B-Flow PW HPRF 2D+PW duplex 2D+PW+CFM triplex	Frequency: 1.8–6.0 MHz Foot print: 17 x 65 mm FOV: 58 degrees

Table 11-5: 8C-RS Probe

Probe	Mode	Technical data
8C-RS	2D MM 2D+MM duplex 2D+AMM 2D+Color+AMM Curved AMM Curved AMM+Color CMM 2D+CMM 2D+CFM 2D+Angio 2D+BFI 2D+BFI Angio 2D+B-Flow PW HPRF 2D+PW duplex 2D+PW+CFM triplex	Frequency: 4.0–11.0 MHz Foot print: 12 x 21 mm FOV: 128 degrees

Curved Array (Convex) probes (continued)

Table 11-6: E8C-RS Probe

Probe	Mode	Technical data
E8C-RS	2D MM 2D+MM duplex 2D+AMM 2D+Color+AMM Curved AMM Curved AMM+Color CMM 2D+CMM 2D+CFM 2D+Angio 2D+BFI 2D+BFI Angio 2D+B-Flow PW HPRF 2D+PW duplex 2D+PW+CFM triplex	Frequency: 4.0–11.0 MHz Foot print: 23 x 23 mm FOV: 128 degrees

Doppler probes

Table 11-7: P2D Probe

Probe	Mode	Technical data
P2D	CW	Frequency: 2.0 MHz

Transesophageal Phased Array probes

Table 11-8: 6Tc-RS Probe

Probe	Mode	Technical data
6Tc-RS	2D MM 2D+MM duplex 2D+AMM 2D+Color+AMM Curved AMM Curved AMM+Color CMM 2D+CMM 2D+CFM PW HPRF 2D+PW duplex 2D+PW+CFM triplex CW 2D+TVD 2D+TVM TT TSI TVI TVI+TVD SI SRI	Frequency: 2.9–8.0 MHz

NOTE: 6Tc-RS probe is not available for China.

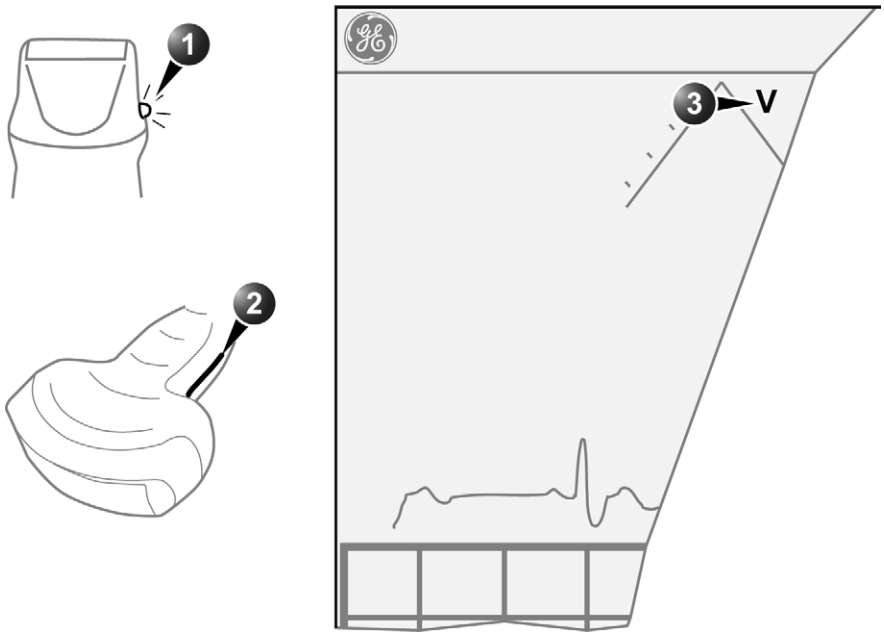
Probe Applications

Probe Application	Probe							
	3Sc-RS	6S-RS	4C-RS	8C-RS	E8C-RS	L6-12-RS	6Tc-RS	P2D
Fetal/OB		x	x		x			
Abdominal	x	x	x		x	x		
Pediatric	x	x	x	x		x		
Small Organ						x		
Neonatal Cephalic		x		x		x		
Adult Cephalic	x							
Cardiac	x	x					x	x
Peripheral Vascular				x		x		
Musculoskeletal Conventional						x		
Musculoskeletal Superficial						x		
Transcranial	x							
Transesophageal							x	
Transrectal					x			
Transvaginal					x			

NOTE: 6Tc-RS is not available for China.

Probe orientation

Some probes are provided with a green light (LED) orientation marking near their head (see Figure 11-1). Probes which do not have a LED have an indentation (notch) for orientation on the probe housing. This LED, or notch, corresponds with the **V** mark on the scanning screen. The **V** mark indicates the orientation of the probe to the scan.



1. LED
2. Notch
3. V-mark on screen: indicates the orientation of the probe to the scan.

Figure 11-1. Orientation marking on probe and on screen

Probe labelling

Each probe is labelled with the following information:

- Name of manufacturer
- Operating frequency
- Model number
- Probe serial number
- Year of manufacture

The probe name displayed on both the probe housing and the connector can be read when the probe is connected.

Probe Integration

Connecting the probe

Probes can be connected at any time, regardless of whether the console is powered on or off. To ensure that the ports are not active, place the system in the image freeze condition.

Before connecting the probe:

- Verify the probe and the probe cable for any damage.
- Do a visual check of the probe pins and system sockets. Remove any dust or foam rests from the probe pins.

To connect a probe:

1. Place the probe's carrying case on a stable surface and open the case.
2. Carefully remove the probe and unwrap the probe cord.
3. Put the probe in the probe holder.

CAUTION

DO NOT allow the probe head to hang free. Impact to the probe head could result in irreparable damage.

4. Hold the probe connector vertically with the cable pointing upward.
5. Slide the connector lock to the left (unlocked position).

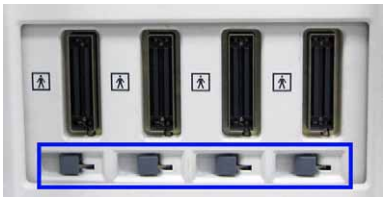


Figure 11-2. Unlocked position

Connecting the probe (continued)

6. Align the connector with the probe port and carefully push into place.

Figure 11-3. Probe Connection

7. Slide the connector lock to the right position to lock the probe connector.

Figure 11-4. Lock the probe connector

8. Carefully position the probe cord so it is free to move and is not resting on the floor.

Figure 11-5. Handle probe cable

Connecting the probe (continued)

Do not allow the probe head to hang freely. Impact to the probe head may result in irreparable damage.

Take the following precautions with the probe cables:

- Keep free from the wheels.
- Do not bend.
- Do not cross cables between probes.

DO NOT touch the patient and any of the connectors on the ultrasound unit simultaneously, including ultrasound probe connectors.

Activating the probe

When a probe is connected to the unit, it is automatically detected.

Selecting a probe and an application

1. Press **Probe** on the control panel. A list of the connected probes is displayed.
2. Select the desired probe.

   The *Application* menu for the probe is displayed.
3. Select the desired application.

Make sure that the probe and application names displayed on the screen correspond to the actual probe and application selection.

Check that the correct TI category is displayed. TIB must be displayed when a fetal application is selected.

Disconnecting a probe

Probes can be disconnected at any time. However, the probe should not be active when disconnecting the probe.

1. Deactivate the probe by selecting another probe or pressing **Freeze**.
2. Slide the connector lock to the left position to unlock the probe.
3. Pull the probe connector straight out of the probe port carefully.
4. Ensure the cable is free.
5. Be sure that the probe head is clean before placing the probe in its storage box.

Care and Maintenance

Planned maintenance


CAUTION

Improper handling can lead to early probe failure and electric shock hazards.

DO follow the specific cleaning and disinfection procedures provided in this chapter and the germicide manufacturers instructions.

Failure to do so will void probe warranty.


CAUTION

Transesophageal probes require a special handling. Refer to the user documentation enclosed with these probes.

It is recommended to keep a maintenance log and note all probe malfunctions. Follow the maintenance schedule below to ensure optimum operation and safety:

After each use:

- Inspect the probe.
- Clean the probe.
- If required disinfect the probe.

Before each use:

- Inspect the probe.

Inspecting the probe


CAUTION

If any damage is found, DO NOT use the probe until it has been inspected and released for further use by a GE service representative.

After each use:

1. Inspect the lens, the probe housing and the cable (Figure 11-6).
2. Look for damage that might allow liquid into the probe.

Before each use:

1. Inspect the lens, the probe housing and the cable (Figure 11-6).
2. Look for damage that might allow liquid into the probe.
3. Test the functionality of the probe.

1. Housing
2. Strain relief
3. Seal
4. Lens

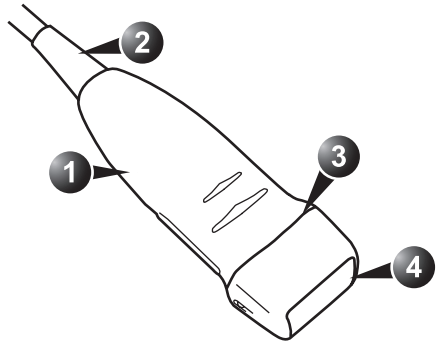


Figure 11-6. Probe parts

Cleaning and disinfecting probes

Transesophageal and intraoperative probes require a special handling. Refer to the user documentation enclosed with these probes.

Cleaning probes

Cleaning procedure

1. Disconnect the probe from the unit.
2. Remove the coupling gel by wiping the probe lens with a soft cloth.
3. Wipe the probe and cable with a soft cloth moisten in a warm soap and water solution (<80 ^{o}F/27 ^{o}C).
4. Wipe the probe and cable with a soft cloth moisten in clean water (<80 ^{o}F/27 ^{o}C) until all soap is removed.
5. Wipe dry with a soft towel.

Disinfecting probes

In order to provide users with options in choosing a germicide, GE routinely reviews new medical germicides for compatibility with the materials used in the transducer housing, cable and lens. Although a necessary step in protecting patients and employees from disease transmission, liquid chemical germicides must also be selected to minimize potential damage to the transducer.

Refer to the Probe Care Card enclosed in the probe case or to **http://www3.gehealthcare.com/Products/Categories/Ultrasound/Ultrasound_Probes#cleaning** for the latest list of compatible cleaning solutions and disinfectants.

Low-level disinfection

1. After cleaning, the probe and cable may be wiped with a tissue sprayed with a recommended disinfectant.

Use additional precautions (e.g. gloves and gown) when decontaminating an infected probe.

High-level disinfection

High-level Disinfection destroys vegetative bacteria; lipid & non-lipid viruses, fungi and, depending highly on time of contact, is effective on bacterial spores. This is required for endocavity probes after contact with mucosal membrane.

1. Prepare the germicide solution according to the manufacturer's instructions.

NOTE: *Follow the manufacturer's instructions for storage, use and disposal of the disinfection solution.*

WARNING

Use only germicides that are listed in the Probe Care Card enclosed with the probe. In addition, refer to the local / national regulations.

Do not steam autoclave or subject the probe to Ethylene Oxide (ETO).

2. Place the cleaned dried probe in contact with the germicide for the time duration specified by the manufacturer.

WARNING

Do not immerse the probe in liquid beyond the level specified for that probe (see Figure 11-7).

Never immerse the probe connector or probe adapters in liquid.

The probe should not be exposed to the germicide longer than specified to achieve the desired effect.

DO NOT soak or saturate probes with solutions containing alcohol, bleach, ammonium chloride compounds or hydrogen peroxide.

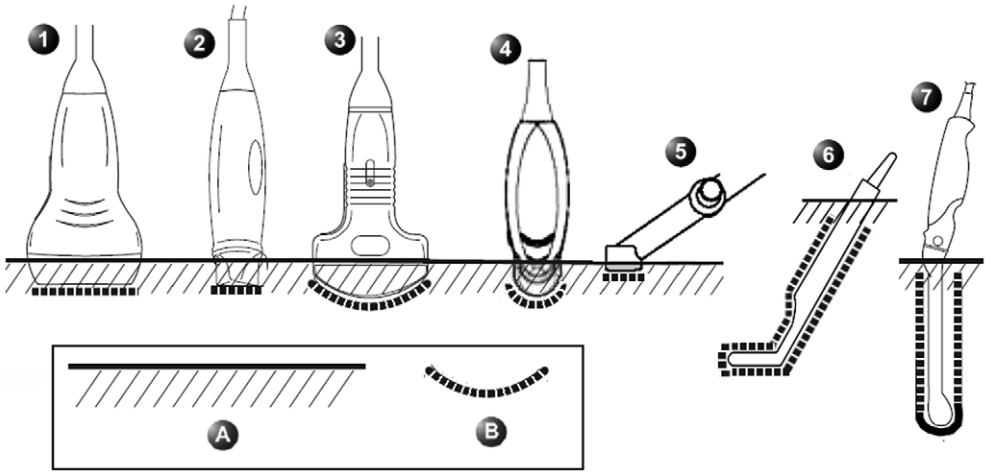
3. Rinse the part of the probe which was in contact with the germicide according to the germicide manufacturer's instructions.
4. Wipe dry with a soft towel or air dry the probe.

