



GE Medical Systems

Technical Publications

Vivid *i*

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User Manual Volume 1

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Operating Documentation

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GE Medical Systems

MANUAL STATUS

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Introduction

The Vivid *i* ultrasound unit is a compact, high performance portable digital ultrasound imaging system.

The system provides image generation in 2D (B) Mode, Color Doppler, Power Doppler (Angio), M-Mode, Color M-Mode, PW and CW Doppler spectra, Tissue-Doppler imaging (TDI) and LVO Contrast option applications.

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

Attention

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



CAUTION

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 14, "Safety" on page 343, should be read and understood before operating the Vivid *i* ultrasound unit.



CAUTION

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

Devices not to be used near this equipment:

Devices which intrinsically transmit radio waves such as cellular phones, radio transceivers, mobile radio transmitters,

radio-controlled toys, and so on, should not be operated near the 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.

Indications for use

The Vivid *i* ultrasound unit is intended for the following applications:

- Abdominal
- Cardiac
- Small Organ
- Pediatric
- Fetal
- Transesophageal
- Peripheral Vascular
- Neonatal
- Adult Cephalic

Contraindications

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

Manual contents

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



CAUTION

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

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

2-column layout, the right column contains the main text. The left column contains notes, hints and warnings texts.

Keys and button, on the control panel are indicated by over and underlined text (ex. 2D refers to the 2D mode key)

Bold type, describes button names on the screen.

Italic type: describes program windows, screens and dialogue boxes.

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
- Substantial property damage



WARNING

Indicates that a specific hazard exists that, given inappropriate conditions or actions, will cause:

- Severe 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

Contact information

If additional information or assistance is needed, please contact the local distributor or the appropriate support resource listed below:

Europe GE Ultraschall KG Deutschland GmbH & Co. Beethovenstraße 239 Postfach 11 05 60 D-42655 Solingen	Tel: 0130 81 6370 Tel: (49)(0) 212-28-02-208
USA GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 On-line Applications Support	Tel: (1) 800-437-1171 Fax: (1) 414-647-4090 Tel: (1) 800-682-5327 or (262) 524-5698
Canada GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 On-line Applications Support	Tel: (1) 800-664-0732 Tel: (1) 800-682-5327 or (262) 524-5698
Asia GE Ultrasound Asia Service Department Ultrasound 298 Tiong Gahru Road # 15-01/06 Central Plaza Singapore 168730	Tel: (65) 291-8528 Fax: (65) 272-3997

Introduction

Latin and South America GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 On-line Applications Support	Tel: (1) 305-735-2304 Tel: (1) 800-682-5327 or (262) 524-5698
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Chapter 1

Getting started

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Introduction

Only qualified physicians or ultrasound sonographers should perform scans of patients for medical diagnostic reasons. Request training, if needed.

An authorized GE representative will unpack and install the unit. Do not attempt to install the unit alone.

The Vivid *i* does not contain any operator serviceable internal components. Ensure that authorized personnel do not tamper with the unit.

Perform regular preventive maintenance. See 'System Care and Maintenance' for more information.

Maintain a clean environment. Turn OFF, and if possible, disconnect the system before cleaning the unit. See 'Cleaning the system' for more information.

Never set liquids on the unit to ensure that liquid does not drip into the control panel or unit.



WARNING

All the warnings in "Important safety considerations" on page 347, should be read and understood before operating the unit.

Preparing the unit for use

The Vivid *i* 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 Vivid *i* ultrasound unit is powered either by its internal battery or by a separate power supply adaptor unit connected to a separate power outlet for any range of 100 – 230 VAC, 50–60 Hz.



WARNING

Operating the unit with the wrong voltage range causes damages, voiding the factory warranty.

Operating Environment

Ensure that there is sufficient air flow around the Vivid *i* ultrasound unit when installed or operated.

Environmental requirements

The Vivid *i* 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	10–40 °C	30–85%	700–1060 hPa
Storage	-10–60 °C	30–95%	700–1060 hPa
Transport	-10–60 °C	30–95%	700–1060 hPa

The Vivid i 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.



WARNING

Electromagnetic interferences

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

- Operate the unit at least 4.5 meters (fifteen 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 Vivid i ultrasound unit involves preliminary checks of the power adaptor unit and cord, voltage level and compliance with electrical safety requirements.

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

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

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

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

Voltage level check

Check the label on the Vivid *i*'s AC power adaptor (Figure 1-1).