WARNING

CREUTZFELD-JACOB DISEASE

Neurological use on patients with this disease must be avoided. If a probe becomes contaminated, there is no adequate disinfecting means.

High-level disinfection (continued)



1. L6-12-RS
2. 3Sc-RS, 6S-RS
3. 4C-RS
4. 8C-RS
5. P2D
6. 6Tc-RS
7. E8C-RS

Note: 6Tc-RS is not available for China.

a. Fluid level
b. Contact face with patient environment

Figure 11-7. Probe immersion levels

Probe safety

Electrical hazards

Probes are driven by electricity, which can injure the patient or user when exposed to contact with conductive solution.

WARNING

Do not immerse the probe into any liquid beyond the level shown in Figure 11-7. Never immerse the probe connector or adaptors into any liquid.

Do not subject the probe to mechanical shock or impact, which may result in cracks or chips in the housing and degrade performance.

Inspect the probe before and after each use, as described on page 11-14, for damage or degradation to the housing, strain relief, lens and seal.

DO NOT apply excessive force to the probe cable, to prevent insulation failure.

Electrical leakage checks should be performed regularly by a GE service representative or qualified hospital personnel, according to the procedures described in EN 60601-1/ IEC 60601-1.

Mechanical hazards

Take precaution to avoid mechanical hazards.

WARNING

Observe immersion levels as displayed in Figure 11-7 *on page 11-18*.

Inspect probes for sharp edges or rough surfaces that could injure sensitive tissue.

DO NOT bend or pull the cable forcefully, to avoid mechanical shock or impact to the probe.

Biological hazards

Transesophageal probes require a special handling. Refer to the user documentation enclosed with these probes.

To minimize disease transmission, legally marketed and sterile pyrogen-free sheaths should be used for each probe recommended for intra-cavity and intraoperative procedures.

Adequate cleaning and disinfection are essential to prevent disease transmission. It is the responsibility of the user to verify and maintain the effectiveness of the infection control procedures in use.

According to local regulations, the use of sterile sheath is mandatory when performing intra-cavity procedures in China.

6Tc-RS Probe Thermal Safety

NOTE: 6Tc-RS is not available for China.

Maintaining a safe thermal environment for the patient has been a design priority at GE. It is generally agreed that in order to avoid damage to body tissues, for long term exposures, tissue contact probe tip temperatures should be less than 42.7 ºC. The ultrasound scanner incorporates an elaborate thermal safety system which informs the physician of the operating temperature of the probe, and prevents the operative temperature from exceeding given limits. Whenever the 6Tc-RS Probe is plugged into the system and selected, the probe tip temperature is displayed on the system monitor.

If the temperature sensor is not working properly when you plug the probe into the system, the probe will not be accepted and scanning will not be possible.

If the probe temperature is over 42.7 ºC (including probe temperature measurement error), the system will shut down the probe transmitting.

High temperature protection levels

The temperature is always displayed on the system monitor. The system has two levels of upper thermal limit: the first high limit is set at 41.0 ºC, and the second high limit is set at 42.7 ºC. If the temperature of the probe tip reaches 41.0 ºC, the temperature display turns red, the system enters freeze mode, and a warning appears on the monitor, asking the user if he/she wishes to continue scanning up to a higher temperature limit. If the response is OK, the scanner will resume scanning. If he/she selects Cancel, or no response is given, the system will remain in Freeze mode. If the temperature reaches 42.7 ºC, the system will freeze unconditionally. The user will not be allowed to start scanning until the temperature has decreased 0.5 ºC below the limit where the system entered Freeze mode. To restart scanning, the user must press the Freeze button.

Transesophageal probes require special handling. Refer to the user documentation enclosed with these probes.

6Tc-RS Probe

After the probe has been selected, the scan plane positioning system automatically calibrates. This calibration cycle lasts 10 to 15 seconds. After the calibration is complete, the probe temperature sensor is activated, and the probe temperature is displayed.

In case the initialization of the probe fails (no response from the scan plane button after initialization), re-select the probe to repeat the initialization routine.

Biopsy

The system supports biopsy capability for the 4C-RS, 3Sc-RS, L6-12-RS and E8C-RS probes. The biopsy option is intended for use by a duly licensed physician who has received the appropriate training in biopsy techniques as dictated by current relevant practices, as well as in proper operation of the ultrasound unit.

Precaution concerning the use of biopsy procedures

WARNING

Do not freeze the image during a biopsy procedure. The image must be live to avoid a positioning error.

CAUTION

The use of biopsy devices and accessories that have not been evaluated for use with the equipment may not be compatible and could result in injury.

CAUTION

The invasive nature of biopsy procedures requires proper preparation and technique to control infection and disease transmission. Equipment must be cleaned as appropriate for the procedure prior to use.

- Follow the probe cleaning and disinfection procedures and precautions to properly prepare the probe.
- Follow the manufacturer’s instructions for the cleaning of biopsy devices and accessories.
- After use, follow proper procedures for decontamination, cleaning, and waste disposal.

Improper cleaning methods and the use of certain cleaning and disinfecting agents can cause damage to the plastic components that will degrade imaging performance or increase the risk of electric shock.

Preparing the Biopsy guide attachment

The probes have an optional biopsy kit specific for each probe. The biopsy kit consists of:

- A reusable non-sterile bracket
- Disposable sterile Ultra-Pro II™ Needle guide kits (Civco Medical Instruments Co, Inc.) consisting of:
  - Sets with needle inserts covering gauge size 14 through 23 (2.1 mm to 0.6 mm)
  - Sterile sheath
  - Rubber bands
  - Gel
- A reusable needle guide
- Instructions

In addition sterile Ultra-Pro II™ Needle guide kits can be ordered as replacement kit.

Read the following instructions and the user's guide for the Ultra-Pro II™ Needle Guide kit before using the biopsy equipment.

Bracket attachment procedure

1. Identify the appropriate biopsy guide bracket as shown in Figure 11-8.

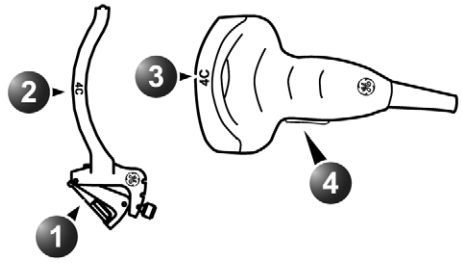
Probe	Biopsy bracket	Probe with bracket
4C-RS		
3Sc-RS		
L6-12-RS		
E8C-RS		
		

Figure 11-8. The biopsy brackets

Bracket attachment procedure (continued)

2. Orient the bracket so that the needle clip attachment is on the same side as the probe orientation mark, see Figure 11-9.
3. Attach the biopsy bracket to the probe by sliding the bracket over the end of the probe until it clicks or lock into place.

   Make sure the bracket is firmly attached to the probe.



1. Needle clip attachment on the bracket
2. Bracket label
3. Probe label
4. Probe orientation mark

Figure 11-9. Probe/bracket alignment

Placing the probe and bracket into the sterile sheath

Refer to the Ultra-Pro II™ Needle Guide user manual.

Attaching the needle guide to the bracket

Refer to the Ultra-Pro II™ Needle Guide user manual.

Displaying the Guide zone

1. Select the desired probe with biopsy support.
2. Press **Biopsy** on the Touch panel (Page 2).
3. If the needle multi-angle is supported, select the correct angle from the *Biopsy* menu.

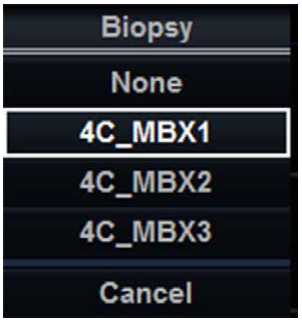
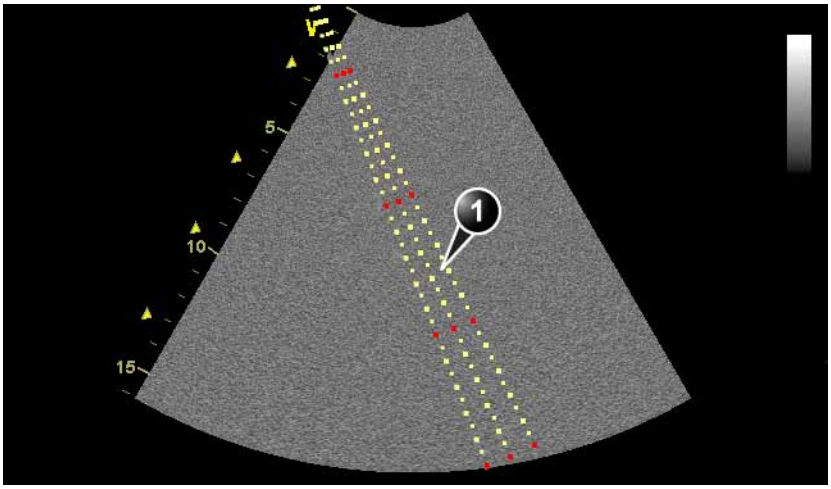


Figure 11-10. The Biopsy menu

The biopsy guide zone is displayed on the screen.



1. Biopsy guide zone
   - 5 cm between the red marks
   - 1 cm between the large yellow marks
   - 0.5 cm between two consecutive marks

   The first red mark is at 5 cm from the top of the needle guide.

Figure 11-11. Biopsy guide zone

Biopsy needle path verification

Perform the Needle path verification once a year or whenever there is a suspicion of malfunction.

To verify that the path of the needle is accurately indicated within the guide zone on the system monitor, perform the following:

1. Properly install the bracket and biopsy guide (see page 11-25).
2. Scan in a container filled with a glycerol solution (6% in water).
3. Display the biopsy guide zone on the monitor (see page 11-27).
4. Ensure that the needle echo falls within the guide zone markers.

Starting the biopsy procedure

1. Press **Biopsy** on the Touch panel (Page 2).
2. Place sterile coupling gel on the scanning surface of the probe/sheath.
3. Perform the biopsy.

NOTE: Enabling color flow would allow for visualization of the vascular structure around the area to be biopsied.

Cleaning, disinfection and disposal

1. Refer to the Ultra-Pro II™ Needle Guide user manual for cleaning and disinfection of the bracket.
2. Perform cleaning and disinfection of the probe as described in page 11-16.
3. Dispose the sheath, bands and needle guide after use, according to medical regulations for biohazardous waste.

Chapter 12

Peripherals

This chapter describes:

Introduction

Peripherals

This chapter provides information on peripherals that can operate with the ultrasound unit, as follows:

- NetGear WNA1000M wireless card
- Footswitch MKF 2-MED USB GP26 (Option)
- Pediatric ECG (Option)
- Internal ECG
- SanDisk USB Stick 8G
- 1TB mobile USB HDD
- LITEON eUAU108 DVDRW
- SONY UPD25 Color Printer
- SONY UP-D897MD B/W Printer
- SONY UP-D711MD
- HP100 Printer

CAUTION

Use only GE approved internal equipment when replacing an *internal* peripheral.

External peripheral equipment must be CE marked and in compliance with related standards (EN 60601-1 or EN 60950). Conformance to EN 60601-1 must be verified.

All devices meeting IEC60950 must be kept outside of the patient environment, as defined in IEC60601-1, unless it, according to IEC60601-1, is equipped with additional protective earth or extra isolating transformer. Commercial devices such as laser cameras, printers, VCRs and external monitors, usually exceed allowable leakage current limits and, when plugged into separate AC outlets, are in violation of patient safety standards. Suitable electrical isolation of such external AC outlets, or providing the device with extra protective earth, will be required in order to meet UL60601-1 and IEC 60601-1 standards for electrical leakage.

Peripherals (continued)

Any devices or cables, other than those sold with the ultrasound unit, connected to the Peripheral /accessory connector panel or to an USB port on the unit may result in an increase of the electromagnetic emission from the unit, or a decrease of the electromagnetic immunity of the unit.

When using peripheral device, observe all warnings and cautions given in peripheral operator manuals.

Printing

The printer device is controlled from the **P1** or **P2** key on the control panel (see Figure 12-1).

The **P1** and **P2** keys can also be configured to perform alternative storage (i.e. storage to DICOM media or secondary capture). See page 9-86 for configuration of the **P1** and **P2** keys.

Figure 12-1. The printer controls on the Control panel

To print an image

1. Press **P1** or **P2** on the Control panel (see Figure 12-1).

   The image displayed on the screen is printed on the printer, depending on the key assignment configuration (see page 9-86).

NOTE: *For details on the Thermal video printers operation, consult the manufacturer operator manual provided with the printer.*

Printer configuration

The following procedure describes how to configure and select a printer as the default printer.

1. Press **Utility**/**Config** on the Touch panel.
2. Select **Connectivity** and **Additional Outputs**.

   The *Additional Outputs screen* is displayed.
3. In the Additional Outputs screen select **Advanced** in the *Printer setup* field.

   The *Printer properties* window is displayed.
4. Press **Configure**.

   The *Print setup* window is displayed.
5. In the *Print setup* window, select the printer and adjust the parameters for the printer. Additional settings may be adjusted by selecting **Properties**.
6. Select **OK** to close the *Print setup* window.

   The *Standard printer properties* window is displayed.