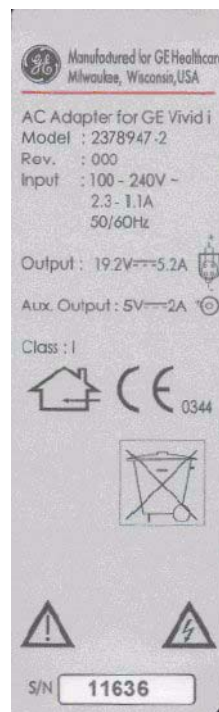


Figure 1-1: The rating label

Check the voltage range indicated on the label:

- 100–240 V, 1.08–0.45 A, 50/60 Hz



WARNING

If the mains supply is not within the specified range, do not connect the unit to the power source. Contact the dealer to have the unit adjusted to the specific mains supply.



WARNING

Connecting to the electrical outlet

The unit's power must be supplied from a separate, properly rated outlet to avoid risk of fire. Refer to "Power requirements" on page 9 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. Connect the AC power adaptor output plug into the appropriate socket on the rear of the Vivid *i*.
2. Ensure that the wall outlet is of appropriate type.
3. Secure the power plug in the wall outlet.

AC Adapter



CAUTION

Use only the special AC Power adapter for Vivid *i*, specifically designed and approved by GE.

Be sure that nothing rests on the AC adapter's power cable and that the cable is not located where it can be tripped over or stepped on.

Place the AC power adapter in a ventilated area, such as a desk, when you use it to run the Vivid *i*.

Do not cover the AC power adapter with paper or other items that will reduce cooling; do not use the AC power adapter inside a carrying case.

Battery

The lithium ion battery provides power when an AC power source is not available. A battery in the battery bay is standard with the Vivid *i*. You can expect one hour of battery life with a single fully charged battery. Lithium ion batteries last longer than conventional batteries and do not require replacement as often.

*Note: The battery is designed to work with Vivid *i* systems only. Only use the batteries authorized by GE.*

The lithium ion technology used in the system's battery is significantly less hazardous to the environment than the lithium metal technology used in some other batteries (such as watch batteries). Used batteries should not be placed with common household waste products. Contact local authorities for the location of a chemical waste collection program nearest you.

**WARNING**

The battery has a safety device. Do not disassemble or alter it.

Charge the batteries only when the ambient temperature is between 0° and 65° C (32° and 149° F) and discharge the batteries between -10° and 55° C (14° and 131° F).

Do not short-circuit the battery by directly connecting the battery terminals with metal objects.

Do not heat the battery or discard it in a fire.

Do not expose the battery to temperature over 60° C (140° F). Keep it away from fire and other heat sources.

Do not charge the battery near a heat source, e.g. fire or heaters.

Do not leave the battery in direct sunlight.

Do not pierce the battery with a sharp object, hit it, or step on it.

Do not use a damaged battery.

Do not solder a battery.

Do not connect the battery to an electrical outlet.

**WARNING**

If the Vivid i is not being used on a monthly basis, the battery needs to be removed during lengthy non-use period.

**CAUTION**

To avoid the battery bursting, igniting, or fumes from the battery causing equipment damage, observe the following precautions:

- ***Do not immerse the battery in water or allow it to get wet.***
- ***Do not put the battery into a microwave oven or pressurized container.***
- ***If the battery leaks or emits an odor, remove it from all possible flammable sources.***
- ***If the battery emits an odor or heat, is deformed or discolored, or in a way appears abnormal during use, recharging or storage, immediately remove it and stop using it. If you have any questions about the battery, consult GE or your local representative.***

Storage of battery pack:

- ***Short term (less than one month): 0° C (32°F) - 50° C (122°F)***
- ***Long term (more than three months): 10° C (50°F) - 35° C (95°F).***
- ***Use only GE recognized batteries.***

Using the Vivid *i* with a Battery

The Vivid *i* can be powered by two different power sources in three different ways:









1. AC power adapter only (without the battery)
2. AC power adapter and a battery (Battery being charged in the system)
3. Battery only (without power from the AC power adaptor)

The user has indications of the states of the power sources both by a graphic icon on bottom of display (while system is operating), and by a pair of LED lights which operate even while the system is OFF.

View Current Battery Status

When the system is running, a status icon is displayed in the system *Status* bar to indicate the current battery status.