To choose the configured printer as the default printer:

1. Select **Open** in the *Printer properties* window.

   The *Printer status* window for the opened printer is displayed.
2. Select **Printer** and **Set as default printer**.
3. Close the *Printer status* window and select **OK** in the *Standard printer properties* window.

Chapter 13

Maintenance

This chapter describes:

System Data

Features/Specifications

Table 13-1: Physical Attributes

Dimensions and Weight
• Width:
  • Keyboard: 500mm (19.7 in)
  • Caster: 720mm (28.3 in)
• Depth:
  • Maximum: 810mm (31.9 in)
  • Caster: 800mm (31.5 in)
• Height:
  • Maximum: 1495mm (58.9 in)
  • Minimum: 1410mm (55.5 in)
• Weight: 65 kg (144 lbs)
 	
Console Design
• 4 active probe ports
• ECG port
• Integrated HDD (500G)
• Multiple USB ports
• Optional DVD-RW
• Optional on-board storage of thermal printer, speakers
• Integrated locking mechanism that provides rolling lock and caster swivel lock
• Integrated cable management
• Removable air filters
• Front and rear handles
• Optional probe cable tray
• One gel holder
• Six probe holders (two optional, four standard)
 	
Electrical Power
• Voltage:100-240 Vac
• Frequency: 50/60 Hz
• Power consumption maximum: 400 VA with peripherals
	Operator Keyboard
	• Support for international keyboard character sets (ISO 8859)
	• Ergonomic full size hard key layout
	• Interactive back lighting for control panel
	• Six TGC pods
	
	Touch Screen
	• 8.4” high-resolution, color, touch screen
	• Interactive dynamic software menu
	
	LCD Monitor
	• 19” high-resolution LCD
	• Optional articulating monitor arm
	• Optional LCD translation (independent of console):
	  • +25º/-90º tilt on LCD
	  • Swivel to side viewing direction
	• Fold down and rotation lock mechanism for transportation
	• Resolution: 1280x1024
	• Brightness, contrast and backlight adjustments

Table 13-2: System Overview

Applications • Abdominal • Breast • Cardiac • Cranial • Carotid • Coronary • Exercise • FAST • FATE • FetalEcho • FetalHeart • Follicle • Gynecological • LEA • LEV • LVO Contrast (optional) • Musculoskeletal • NeoAbd • NeoHead • Obstetrics • PedAbd • PedHip • Pediatrics • Prostate • Renal • Thyroid • UEA UEV Small Parts • Scrotal • MscSkelSup Scanning Methods • Electronic Sector • Electronic Convex • Electronic Linear • CW pencil Transducer Types • Sector Phased Array • Linear Array • Convex Array • CW Pencil • Endovaginal • TEE	Operating Modes • 2D tissue • 2D color flow • 2D angio flow • Color M-mofe • Tissue velocity M-mode • Pulsed wave Doppler with high PRF • Anatomical M-mode • Curved anatomical M-mode (optional) • Tissue velocity imaging • Tissue tracking (optional) • Tissue synchronization imaging (optional) • Strain imaging (optional) • Strain rate imaging (optional) • Tissue Doppler imaging • Blood flow imaging (optional) • Blood flow angio flow imaging (optional) • B-flowTM (optional) • Stress • Auto EF (optional) • AFI Automated Function Imaging (optional) • Coded phase inversion LVO contrast (optional) • Compound imaging (optional) • Scan assist (optional) • Image archive • Z scores • Fetal trending • Renal calculations • On-board report package • MPEGVue (optional)

Table 13-2: System Overview

System Options	Peripheral Options
• Curved AMM • Blood flow imaging • Blood flow imaging with Angio • B-flow • Tissue tracking • TSI • Strain imaging • Strain rate imaging • Smart stress • AFI • Auto EF • Q-Analysis • LOGIQ View • Scan Assist • IMT • DICOM connectivity • MpegVue/eVue • LVO contrast	• LITEON eUAU 108 DVDRW • UP-D711MD • SONY UPD25 color printer • B/W printer (UP-D897MD) • HP100 printer • 8 GB memory stick • 1 TB USB hard drive • Three-pedal configurable footswitch • ECG kits

Table 13-3: System Parameters

Scanning Parameters	CINE Memory/Image Memory

• Displayed Imaging Depth: 0 - 33 cm (probe dependent)
• Minimum Depth of Field: 0 - 2 cm (probe dependent)
• Maximum Depth of Field: 0 - 35 cm (probe dependent)
• Continuous Dynamic Receive Focus / Continuous Dynamic Receive Aperture
• Adjustable Dynamic Range up to 120dB
• Image Reverse: Right/ Left
• Image Rotation: 0°, 180°
 	
Image Storage
• On-board database of patient information from past exams
• Storage Formats:
  • DICOM - compressed/ uncompressed, single/ multiframe, with/ without Raw Data
  • “Save As” JPEG, MPEG, AVI
• Storage Devices:
  • USB Memory Stick: 8GB
  • CD-RW storage: 700MB
  • DVD storage: -R (4.7GB)
  • Hard Drive Image Storage: minimum 500GB
• Compare old images with current exam
• Reload of archived data sets
	• 210 MB of CINE memory
	• Selectable CINE Sequence for CINE Review
	• Measurements/Calculations & Annotations on CINE Playback
	• Scrolling timeline memory
	• Dual Image CINE Display
	• Quad Image CINE Display
	• CINE Gauge and CINE Image Number Display
	• CINE Review Loop
	• CINE Review Speed
	
	Connectivity and DICOM (Optional)
	• Ethernet network connection
	• DICOM
	• Verify
	• Print
	• Store
	• Modality worklist
	• Storage commitment
	• Modality Performed Procedure Step (MPPS)
	• Media exchange
	• off-network DICOM spooler
	• Query/Retrieve
	• Structured reporting - compatible with adult cardiac and vascular
	• Media store of structured reporting
	• InSite*ExC capability for remote service/access

Table 13-4: Measurements and Calculations

Measurements/Calculations Supported: • General 2D Mode measurements/calculations • General M Mode measurements/calculations • General Doppler Mode measurements/ calculations • General Color Flow Mode measurements/ calculations • General Color M Mode measurements/ calculations	• Obstetrics • Gynecology • Vascular • Urological • Abdominal • Pediatric • Cardiac • Small parts • RI (Resistivity Index)

Table 13-5: Probes

• 3Sc-RS (Application: Abdominal, Pediatric, Adult Cephalic, Cardiac, Transcranial) • 6S-RS (Application: Fetal/OB, Abdominal, Pediatric, Neonatal Cephalic, Cardiac) • 4C-RS (Application: Fetal/OB, Abdominal, Pediatric) • 8C-RS (Application: Pediatric, Neonatal Cephalic, Peripheral Vascular)	• E8C-RS (Application: Fetal/OB, Abdominal, Transrectal, Transvaginal) • L6-12-RS (Application: Abdominal, Pediatric, Small Organ, Neonatal Cephalic, Peripheral Vascular, Musculoskeletal Conventional, Musculoskeletal Superficial) • 6Tc-RS (Application: Cardiac, Transesophageal) • P2D (Application: Cardiac)

Table 13-6: Inputs and Outputs Signal

Inputs • 6 USB 2.0 ports • Ethernet	Outputs • Composite Color Video Output • S-Video Output • VGA output • Audio Stereo Output ;

Clinical Measurement Accuracy

Basic Measurements

The following information is intended to provide guidance to the user in determining the amount of variation or measurement error that should be considered when performing clinical measurements with this equipment. Error can be contributed by equipment limitations and improper user technique. Be sure to follow all measurement instructions and develop uniform measurement techniques among all users to minimize the potential operator error. Also, in order to detect possible equipment malfunctions that could affect measurement accuracy, a quality assurance (QA) plan should be established for the equipment that includes routine accuracy checks with tissue mimicking phantoms.

Please be advised that all distance and Doppler related measurements through tissue are dependent upon the propagation velocity of sound within the tissue. The propagation velocity usually varies with the type of tissue, but an average velocity for soft tissue is assumed. This equipment is designed for, and the accuracy statements listed on are based on, an assumed average velocity of 1540 m/s. The percent accuracy when stated applies to the measurement obtained (not the full scale range). Where the accuracy is stated as a percent with a fixed value, the expected inaccuracy is the greater of the two.

Basic Measurements (continued)

Table 13-7: System Measurements and Accuracies

Measurement	Units	Useful Range	Accuracy	Limitations or Conditions
Depth	mm	Full Screen	<=10%	
Angle	degree	Full Screen	<=5%	
Distance:				
Axial	mm	Full Screen	<5%	
Lateral	mm	Full Screen	<5%	Linear Probes
Lateral	mm	Full Screen	<5%	Convex Probes
Lateral	mm	Full Screen	<5%	Sector Probes
Circumference:				
Trace	mm	Full Screen	<=10%	Linear Probes, Convex Probes, Sector Probes
Ellipse	mm	Full Screen	<=5%	Linear Probes, Convex Probes, Sector Probes
Area:				
Trace	mm^2	Full Screen	<=5%	Linear Probes, Convex Probes, Sector Probes
Ellipse	mm^2	Full Screen	<=5%	Linear Probes, Convex Probes, Sector Probes
Time	s	Timeline Display	<5%	M mode, AM mode, CM mode, PWD mode, CWD mode
Slope	mm/s	Timeline Display	<=10%	M mode, AM mode, CM mode,
Doppler SV Position	mm	Full Screen	<=2 mm	PWD mode
Doppler Velocity	cm/s	Form 0 to 100 cm/s From 100 to 130 cm/s	<15% <10%	PWD mode, CWD mode
Doppler Angle Correction	cm/s	From 0-80°	<=5%	PWD mode

Clinical Calculation Accuracy

Estimate the overall inaccuracy of a combined measurement and calculation by including the stated inaccuracy from the basic measurement accuracy statements.

Diagnostic errors may result from the inappropriate use of clinical calculations. Review the referenced source of the stated formula or method to become familiar with the intended uses and possible limitations of the calculation.

Calculation formulas and databases are provided as a tool to assist the user, but should not be considered an undisputed database, in making a clinical diagnosis. The user is encouraged to research the literature and judge the equipment capabilities on an ongoing basis in order to assess its utility as a clinical tool.

System Care and Maintenance

CAUTION

Standard maintenance must be performed by authorized service personnel for the lifetime of the product (7 years).

CAUTION

The user must ensure that safety inspections are performed at least every 12 months according to the requirements of the patient safety standard IEC 60601-1. Refer to the Service manual, Chapter 10.

Only trained persons are allowed to perform the safety inspections mentioned above.

Technical descriptions are available on request.

To ensure that the unit constantly operates at maximum efficiency we recommend that the following procedures be observed as part of the customer's internal routine maintenance program.

Inspecting the system

If any defects are observed or malfunctions occur, DO NOT operate the equipment, and inform a qualified service person.

Examine the following on a monthly basis (or whenever there is a reason to assume that any issue may have occurred):

- Connectors on cables, for any mechanical defects
- Entire length of electrical and power cables, for cuts or abrasions
- Equipment, for loose or missing hardware
- Control panel and keyboard for defects
- Wheels for proper locking operation

To avoid electrical shock hazard, do not remove panels or covers from the unit.

Cleaning the unit

The ultrasound unit requires regular care and maintenance to function safely and properly. The following components should be cleaned.

Weekly:

- LCD monitor and Touch screen
- Control panel
- Keyboard
- Probe holders
- System cabinet
- Footswitch

Biweekly:

- Air filters

Cleaning the unit (continued)

When performing cleaning procedures, to prevent the risk of system damage, always observe the following precautions:

- Use only cleaning materials and solutions as recommended in the procedures described below.
- Never use thinner, benzene, ethanol or methanol alcohol, abrasive cleaners, or other strong solvents, as these may cause damage to the cabinet or LCD panel. Only use isopropyl alcohol, when instructed to do so.
- Do not spray any liquid directly onto the Vivid T8/Vivid T8 Pro covers, LCD Display or keyboard.
- Do not allow any liquid to drip or seep into the system.
- DO NOT scratch or press on the panel with any sharp objects, such as pencils or pens, as this may result in damage to the panel.
- Make sure not to spill or spray any liquid on the controls, into the system cabinet, or in the probe connection receptacle.
- Prior to cleaning, turn OFF power to the system and disconnect the mains cable.

LCD Monitor and Touch panel

NOTE: Never use thinner, benzene, ethanol or methanol alcohol, abrasive cleaners, or other strong solvents, as these may cause damage to the cabinet or LCD panel.

NOTE: DO NOT scratch or press on the panel with any sharp objects, such as pencils or pens, as this may result in damage to the panel.

To clean the cabinet:

1. To remove stains, wipe the cabinet with a soft, lightly moistened cloth using a mild detergent. Do not spray wax or cleaner directly into the cabinet.
2. In the event that disinfection is required or any stubborn stains remain, absorb a small quantity of isopropyl rubbing alcohol on a soft, dust-free cloth. Wipe the cabinet and allow to dry.

LCD Monitor and Touch panel (continued)

To clean LCD panel and Touch panel:

1. Clean the LCD surface with a soft cloth, such as cotton or lens paper.

   If necessary, stubborn stains can be removed by moistening part of a cloth with water or a 50-50 mixture of isopropyl alcohol and water that does not contain impurities. Wring out as much of the liquid as possible then wipe the LCD surface. Do not let any liquid drip into the system.

Control panel and keyboard

NOTE: Diligent cleaning of the console reduces the risk of spreading infection from person to person, and also helps to maintain a clean working environment.

Only use the following cleaners on the Control panel:

- A non-abrasive soap and water solution (e.g. Palmolive Dishwashing Liquid, manufactured by Colgate-Palmolive)
- Sani Wipes Alcohol-free (manufactured by Micorgen Inc.)
- T-Spray II (manufactured by Pharmaceutical Innovations, Inc.)

To clean the Control panel:

1. Turn off the power of the system.
2. Moisten a soft, non-abrasive folded cloth with water or a mild, non-abrasive soap and water solution.
3. Gently wipe the surface of the console.
4. Use a cotton swab to clean around keys or controls. Use a toothpick to remove solids from between keys and controls.

   When cleaning the operator control panel, make sure not to spill or spray any liquid on the controls, into the system cabinet, or in the probe connection receptacle.
5. In the event that disinfection is required or any stubborn stains remain, absorb a small quantity of isopropyl rubbing alcohol on a soft, dust-free cloth. Wipe the surface of the console. Make sure no liquid drips on or between the keys. Allow to dry.

NOTE: Please contact GE Service if the trackball needs to be cleaned.

Control panel and keyboard (continued)

To clean the keyboard:

1. Clean the keyboard as described above for the Control panel.
2. In the event that disinfection is required or any stubborn stains remain, absorb a small quantity of isopropyl rubbing alcohol on a soft, dust-free cloth. Wipe the surface of the key caps. Make sure no liquid drips on or between the keys. Allow to dry.

Probe holder

1. Clean the probe holders with warm water and a damp cloth to remove all traces of gel.
2. In the event that disinfection is required or any stubborn stains remain, absorb a small quantity of isopropyl rubbing alcohol on a soft, dust-free cloth. Wipe the surface of the probe holder. Make sure no liquid drips into the system. Allow to dry.

System cabinet

1. Moisten a soft, non-abrasive folded cloth with a mild, general purpose, non-abrasive soap and water solution or a general purpose disinfectant.
2. Wipe down the top, front, back and both sides of the cabinet. Do not spray any liquid directly onto the unit.
3. In the event that disinfection is required or any stubborn stains remain, absorb a small quantity of isopropyl rubbing alcohol on a soft, dust-free cloth. Wipe the system cabinet and allow to dry.

Footswitch

To clean the footswitch:

1. Moisten a soft, non-abrasive folded cloth with a mild, general purpose, non-abrasive soap and water solution.
2. Wipe the external surfaces of the unit then dry with a soft, clean, cloth.
3. In the event that disinfection is required or any stubborn stains remain, absorb a small quantity of isopropyl rubbing alcohol on a soft, dust-free cloth. Wipe the footswitch and allow to dry.

Cleaning the air filters

Clean the system's air filters to ensure that a clogged filter does not cause the system to overheat and reduce system performance and reliability. It is recommended the filters be cleaned every two weeks, but the requirements will vary due to your system use.

CAUTION

Be sure to lock the wheels before cleaning the air filters to avoid injury by any unexpected movement of the system.

DO NOT operate the unit without the air filters in place.

Allow the air filters to dry thoroughly before re-installing them on the unit.

Cleaning

1. Pull out the air filter.

Figure 13-1. Pull Out the Filter

2. Dust the filter with a vacuum cleaner and/or wash it with a mild soapy solution.

   If washed, rinse and dry the filter before re-installation.
3. Put back the air filter.

Cleaning the probes

Refer to the Probes chapter, section for probe cleaning and disinfecting instructions.

Prevention of static electricity interference

Interference from static electricity can damage electronic components in the system. The following measures help to reduce the likelihood of electrostatic discharge:

- Wipe the alphanumeric keyboard and monitor with lint-free tissue or a soft cloth dampened with anti-static spray on a monthly basis.
- Spray carpets with anti-static spray because constant walking on carpets in or near the scanning room may be a source of static electricity.

System self-test

The ultrasound unit is designed for reliable operation and consistent, high-quality performance. Automatic self-testing facilities are provided to monitor system operation and to detect malfunction as soon as possible, thereby eliminating unnecessary downtime. The detection of any serious malfunction may result in immediate interruption of the unit operation.

System malfunction

In the event of error or system malfunction the user may save locally or export a log file to a removable media as described below and contact authorized service personnel.

In addition, system malfunctions can be bookmarked, enabling creation of a log file specific to that event.

Bookmarking a system malfunction

1. If a system malfunction is observed, press **Alt** - **B**.
   A bookmark will be created when creating a log file.

Generating a log file

1. Press **Alt** - **D** on the alphanumeric keyboard.

   The *Problem description dialogue* window is displayed (see Figure 13-2).

2. Type in a description of the problem. Notes should be made regarding the selected probe, the imaging mode and the application that was being used at the time of malfunction. If applicable, try to describe the button or key pushing sequence that immediately preceded the problem.

   Check the mention *System lockup* if applicable.

3. Select the destination where to save or export the log file.

   If **STORE LOCALLY** is selected, the log file is saved to the local hard disk.

   If a removable media is selected, the current and previously saved log files are exported to the selected media.

NOTE: To export to a shared folder on a network, a remote path must be defined (see 'Remote path setting' on page 9-81).

4. Press **Save and Export**.

   A Zip file (named "logfile_<date>_<time>.zip") is created.

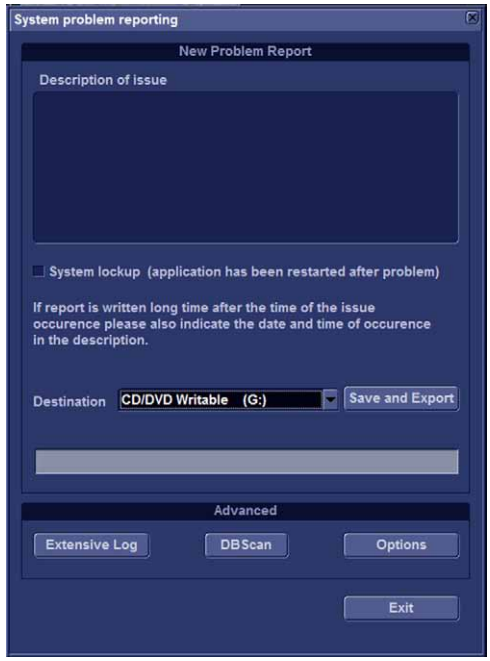


Figure 13-2. The Problem description dialogue window

Advanced log options

Extensive Log

Extensive Log enables the creation of a log file containing additional information for the selected functionality.

Options

Options enables creation of a log file based on a selected bookmark or for a user configurable time frame. Different type of information can be selected to be part of the log file.

System Software Download

Software upgrade for the unit may become available for download and installation through the GE Service platform. When a software upgrade is available a message icon  is displayed on the status bar.

Only users with administrator rights are allowed to download software upgrade. You first download the software, then install the software. It is a two-step process.

Once the software installation has begun, the system is not usable until the software installation is done. The installation can take up to 45 minutes to complete. While installing, **DO NOT** turn off the system power or the system.

After the software installation is complete, you will be asked to perform a few system functional checks to determine normal system operation.

NOTE: A software download may take more than one hour, depending on local network conditions. During this time, you can not perform any other function. Please allow sufficient time to complete the software download and installation.

NOTE: Software Upgrade through the GE service platform may not be available in all markets.

Software download and installation

NOTE: To upgrade the software, you must login with administrator privileges.

1. Press the **On/Off** button on the top left of the control panel. The *Exit dialogue* window with software download is displayed.

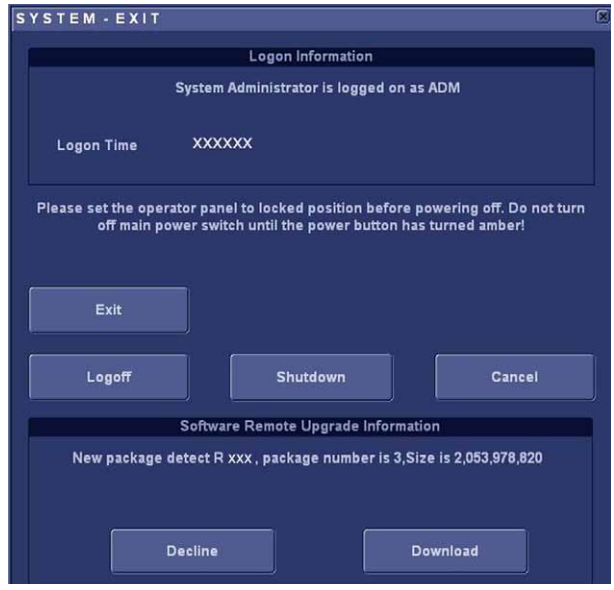


Figure 13-3. System Exit Window

- **Decline**: To decline the software download, the software is not downloaded, not update will be performed. The software download will not occur and you will not be informed about this package again.
- **Download**: To start the software download.

System Software Download (continued)

2. Press **Download**. A pop-up screen will display to ask the operator to confirm the software download.

Figure 13-4. Start Download

3. Press **OK** to start download.

   The download process starts. The progression of the download process is displayed.

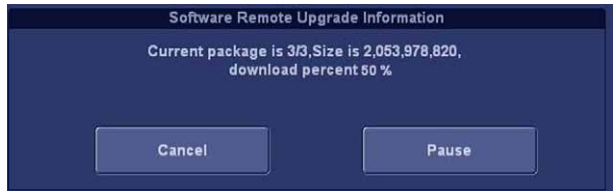


Figure 13-5. Download Process

*NOTE: The download step can be paused. While paused, you can return to normal operation. However, once the software installation has begun, the system is not usable until the software installation is done. The installation can take up to 45 minutes to complete. While installing, **DO NOT** turn off system power.*

NOTE: A typical software update of about 600 Mb may take up to 60 minutes to download, but time may vary depending on your location and network connection.

- **Pause**: To pause the software download process. If you select **Pause**, you can cancel out of this dialog and return to normal scanning or you can power off the system. A paused download can be resumed by logging in as administrator, pressing the power on/off button and selecting **Resume**.
- **Resume**: Select **Resume** to continue the software download.

System Software Download (continued)

4. The following dialogue is displayed when the software download is complete. Press **Install**.

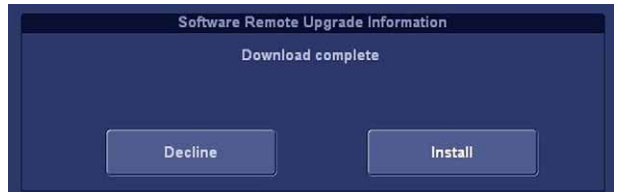


Figure 13-6. Download Complete

NOTE: *You can also select to decline the software installation process.*

Decline: **DO NOT** install the downloaded software, no software upgrade will be performed. If you decline this installation, you **WILL NOT** be offered the chance to install this software package again. You can contact with GE Service Engineer to perform the install at a later time.

5. A pop-up screen will display to ask the operator to confirm the software installation. Press **OK** to install the software.

Figure 13-7. Software Installation

System Software Download (continued)

6. The system indicates to reboot the system after the installation is completed. Press **Shutdown** and then press **On/Off** button to power on the system.

   Multiple screens appear during the software installation process. **DO NOT** interrupt this process, and follow the instructions as they appear on the display.

NOTE: A typical installation may take up to 15 minutes.

7. Press **On/Off** to show the *Exit dialogue* window. Press **Verify**. The New Software Verification Checklist window is displayed.

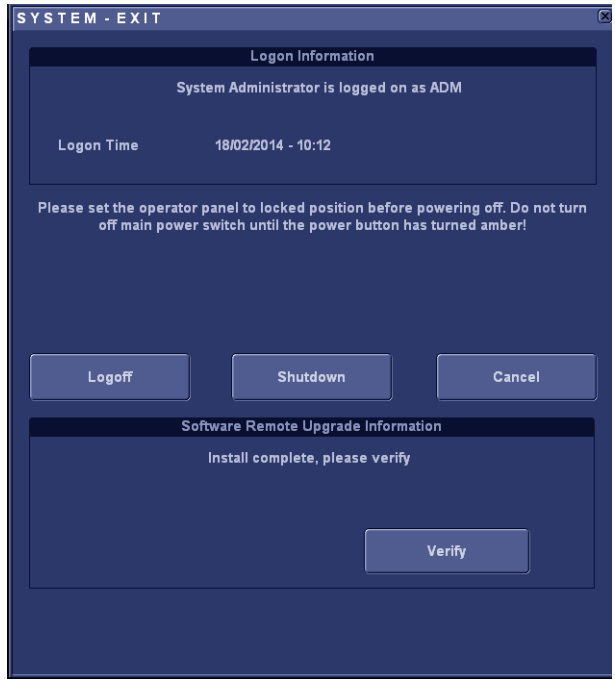


Figure 13-8. System Exit Screen

System Software Download (continued)

8. Perform a check for all features listed. Press ? to get information on how to check each feature.

CAUTION

You **MUST** ensure that the entire system functions normally, as expected, in each of the categories listed on the New Software Verification checklist.