Table 1-1: Battery status icons

Icon	Status Description
	AC Power is ON; no battery present
	AC Power is ON; battery is full
	AC Power is ON; battery is partially charged
	AC Power is ON; battery is almost empty
	Battery in use - fully charged (80% - 100%)
	Battery in use - partly charged (25% - 80%)
	Battery in use - battery is discharged (10% - 25%)
	Battery in use -battery is almost empty (0% - 10%)

When the user clicks on the displayed icon, a status description appears.

Battery Power Low Warning

If the battery is in use and the battery power is 10% or less, a warning message appears to warn the user that the battery power is low and that it needs to be charged.

Note: When the battery power is low and the user cannot charge the battery in time, the system automatically shuts down in 2 minutes. This protects the whole system. You need to save all unsaved data before the system shuts down or you may lose useful information.

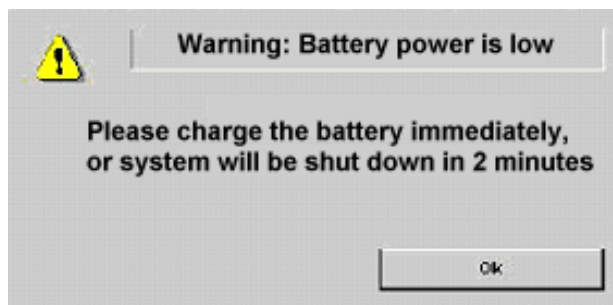


Figure 1-2: Low Battery Power Warning

Peripherals/Accessory connection

Refer to page 279 for further information on peripherals.

The external Peripherals / accessories connectors are situated on the rear side of the unit See Figure 1-3.

Peripherals/Accessory Connector Panel

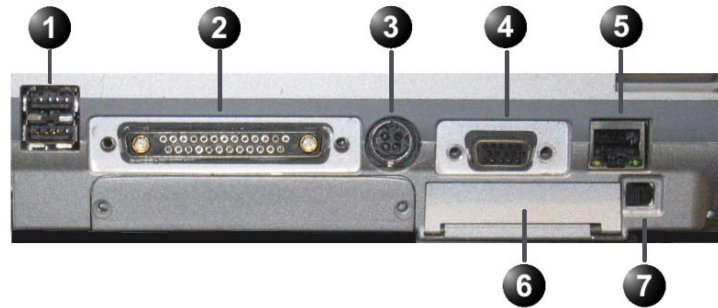
Vivid *i* peripherals and accessories can be properly connected using the rear connector panel.



CAUTION

Use only approved peripherals, accessories or probes.

DO NOT connect any accessories or probes without approval by GE



1. Two interchangeable USB ports (digital printer, CD-RW and other peripherals)
2. Docking connector - for future external devices
3. Port for DC IN (AC Power Adapter)
4. SVGA Output (VCR option or External monitor)
5. LAN 10/100 Base-TX Ethernet network connector
6. PCMCIA port for wireless card
7. Ejection lever for PCMCIA device

Figure 1-3: Peripherals/Accessory Connector Panel



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 (1988) 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 60601-1-1 (2000). 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.



CAUTION

The connection of equipment or transmission networks other than as specified in these instructions can result in electric shock hazard. Alternate connections will require verification of compatibility and conformity to IEC/EN 60601-1-1 by the installer.

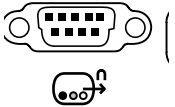
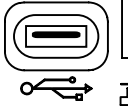
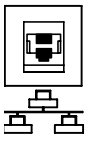


Socket	Signal type	Device type	Note
SVGA Out 	SVGA output RGB high resolution video	Computer monitor	
USB 	Universal serial bus x2		
Ethernet 	10/100 Base-TX Ethernet IEEE 8023 Network device	Network device	
Docking Bay Connector 	Docking bay connector		
AC Adapter Input 	DC voltage from AC adapter unit		

Table 1-2: Contents of the Rear Panel

Switching On/Off

To switch on the unit:

1. Make sure a charge battery is in place by checking the power indicator LED, or connect the appropriate AC power supply adapter output to the rear of the unit (see Figure 1-3).
2. Press \ominus (on/off button) on the top right of the control panel (see Figure 1-6).
After initialization the default scanning screen (2D mode) is displayed, using the active probe.
If the battery is too weak, an appropriate message will display on screen accordingly.

When used with the AC Power Adaptor, the system can be used regardless of the battery level. The battery is automatically charged when the system is operating with the AC Power Adaptor.

Note: When turning ON a system while system is in standby, it takes a few seconds before it responds. Do not push the on/off button again during this period (A second push will initiate a full shutdown).