These verification results are tracked for regulatory purposes, sent back to GE for tracking and approved with your signature.

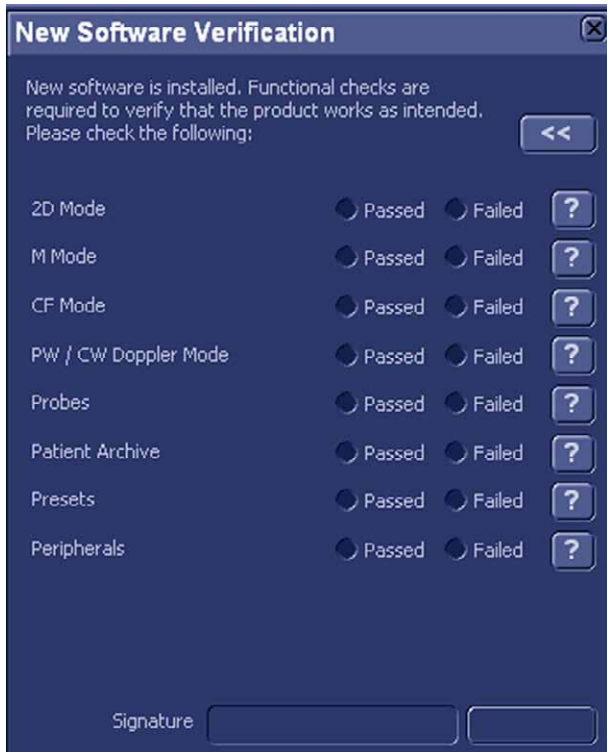


Figure 13-9. Software Verification

System Software Download (continued)

9. Select Passed if the verified feature works correctly.

   Enter your signature (minimum three characters) and press **OK**.

Figure 13-10. Signature field enabled

The system is ready.

NOTE: If one feature gets "Failed", the system will rollback the original software.

Chapter 14

Safety

This chapter describes:

Introduction

This chapter describes the important safety measures which should be taken before operating the ultrasound unit. Procedures for simple care and maintenance of the unit are also described.

Various levels of safety precautions may be found on the equipment, and different levels of severity are identified by one of the following icons that precede precautionary statements in the text.

The following icons are used to indicate precautions:

DANGER

Indicates that a specific hazard exists that, given inappropriate conditions or actions, will cause:

- Severe or fatal personal injury
- Substantial property damage

WARNING

Indicates that a specific hazard exists that, given inappropriate conditions or actions, will cause:

- Severe or fatal personal injury
- Substantial property damage

CAUTION

Indicates that a potential hazard may exist that, given inappropriate conditions or actions, can cause:

- Minor injury
- Property damage

Owner responsibility

For USA only:

Federal law restricts this device to use by, or on the orders of, a physician.

It is the responsibility of the owner to ensure that anyone operating the system reads and understands this section of the manual. However, there is no representation that the act of reading this manual renders the reader qualified to operate, inspect, test, align, calibrate, troubleshoot, repair or modify the system. The owner should make certain that only properly trained, fully-qualified service personnel undertake the installation, maintenance, troubleshooting, calibration and repair of the equipment.

The owner of the ultrasound unit should ensure that only properly trained, fully qualified personnel are authorized to operate the system. Before authorizing anyone to operate the system, it should be verified that the person has read, and fully understands, the operating instructions contained in this manual. It is advisable to maintain a list of authorized operators.

Should the system fail to operate correctly, or if the unit does not respond to the commands described in this manual, the operator should contact the nearest field GE Ultrasound Service Office.

For information about specific requirements and regulations applicable to the use of electronic medical equipment, consult the local, state and federal agencies.

Notice against user modification

Never modify this product, including system components, software, cables, and so on. User modification may cause safety hazards and degradation in system performance. All modification must be done by a GE qualified person.

Acoustic output

Definition of the acoustic output parameters

Thermal Index

TI is an estimate of the temperature increase of soft tissue or bone. There are three thermal index categories:

- TIS: Soft tissue thermal index. The main TI category. Used for applications that do not image bone.
- TIB: Bone thermal index (bone located in a focal region). Used for fetal application.
- TIC: Cranial bone thermal index (bone located close to the surface). Used for transcranial application.

Mechanical Index

MI recognizes the importance of non-thermal processes, cavitation in particular, and the Index is an attempt to indicate the probability that they might occur within the tissue.

TI and MI Display Accuracy

When display MI >= 0.6, TI >= 3.6, the displayed values of MI and TI is not lower than 50% or higher than 150% of the measured values.

When display MI < 0.6, TI < 3.6, the absolute error of MI <= 0.3, the absolute error of TI <= 1.8.

Acoustic output and display on the Vivid T8/Vivid T8 Pro

In the title bar, two fields are allocated for the display of power values as shown in Figure 14-1.

1. Title bar
2. MI
3. TI

Figure 14-1. The display of MI and TI on the screen

The Vivid T8/Vivid T8 Pro chooses the correct category based on mode of operation and chosen application, and presents only one TI to the operator. It is therefore important that the operator chooses the right application.

ALARA

Ultrasound procedures should be performed using output levels and exposure times As Low As Reasonably Achievable (ALARA) while acquiring clinical information.

Training

During each ultrasound examination the user is expected to weigh the medical benefit of the diagnostic information that would be obtained against the risk of potential harmful effects. Once an optimal image is achieved, the need for increasing acoustic output or prolonging the exposure cannot be justified. It is recommended that all users receive proper training in applications before performing them in a clinical setting. Contact the GE sales representative for training assistance.

Safety statement

GE Medical Systems (China) Co., Ltd. safety statement

Although no harmful biological effects have been demonstrated for ultrasound frequencies, intensities and exposure times used in examination with the GE Ultrasound system, GE Medical Systems (China) Co., Ltd. recommends using the lowest acoustic output settings which will produce diagnostically acceptable information.

System controls affecting acoustic output

The operator controls that directly affect the acoustic output are discussed in the Acoustic Output Data Tables in the Reference Manual. These tables show the highest possible acoustic intensity for a given mode, obtainable only when the maximum combination of control settings is selected. Most settings result in a much lower output. It is important to note the following:

- The duration of an ultrasound examination is as important as the acoustic output, since patient exposure to output is directly related to the exposure time.
- Better image quality yields faster clinical results, making it possible to complete the relevant ultrasound examination more rapidly. Therefore, any control that improves the quality of the examination can help to reduce patient exposure, even though it may not directly affect acoustic output.

Probe selection

As long as the appropriate application is available, any probe can be used with the knowledge that the intensities fall at, or below, those stated in the Acoustic Output Data Tables. The duration of patient exposure is most likely minimized with the use of a probe that is optimized to provide resolution and focal depth, appropriate to the examination.

Application selection

Selecting the probe and application preset appropriate to a particular ultrasound examination automatically provides acoustic output limits within FDA guidelines for that application. Other parameters which optimize performance for the selected application are also set automatically, and should assist in reducing the patient exposure time. See page 11-12, for information on selecting probes and application presets.

Changing imaging modes

Acoustic output depends on the imaging mode selected. The choice of mode (2D, M-Mode, Doppler or Color Flow) determines whether the ultrasound beam is stationary or in motion. This greatly affects the energy absorbed by the tissue.

See ‘Scanning Modes’ on *page 4-1*, for complete information on changing imaging modes.

When operating in a combined mode, such as 2D and M-Mode, the total acoustic output comprises contributions from each individual mode. Depending on the modes in use, either or both output indices may be affected.

The user can override the default settings, but care should be taken to observe the displayed MI and TI values.

Power

It is possible to change the power in all operating modes so that the operator can use the ALARA principle.

Important safety considerations

This section includes considerations for the following:

- Patient safety
- Personnel and equipment safety

The information contained in this section is intended to familiarize the user with the hazards associated with the use of the unit, and to alert them to the extent to which injury and damage may occur if the precautions are not observed.

Users are obligated to familiarize themselves with these safety considerations and to avoid conditions that could result in injury or damage.

Patient safety

Patient identification

The concerns listed in this section can seriously affect the safety of the patient undergoing a diagnostic ultrasound examination.

Always include proper identification with all patient data and verify the accuracy of the patient's name and/or identity number when entering such data. Ensure that the correct patient ID is provided on all recorded data and hard copy prints. Identification errors could result in an incorrect diagnosis.

Diagnostic information

The images and calculations provided by the system are intended for use by competent users, as a diagnostic tool. They are explicitly not to be regarded as the sole, irrefutable basis for clinical diagnosis. Users are encouraged to study the literature and reach their own professional conclusions regarding the clinical utility of the system.

The system provides calculations (e.g. estimated foetal weight) and charts based on published scientific literature. The selection of the appropriate chart and clinical interpretation of calculations and charts are the sole responsibility of the user. The user must consider contraindications for the use of a calculation or chart as described in the scientific literature. The diagnosis, decision for further examinations and medical treatment must be performed by qualified personnel following good clinical practice.

The user should be aware of the product specifications and of the system accuracy and stability limitations. These limitations must be considered before making any decision based on quantitative values. If in doubt, the nearest GE Ultrasound Service Office should be consulted.

Equipment malfunction or incorrect settings can result in measurement errors or failure to detect details in the image. The user must become thoroughly familiar with the operation of the unit in order to optimize its performance and to recognize possible malfunctions. Application training is available through the sales representative.

Be certain to ensure privacy data of patient information.

Mechanical hazards

Damaged probes or improper use and manipulation of the transesophageal probe may result in injury or increased risk of infection. Inspect probes frequently for sharp, pointed or rough surface damage that could cause injury or tear protective barriers (gloves and sheaths).

Transesophageal probe safety

Never use excessive force when manipulating the transesophageal probe. The detailed operator manual enclosed with the transesophageal probe must be read carefully.

Safe and efficient data storage is crucial when doing transesophageal examination. To ensure optimal image storage during a transesophageal examination the user should consider:

- To create a new examination when using the TEE probe in order to limit the size of the examination.
- To store the images on the local archive. Storage on a remote archive may be affected by network instability and traffic.

Electrical Hazard

A damaged probe may increase the risk of electric shock if conductive solutions come in contact with internal live pads. Inspect probes often for cracks or openings in the housing and holes in and around the acoustic lens, or other damage that could allow moisture to enter. Become familiar with the probe's use and care precautions outlined in ‘Probes’ on *page 11-1*.

The scanner and Electrosurgical units

This equipment provides no special means of protection from high frequency (HF) burns that may result from using an electrosurgical unit (ESU). To reduce the risk of HF burns, avoid contact between the patient and ultrasound transducer or ECG electrodes while operating the ESU. Where contact cannot be avoided, as in the case of TEE monitoring during surgery, make sure the transducer or ECG electrodes are not located between the ESU active and dispersive electrodes and keep the ESU cables away from the transducer or ECG cables

Personnel and equipment safety

The hazards listed below can seriously affect the safety of personnel and equipment during a diagnostic ultrasound examination.

Explosion hazard

Never operate the equipment in the presence of flammable or explosive liquids, vapors or gases. Malfunctions in the unit, or sparks generated by fan motors, can electrically ignite these substances. Operators should be aware of the following points to prevent such explosion hazards.

- If flammable substances are detected in the environment, do not plug in or turn on the system.
- If flammable substances are detected after the system has been turned on, do not attempt to turn off the unit, or to unplug it.
- If flammable substances are detected, evacuate and ventilate the area before turning off the unit.

Electrical hazard

The internal circuits of the unit use high voltages, capable of causing serious injury or death by electrical shock.

To avoid risk of electric shock, this equipment must only be connected to a supplymains with protective earth.

To avoid injury

- Do not remove the unit's protective covers. No user-serviceable parts are inside. If servicing is required, contact qualified technical personnel.
- Connect the attachment plug to a hospital-grade grounding outlet to ensure adequate grounding.
- Do not place liquids on or above the unit. Conductive fluids seeping into the active circuit components may cause short circuiting, which could result in an electrical fire.
- An electrical hazard may exist if any light, monitor or visual indicator remains on after the unit is turned off.

Fuses blown within 36 hours of being replaced may indicate a malfunctioning electrical circuit within the system. In this event, the unit must be checked by GE Ultrasound service personnel. No attempt should be made to replace the fuses with others of a higher rating.

Moving hazard

The ultrasound unit weighs approximately 65 Kg (144 lb.).

Special care must be used to avoid injury when moving or transporting the unit.

- Always be sure the pathway is clear.
- Limit the speed of movement to a careful walk.
- Use at least two people when moving the unit on inclines.

Ensure that the unit is well prepared before transporting. Refer to ‘Moving and transporting the unit’ on *page 2-13* for more information.

Biological hazard

For patient and personnel safety, beware of biological hazards while performing transesophageal procedures. To avoid the risk of disease transmission:

- Use protective barriers (gloves and probe sheaths) whenever necessary. Follow sterile procedures as required.
- Thoroughly clean probes and reusable accessories after each patient examination and disinfect or sterilize as needed. Refer to Chapter ‘Probes’ on *page 11-1*, for probe use and care instructions.
- Follow all in-house infection control policies as they apply to personnel and equipment.

Pacemaker hazard

The possibility of the system interfering with pacemakers is minimal. However, as this system generates high frequency electrical signals, the operator should be aware of the potential hazard this could cause.

Electrical safety

Internally connected peripheral devices

The system, together with peripheral devices, such as printers, meets UL60601-1 and IEC 60601-1 standards for electrical isolation and safety. These standards are applicable only when the specified peripheral devices are plugged into the AC outlets provided in the unit.

External Connection of other peripheral devices

External devices can be used only if CE marked and in compliance with related standards (EN 60601-1 or EN 60950). Conformance to EN 60601-1 must be verified.

Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC standards (e.g. IEC60950 for data processing equipment and IEC 60601-1 for medical equipment). Furthermore all complete configurations shall comply with the valid version of the system standard IEC 60601-1. Anybody connecting additional equipment to the signal input part or signal output part of ultrasound unit configures a medical system, and is therefore responsible that the system complies with the requirements of the valid version of IEC 60601-1. If in doubt consult the technical service department or your local representative for GE.

Other external devices, such as laser cameras, printers, VCRs and external monitors, usually exceed allowable leakage limits and, when plugged into separate AC outlets that are then connected to the unit, are in violation of patient safety standards. Suitable electrical isolation of such external AC outlets may be required in order to meet UL60601-1 and IEC 60601-1 standards for electrical leakage.

Allergic reactions to latex-containing medical devices

Due to reports of severe allergic reactions to medical devices containing latex (natural rubber), the FDA advises health-care professionals to identify latex-sensitive patients, and be prepared to treat allergic reactions promptly. Latex is a component of many medical devices, including surgical and examination gloves, catheters, incubation tubes, anesthesia masks and dental dams. Patient reaction to latex has ranged from contact urticaria, to systemic anaphylaxis.

For more details regarding allergic reaction to latex, refer to *FDA Medical Alert MDA91-1*, March 29.

Electromagnetic Compatibility (EMC)

NOTE: This unit carries the CE mark. It complies with regulatory requirements of the European Directive 93/42/EEC concerning medical devices. It also complies with emission limits for a Group 1, Class A Medical Device as stated in EN 60601-1-2 (IEC 60601-1-2).

Electrical medical equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in this manual.

AII types of electronic equipment may characteristically cause electromagnetic interference with other equipment, transmitted either through air or connecting cables. The term Electromagnetic Compatibility (EMC), indicates the capability of the equipment to curb electromagnetic influence from other equipment, while at the same time not affecting other equipment with similar electromagnetic radiation.

Radiated or conducted electromagnetic signals can cause distortion, degradation, or artifacts in the ultrasound image which may impair the ultrasound unit's essential performance (see page 14-19).

Electromagnetic Compatibility (EMC) (continued)

There is no guarantee that interference will not occur in a particular installation. If this equipment is found to cause or respond to interference, attempt to correct the problem by one or more of the following measures:

- Re-orient or re-locate the affected device.
- Increase the separation between the unit and the affected device.
- Power the equipment from a source other than that of the affected device.
- Consult the service representative for further suggestions.

The manufacturer is not responsible for any interference or responses caused by the use of interconnecting cables other than those recommended, or by unauthorized changes or modifications to this unit. Unauthorized changes or modifications could void the user's authority to operate the equipment.

To comply with the regulations on electromagnetic interference, all interconnecting cables to peripheral devices must be shielded and properly grounded. Use of cables not properly shielded and grounded may result in the equipment causing or responding to radio frequency interference, in violation of the European Union Medical Device Directive and FCC regulations.

Devices which intrinsically transmit radio waves such as cellular phones, radio transceivers, mobile radio transmitters, radio-controlled toys, and so on, should preferably not be operated near the unit. See ‘Minimum Distance’ on *page 14-19* about the recommended minimum separation distances between portable and mobile RF communications equipment and the ultrasound unit.

Any electrical device can unintentionally emit electromagnetic waves. However, minimum device separation distances cannot be calculated for such unspecified radiation. When the ultrasound unit is used adjacent to or in close proximity to other equipment the user should be attentive to unexpected device behavior which may be caused by such radiation.

The ultrasound unit is intended for use in the electromagnetic environment specified in the tables below.

The user of ultrasound unit should assure that the device is used in such an environment.

Electromagnetic emissions

This system is suitable for use in the following environment. The user must assure that it is used only in the electromagnetic environment as specified.

Table 14-1: Declaration of Emissions

Guidance and manufacturer's declaration - electromagnetic emissions		
The system is intended for use in the electromagnetic environment specified below. The user of the system should assure that it is used in such an environment.		
Emission Type	**Compliance**	**Electromagnetic Environment**
RF Emissions CISPR 11	Group 1	This system uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions CISPR 11	Class A	This system is suitable for use in all establishments, other than domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes, provided the following warning is heeded: WARNING: This system is intended for use by healthcare professionals only. This system may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the system or shielding the location.
Harmonic Emissions IEC 61000-3-2	Class A	
Voltage Fluctuations/Flicker Emissions IEC 61000-3-3	Complies	

Electromagnetic immunity

This system is suitable for use in the following environment. The user must assure that the system is used according to the specified guidance and only in the electromagnetic environment listed.

Table 14-2: Declaration of Immunity

Immunity Type	Equipment Capability	Regulatory Acceptable Level	EMC Environment and Guidance
IEC 61000-4-2 Static discharge (ESD)	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%. Mains power quality should be that of a typical commercial and/or hospital environment. If the user requires continued operation during power mains interruptions, it is recommended that the system be powered from a UPS or a battery. NOTE: UT is the a.c. mains voltage prior to application of the test level. Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial and/or hospital environment. Separation distance to radio communication equipment must be maintained according to the method below. Interference may occur in the vicinity of equipment marked with the symbol:  Image degradation or interference may occur due to conducted RF noise on the equipment mains power supply or other signal cable. Such interference is easily recognized and distinguishable from patient anatomy and physiological waveforms. Interference of this type may delay the examination without affecting diagnostic accuracy. Additional mains/ signal RF isolation or filtering may be needed if this type interference occurs frequently.
IEC 61000-4-4 Electrical fast transient/burst	± 2 kV for mains ± 1 kV for SIP/SOP	± 2 kV for mains ± 1 kV for SIP/SOP	
IEC 61000-4-5 Surge Immunity	± 1 kV differential ± 2 kV common	± 1 kV differential ± 2 kV common	
IEC 61000-4-11 Voltage dips, short interruptions and voltage variations on mains supply	< 5% U_T (> 95% dip in U_T) for 0.5 cycle; 40% U_T (60% dip in U_T) for 5 cycles; 70% U_T (30% dip in U_T) for 25 cycles; < 5% U_T (>95% dip in U_T) for 5 sec	< 5% U_T (> 95% dip in U_T) for 0.5 cycle; 40% U_T (60% dip in U_T) for 5 cycles; 70% U_T (30% dip in U_T) for 25 cycles; < 5% U_T (>95% dip in U_T) for 5 sec	
IEC 61000-4-8 Power frequency (50/ 60 Hz) magnetic field	3 A/m	3 A/m	
IEC 61000-4-6 Conducted RF	3 V_{RMS} 150 kHz - 80 MHz	3 V_{RMS} 150 kHz - 80 MHz	
IEC 61000-4-3 Radiated RF	3 V/m 80 MHz - 2.5 GHz	3 V/m 80 MHz - 2.5 GHz	
NOTE: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people. If noise generated from other electronic equipment is near the probe's center frequency, noise may appear on the image. Good power line isolation is required.			

Minimum Distance

Portable and mobile radio communications equipment (e.g. two-way radio, cellular/cordless telephones and similar equipment) should be used no closer to any part of this system, including cables, than determined according to the following method:

Table 14-3: Portable and mobile radio communications equipment distance requirements

Frequency Range:	**150 kHz - 80 MHz**	**80 MHz - 800 MHz**	**800 MHz - 2.5 GHz**
Calculation Method:	d=[3.5/V_1] square root of P	d = [3.5/E_1] square root of P	d = [7/E_1] square root of P
Where: d= separation distance in meters, P = rated power of the transmitter, V_1=compliance value for conducted RF, E_1 = compliance value for radiated RF			
If the maximum transmitter power in watts is rated	**The separation distance in meters should be**		
5	2.6	2.6	5.2
20	5.2	5.2	10.5
100	12.0	12.0	24.0

Essential performance

The essential performance of the ultrasound unit is:

- The ability to display physiological images as input for diagnosis by trained physician.
- The ability to display physiological traces as aid for diagnosis by trained physician.
- The ability to display quantified data as input for diagnosis by trained physician.
- The display of ultrasound indexes as aid for safe use of the unit.
- The display of probe surface temperature as aid for safe use of the unit (Probe dependent).

Environmental protection

Disposal

Table 14-4: WEEE symbol

	Rear of the system and Probe connector

This symbol indicates that waste electrical and electronic equipment must not be disposed of as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

Device labels

Label Icon Description

The following table describes the purpose and location of safety labels and other important information provided on the equipment.

Table 14-5: Label Icons

Label/Icon	Purpose/Meaning	Location
Identification and Rating Plate 	• Manufacture's name and address • Date of manufacture • Model and serial numbers • Electrical ratings (Volts, Amps, phase, and frequency)	
Identification and Rating Plate 	**Date of manufacture:** The date could be a year, year and month, or year, month and day, as appropriate. See ISO 8601 for date formats.	Rating Plate
	Serial Number	Rating Plate
	Catalog Number	Rating Plate
Type/Class Label	Used to indicate the degree of safety or protection.	
IP Code IPX8: FSU-1000, MKF 2-MED GP26	Indicates the degree of protection provided by the enclosure per IEC60 529.	Bottom of footswitch
	Type BF Applied Part (man in the box) symbol is in accordance with IEC 60878-02-03.	Beside the probe connector

Table 14-5: Label Icons (Continued)

Label/Icon	Purpose/Meaning	Location
	General Warning.	Various
	“CAUTION” - Dangerous voltage” (the lightning flash with arrowhead) is used to indicate electric shock hazards.	Various
	“Protective Earth” indicates the protective earth (grounding) terminal.	Inside Power Box and Console
	“Equipotentiality” indicates the terminal to be used for connecting equipotential conductors when interconnecting (grounding) with other equipment. Connection of additional protective earth conductors or potential equalization conductors is not necessary in most cases and is only recommended for situations involving multiple equipment in a high-risk patient environment to provide assurance that all equipment is at the same potential and operates within acceptable leakage current limits. An example of a high-risk patient would be a special procedure where the patient has an accessible conductive path to the heart such as exposed cardiac pacing leads. IEC60417-5021	Rear panel
	This symbol indicates that waste electrical and electronic equipment must not be disposed of as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.	Rear Panel and probe connector

Table 14-5: Label Icons (Continued)

Label/Icon	Purpose/Meaning	Location
	Indicates the presence of hazardous substance(s) above the maximum concentration value. Maximum concentration values for electronic information products, as set by the People's Republic of China Electronic Industry Standard SJ/T11364-2006, include the hazardous substances of lead, mercury, hexavalent chromium, cadmium, polybrominated biphenyl (PBB), and polybrominated diphenyl ether (PBDE). The number in the cycle indicates the number of years during which the hazardous substance(s) will not leak or mutate so that the use of this product will not result in any severe environmental pollution, bodily injury, or damage to any assets.	Probe and Rear Panel, China Rating Plate
	Equipment Type CF, indicates equipment having a floating applied part having a degree of protection suitable for direct cardiac contact.	ECG module
	Do not place any objects on the monitor.	Back of LCD
	Do not force the LCD monitor with your hands.	Back of LCD
	There is a pinch point on the LCD monitor. Take care to avoid injuring hands or fingers when flipping down the LCD monitor.	Back of LCD
	Use the rear handle for horizontal movement only.	Back of LCD
	"Consult accompanying documents" is intended to alert the user to refer to the operator manual or other instructions when complete information cannot be provided on the label.	Various

Table 14-5: Label Icons (Continued)

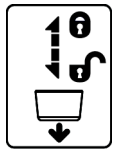
Label/Icon	Purpose/Meaning	Location
	DO NOT push place a finger, hand or any object on the joint of the monitor or monitor arm to avoid injury when moving the monitor and monitor arm.	Flexible Arm
	DO NOT push place a finger, hand or any object on the flexible arm locking position to avoid injury when locking the flexible arm.	Flexible Arm
	How to lock the flexible arm. • Pull down the locker and rotate the locker slightly to release the flexible arm • Rotate the locker slightly and then loose it to lock the lfexible arm	Keyboard Bottom Cover
	Warning: crushing of hands	Top of Touch Panel
	Do not push the system	Back of LCD

Table 14-5: Label Icons (Continued)

Label/Icon	Purpose/Meaning	Location
	GOST symbol: Russia Regulatory Country Clearance.	Rating plate Note: Only after Russian regulatory registration is complete, this label will be located on the console rating plate.
Segurança TÜVRheinland	INMETRO Certification: TUV Rheinland Brazil	Rating plate Note: Only after Brazilian regulatory registration is complete, this label will be located on the console rating plate.
TÜVRheinland c us	NRTL Listing and Certification Mark is used to designate conformance to nationally recognized product safety standards. The Mark bears the name and/or logo of the testing laboratory, product category, safety standard to which conformity is assessed and a control number.	Back of Vivid T8/Vivid T8 Pro

Warning Label Locations

Vivid T8/Vivid T8 Pro warning labels are provided in English.

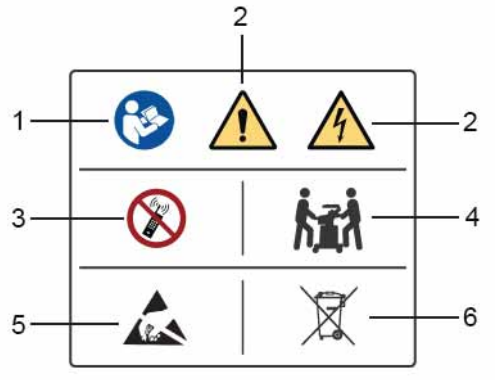


Figure 14-2. Label location explanations

Table 14-6: Label Location Explanations

1. “Consult accompany document” is intended to alert the user to refer to the operator manual or other instructions when complete information cannot be provided on the label.
2. Possible shock hazard. Do not remove covers or panels. No user serviceable parts are inside. Refer servicing to qualified service personnel.
3. Do not use the following devices near this equipment: cellular phone, radio receiver, mobile radio transmitter, radio controlled toy, etc. Use of these devices near this equipment could cause this equipment to perform outside the published specifications. Keep power to these devices turned off when near this equipment.
4. The equipment weighs approximately 65 kg (144 lbs). To avoid possible injury and equipment damage when transporting from one area of use to another:
   - Be sure the pathway is clear.
   - Limit movement to a slow careful walk.
   - Use two or more persons to move the equipment on inclines or long distance
5. Be careful of static
6. WEEE Label

Warning Label Locations (continued)

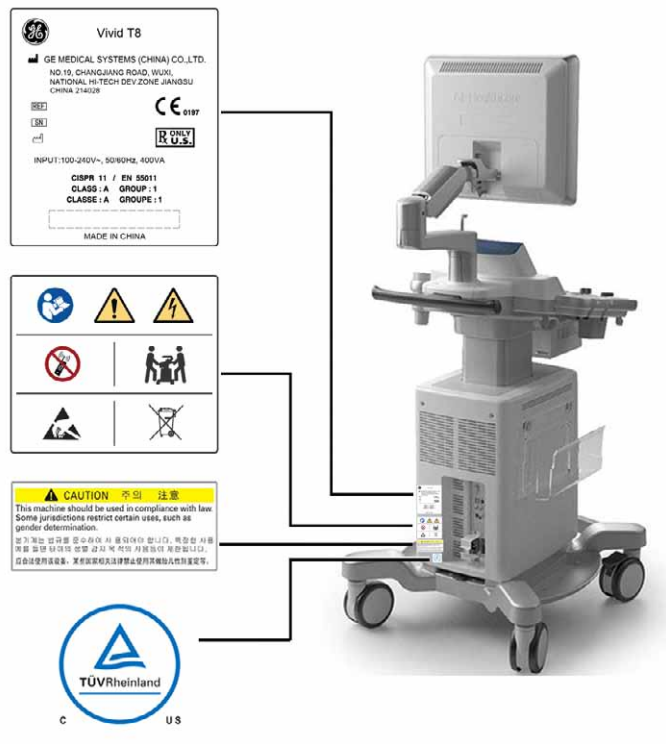


Figure 14-3. Rating Plate Label Location

For China only

RoHS Vivid T8/Vivid T8 Pro Hazardous Substances

The following product pollution control information is provided according to SJ/T11364-2006 Marking for Control of Pollution caused by Electronic Information Products.

This symbol indicates the product contains hazardous materials in excess of the limits established by the Chinese standard SJ/T11363-2006 Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products. The number in the symbol is the Environment-friendly Use Period (EFUP), which indicates the period during which the toxic or hazardous substances or elements contained in electronic information products will not leak or mutate under normal operating conditions so that the use of such electronic information products will not result in any severe environmental pollution, any bodily injury or damage to any assets. The unit of the period is "Year".

In order to maintain the declared EFUP, the product shall be operated normally according to the instructions and environmental conditions as defined in the product manual, and periodic maintenance schedules specified in Product Maintenance Procedures shall be followed strictly.

Consummables or certain parts may have their own label with an EFUP value less than the product. Periodic replacement of those consummables or parts to maintain the declared EFUP shall be done in accordance with the Product Maintenance Procedures. This product must not be disposed of as unsorted municipal waste, and must be collected separately and handled properly after decommissioning.

Name and Concentration of Hazardous Substances

Table 14-7: Table of hazardous substances' name and concentration for Vivid T8/Vivid T8 Pro

Component Name	Hazardous substances' name					
	Pb	Hg	Cd	Cr (VI)	PBB	PBDE
LCD Panel	X	X	O	O	O	O
Printed Circuit Board Assemblies	X	O	O	O	O	O
Keyboard Assemblies	X	O	O	O	O	O
Power Assemblies	X	O	O	O	O	O
Console Cabinet	O	O	O	O	O	O
Ultrasound Probes	X	O	O	O	O	O
Wheels	O	O	O	O	O	O

O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.
X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006

- Data listed in the table represents best information available at the time of publication.
- Applications of hazardous substances in this medical device are required to achieve its intended clinical uses, and/or to provide better protection to human beings and/or to environment, due to lack of reasonably (economically or technically) available substitutes. For example: 1) Lead is could be used in Printed circuit solder; 2) Mercury could be used in LCD Panel.

Chapter 15

Appendix

This chapter describes:

Scan Assist Pro Creator

NOTE: Scan Assist is an option for Vivid T8 and Vivid T8 Pro.

Overview

The Scan Assist Pro Creator is used to build customized Protocols that can be imported onto the Vivid T8/Vivid T8 Pro. These Protocols automate many of the steps normally performed manually by the user, thereby reducing the number of user actions and the amount of time to perform an exam.

Protocol export from Vivid T8/Vivid T8 Pro

The factory and user-defined Protocols can also be exported for editing with the Scan Assist Pro Creator.

1. Insert the USB media to save the files.

NOTE: CD/DVD are not supported for this function.

2. Press **Protocol** on the Control panel and **Config** on the Touch panel. Log on if required.

   The *Scan Assist Pro* sheet is displayed.

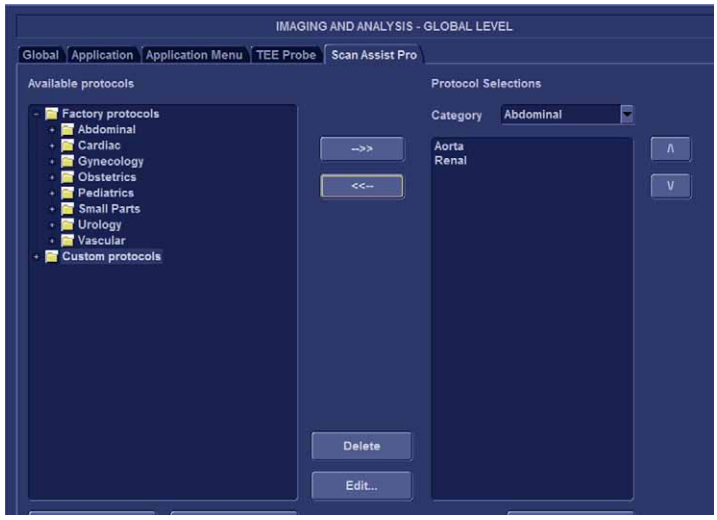


Figure 15-1. The Scan Assist Pro sheet

Protocol export from Vivid T8/Vivid T8 Pro (continued)

3. Select **Export** from the *Scan Assist Pro* sheet.
   The *Export Protocols* window is displayed.

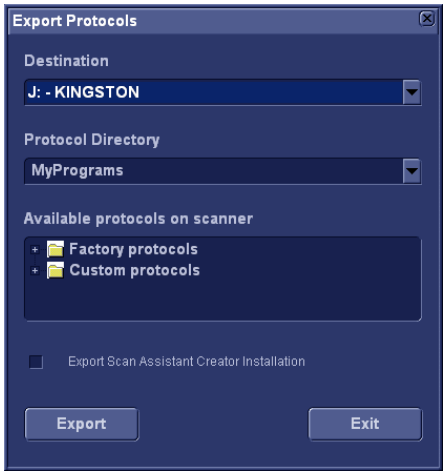


Figure 15-2. Export Protocols

4. In the *Destination* field, select the media to store the files on.
5. In the *Protocol Directory* field, select an existing folder or enter the name of a new folder. The Protocols will be stored to that location.
6. Highlight the Protocol(s) to be exported. If a folder is highlighted, all Protocols in the folder are selected.

   Make sure that the option **Export Scan Assist Pro Creator Installation** is checked.

   The installation file for the Scan Assist Pro Creator will be stored to a separate folder named ScanAssistantCreatorSetup (Figure 15-3).

Protocol export from Vivid T8/Vivid T8 Pro (continued)

7. Select **Export**.

   The Protocols and the Scan Assist Pro Creator installation file are exported.

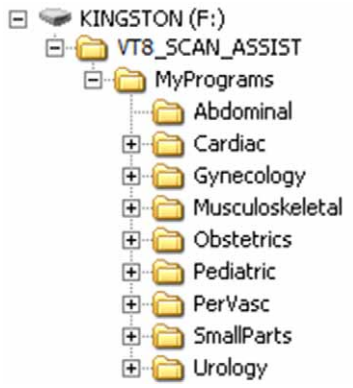


Figure 15-3. Export folder structure

File Extensions

Factory defined Protocols have an .ep (exam protocol) extension while user-defined Protocols have and .uep (user exam protocol) extension. Both factory and user-defined Protocols can be read into the Scan Assist Pro Creator, but only user-defined Protocols can be created. If a factory Protocol is read into the Scan Assistant Pro Creator and then edited, it is saved as a user-defined Protocol.

Protocol import to Vivid T8/Vivid T8 Pro

Import the Scan Assistant Protocol created using the Scan Assistant Creator or exported from another Vivid T8/Vivid T8 Pro protocol.

1. Insert the USB media to import the files.
2. Press **Protocol** on the Control panel and **Config** on the Touch panel. Log on if required.

   The *Scan Assist Pro* sheet is displayed.

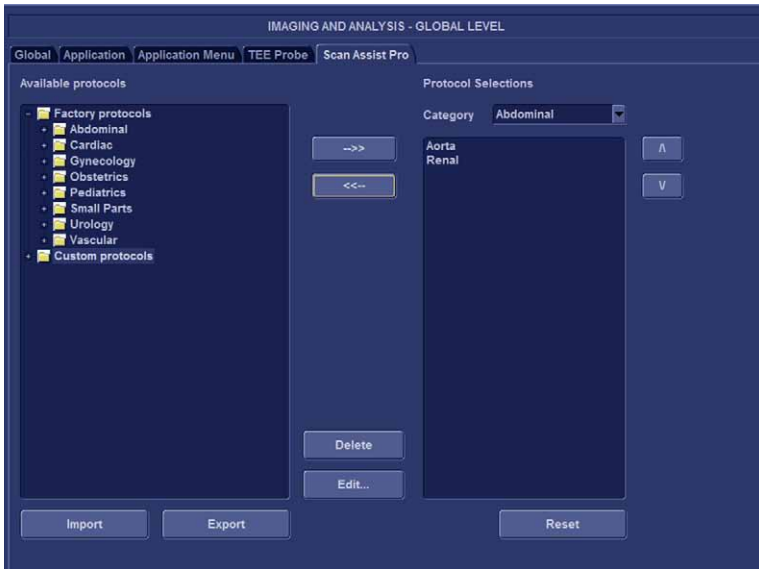


Figure 15-4. The Scan Assistant Pro Sheet

3. Select **Import** from the *Scan Assist Pro* sheet.

   The *Import Protocols* window is displayed.

Protocol import to Vivid T8/Vivid T8 Pro (continued)

Figure 15-5. Export Protocols

4. Highlight the Protocol(s) to be imported. If a folder is highlighted, all Protocols in the folder are selected.
5. Select **Import**, the selected protocols are imported and set up on Vivid T8/Vivid T8 Pro.

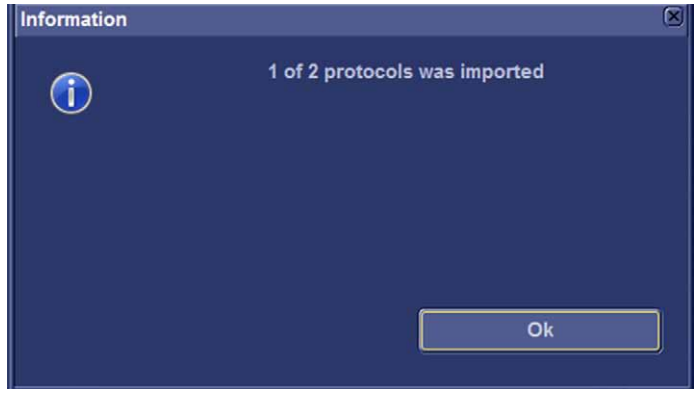


Figure 15-6. Import Scan Assistant Protocol

NOTE: The Factory Protocols can not be imported.

Starting Scan Assist Pro Creator

Editing an Existing Protocol

1. Press **Protocol** on the Control panel and **Config** on the Touch panel. Log on if required.

   The *Scan Assist Pro* sheet is displayed (Figure 15-1, page 15-2).
2. To edit an existing Protocol, select the Protocol in the *Available Protocols* field on the left-hand side of the *Scan Assist Pro* sheet.
3. Select **Edit** to start the Scan Assist Pro Creator.

Creating new Protocols

A Protocol is made up of a series of steps. Each step has various attributes that need to be defined. Protocols can be made from scratch or by modifying an existing Protocol.

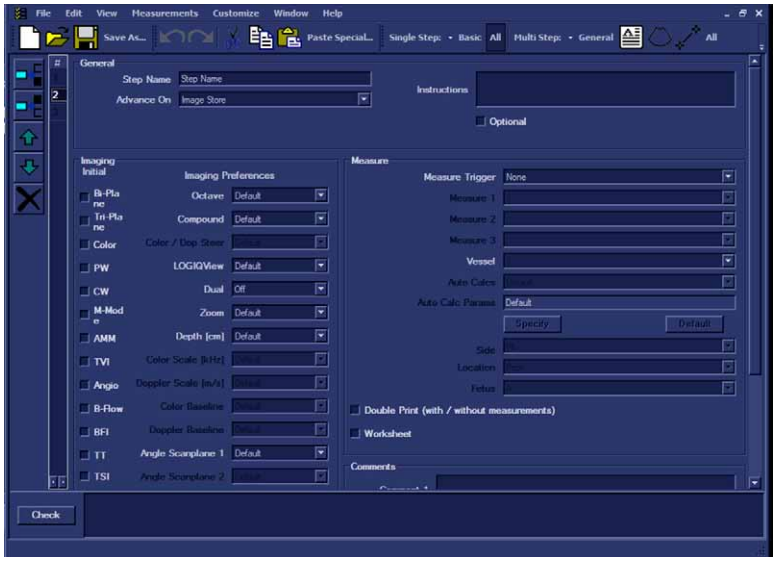


Figure 15-7. Scan Assistant Creator

Creating new Protocols (continued)

To create a new Protocol:

1. Select either:
   - **File**/**New** (**Ctrl**+**n**) to start a new Protocol.
   - **File**/**Open** (**Ctrl**+**o**) to open an existing Protocol (.ep or .uep)
2. Select **View**/**Single step: All** to display all the attributes for the first step.
3. Adjust the attributes for the current step. See ‘Step attributes’ on *page 15-12* for a description of the attributes.
4. Once done press  to add a new step below the first step (or select the next step if editing an existing Protocol) and adjust the attributes for this new step as required.
5. Other possible adjustments:
   - Select  (**Ctrl**+**Up Arrow**)/  (**Ctrl**+**Down Arrow**) to move a step.

     Select  to delete selected step(s).
6. When all steps are created, press **Check** to verify the Protocol.

   Any invalid attribute settings reported should be corrected and the Protocol rechecked.

Measurements in Protocols

Because there are many measurements available on the Vivid T8/Vivid T8 Pro and because the measurement package is highly customizable, there is some special handling for measurements.

To set up a measurement step in a Protocol:

1. Press **Measurements** and select a measurement category and optionally a measurement subcategory.

   The measurements available for the attributes *Measure 1* to *Measure 3* and *Vessel* are limited to the measurements available in the category or subcategory selected.
2. Select the desired *Measure trigger* parameter (see ‘Measurement attributes’ on *page 15-15*).

NOTE: *To configure a Vessel measurement, leave the Measure trigger attribute to* ***None****.*

3. Select the desired measurements for *Measure 1*, *Measure 2* and *Measure 3*.

Saving Protocols

1. Select **File**/**Save** (**Ctrl**+**s**)

NOTE: *Select **File**/**Save as** to save the Protocol with a different name.*

If the Protocol was not checked, a dialog is displayed giving the opportunity to check the Protocol for errors before saving.

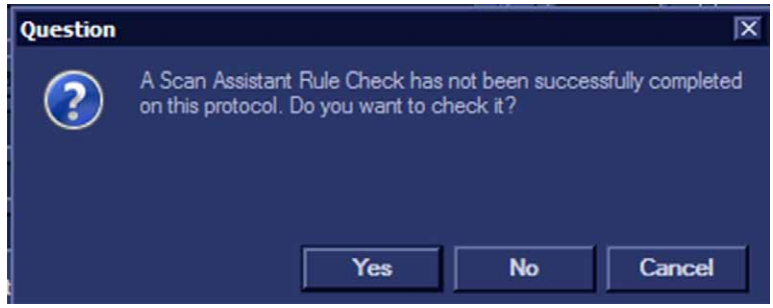


Figure 15-8. Protocol check dialog

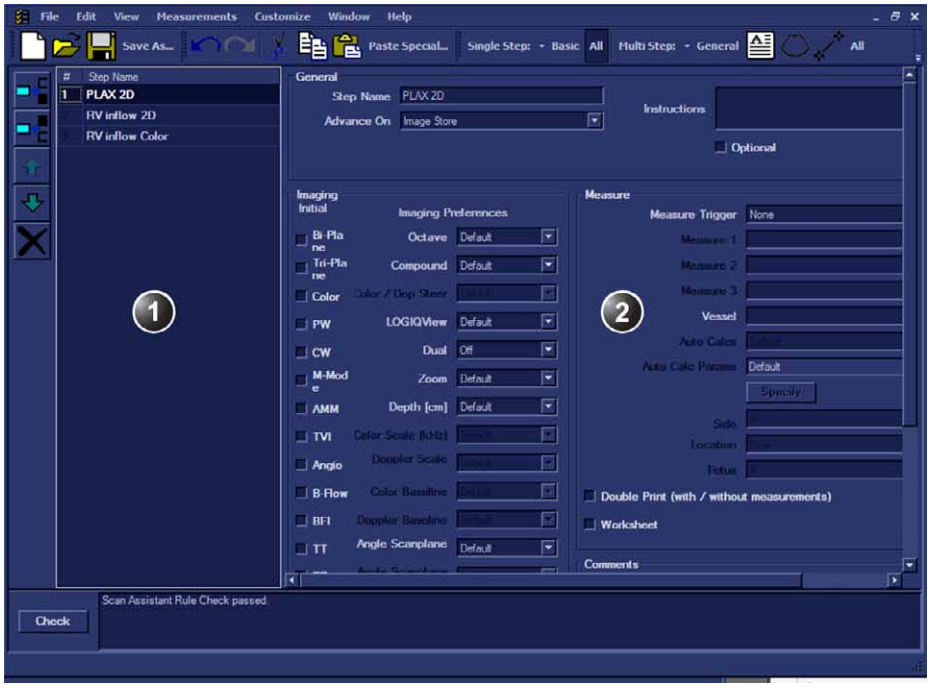
2. Select:
   - **Yes** to check the Protocol before saving it.
   - **No** to bypass the Protocol check.
   - **Cancel** to cancel the save request.

Views

A Protocol is made up of a series of steps. Each step is made up of various step attributes. The step and step attribute data can be viewed in many ways using the Scan Assist Pro Creator. The different ways to look at the data are called Views. The view of choice is selected from the *View* Menu or from toolbar.

Single step views

There are two Single step views: Basic and All. The Basic view shows the most common attributes of the selected step. The All view shows all of the attributes of the selected step.

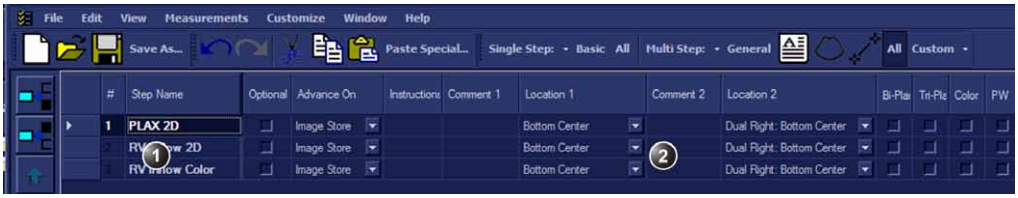


1. List of all steps in the Protocol
2. Attributes for the selected step

Figure 15-9. Single step view (All)

Multi step views

Multi step views show the step attributes for all the steps in a Protocol. There are six Multi step views: General, Comment, Scan, Measure, Custom and All.



1. List of all steps in the Protocol
2. Attributes for all steps in the Protocol

Figure 15-10. Multi step view (All)

The information displayed in each multi step view is configurable.

1. Select **Customize/Views**.

   The Customize multi step views window is displayed.

   Each tab represents a different Multi step view. Within a tab, the checked boxes are the step attributes that are displayed in that Multi step view.
2. For each Multi step view check the attributes to be displayed.
3. Select **Save**.

Step attributes

Scan Assist Pro allows the user to program the steps in an exam and to program certain attributes for each step. The attributes are what give the Scan Assist Pro Protocol behavior. The tables below provide a description of all attributes.

General attributes

Name	Input	Description
Step name	Any text	Name of the step that appears in the Scan Assist Pro window.
Advance on	Store	Advance to the next step after pressing **Store** on the Control panel.
	Store & Unfreeze	Advance to the next step after pressing **Store** and **Unfreeze** on the Control panel.
	Store & user selection	Advance to next step after pressing **Store** on the Control panel and **Down arrow** on the keyboard.
Instructions	Any text	Notes displayed in the Scan Assist Pro window when the step is active. Hint: the probe and application required for this Protocol should be entered in the *Instruction* field of the first step.
Optional	☑	An optional step is given a check mark during Protocol execution even if no image is acquired.

Comment attributes

Name	Input	Description
Comment 1 Comment 2	Any text	User annotation associated with the step. When editing in a Multi step view, use **Alt**+**Enter** to create a new line.
Location 1 Location 2	Top Left Middle Left Bottom Left Top Center Bottom Center Top Right Mid Right Bottom Right	Location of the annotation on screen.

Imaging attributes

Name	Input	Description
Initial modes	☑	Scanning mode associated with the step. Some scanning modes may be combined (e.g PW Doppler and Color Flow).
Octave	Off	Octave is off.
	On	Octave is on.
	Default	Octave not specified.
Compound	Off	Compound is off.
	On	Compound is on.
	Default	Compound is not specified.
Color/Doppler steer	Left	Color/Doppler steered to the left.
	Center	Color/Doppler not steered.
	Right	Color/Doppler steered to the right.
LOGIQ View	Off	LOGIQ View is off.
	On	LOGIQ View is on.
	Default	LOGIQ View not specified.
Dual	Off	Single screen display
	Left Active	Dual screen display is on with the left image active.
	Right Active	Dual screen display is on with the right image active.
	Simultaneous	Displays 2D and Color mode side-by-side.
Zoom	Off	Zoom is off.
	On	Zoom is on.
	Default	Zoom is not specified.
Depth	Default	Depth is not specified.
	1 – 30 cm	Adjust Depth.
Color Scale	Default	Color Scale is not specified.
	0.25 – 14 kHz	Adjust Color Scale.
Doppler Scale	Default	Doppler Scale is not specified.
	0.05 – 13 m/s	Adjust Doppler Scale.

Name	Input	Description
Color Baseline	Default	Color Baseline is not specified.
	0 – 20	Adjust Color Baseline.
Doppler Baseline	Default	Doppler Baseline is not specified.
	0 – 20	Adjust Doppler Baseline.
Angle Scan plane 1 – 3	Default	Scan plane is not specified.
	0 – 355 deg.	Adjust scan plane.

Measurement attributes

Name	Input	Description
Measure trigger	**Measure** key	Start Measure 1 attribute when **Measure** is pressed on the Control panel.
	Freeze key	Start Measure 1 attribute when **Freeze** is pressed on the Control panel.
	Store key	Start Measure 1 attribute when **Store** is pressed on the Control panel.
	None	Measurement not triggered by the Protocol. Vessel measurements are available when Measure trigger is set to None (see below).
Measure 1 Measure 2 Measure 3	Various measurements	Specify the measurement to perform. Select a measurement category from the *Measurement* menu.
Vessel	Various Doppler vessel measurements	Specify the vessel measurement to perform. Vessel measurement is available only if *Measure trigger* is set to **None**. The list of available measurements is dependent of the category selected in the *Measurement* menu.
Auto Calcs	Default	Auto Calcs state is not specified.
	Off	Auto Calcs state is set to off.
	Frozen	Auto Calcs state is set to Frozen.
	Live	Auto Calcs state is set to Live.

Name	Input	Description
Auto Calc Params	Various Auto Calc parameters	Specify the Auto Calc parameters to be used. Press **Specify** and select the Auto Calc parameters from the *Auto Calc parameter* selection window. Press Default to set the Auto Calc parameter selection to default.
Side	Rt Lt None	Set the side measurement qualifier to either Right or Left. Note: the side measurement qualifier is not set by the Protocol.
Location	Prox Mid Dist None	Set the location measurement qualifier to either Proximal, Middle or Distal. Note: the location measurement qualifier is not set by the Protocol.
Fetus	A, B, C or D	The fetus measurement qualifier is set to either Fetus A, B, C or D.
Double Save (with/without measurements)	☑	The image is stored twice, once with measurements and once without.

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