LEDs

There are two LEDs to indicate the status of the system.

- LED #1 Indicates power status.
After pressing the On/Standby switch, the system power is ON and this LED is lit.
Color: Green
- LED #2 Indicates battery status.
When the battery is charged, the LED is green.
When the battery power is low, the LED is orange.
Color: Green and Orange

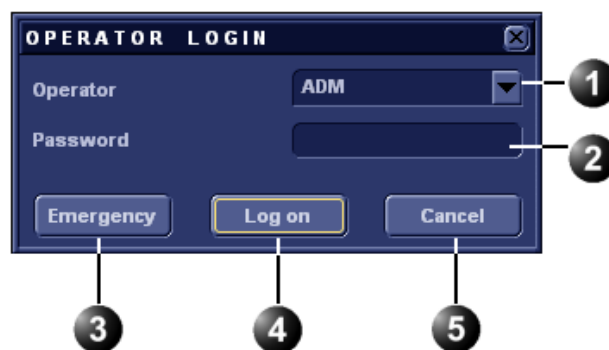
Password Protection

Log In

During the turn-on process the system may require the user to enter a password in order to operate it. Personal IDs and associated passwords can be configured in the Vivid *i*. See "Presets and System setup" on page 283 for more information.

If IDs and passwords have been entered and the Use Auto Logon is *Off* (see "Users" on page 331 for details), the Operator Login Window appears, requesting for an ID and

password when Power up sequence is completed, or when it is required.



- | | |
|---------------------|---|
| 1. Operator: | Select the relevant Operator name. |
| 2. Password | Enter the Operator's password. |
| 3. Emergency | Data stored for the duration of the current examination only. |
| 4. Log on: | Select type of Log on (for example, Standard logon). |
| 5. Cancel | Cancel Log on. |

Figure 1-4: Operator Login Window

Switching off the unit

When the Vivid *i* is switched off, the system performs an automatic shutdown sequence. The unit can be switched off into two states.

- **Standby mode:** most of the system is powered down, but a certain portion of the unit remains energized. The standby mode allows a shorter reboot time when the system is used on a daily basis or moved from one place to another.
- **Full shutdown:** the entire system is shut down. Full shutdown is recommended if the system is not intended to be used for a whole day or longer. It is recommended to **perform a full shutdown at least once a week.**

Full shutdown

1. Press \ominus (on/off button) on the top left of the control panel. The *Exit dialogue window* is displayed.

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



Figure 1-5: The Exit dialogue window

In case of total lock-up 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.

Standby mode

1. Press \ominus (on/off button) on the top left of the control panel. The *Exit dialogue window* is displayed (Figure 1-5).
2. Select **Standby**. The system enters *Standby* mode.

The system remains in *Standby* mode for approximately **XX** hours using the internal battery.

Note: When the system is operating, if the power cable is removed from the wall outlet or the Power Adaptor is disconnected from the Vivid *i*, the system will continue to operate using the internal battery. When battery power is reduced below a certain level the system automatically shuts down into Standby mode.

Eventually, if left for a long time, the system will switch from *Standby* mode to full shut-down.

Turning on the system at the new location

1. In order to maintain the battery charge it is recommended to plug the AC cable into a proper power outlet. If a charged battery is in place, the power plug does not need to be plugged into the wall outlet.
2. Press \ominus (on/off button) (Figure 1-6).
3. If the system does not turn ON, the battery may be drained. In this case, plug the power plug into the wall outlet and try again.

When turning on a system in standby it takes a few seconds before it responds. Do not push the on/off button again during this period (A second push will initiate a full shutdown).

The system can be used regardless of the battery level. The battery is automatically charged when the system is plugged to the wall outlet. It takes about 2 hours to charge a completely discharged battery. This may gradually change as battery ages with time.

Moving and transporting the unit

Moving the unit on a Cart

To prepare the unit to be moved

1. Turn the system OFF either in Standby or Full Shutdown mode, and remove the AC power plug from the wall outlet.
2. Fold the LCD screen to the fully closed position.
3. Disconnect all cables linking the system or peripherals to any off-board peripheral devices and network.
4. Secure the unit's power cable on the Cart.
5. Place all probes securely on the cart. 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

Note the marks on each cable to reconnect them later.

To ensure safety while moving the unit

1. Ensure that the LCD screen is in the locked position.
2. Proceed cautiously when crossing door or elevator thresholds. 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 the pathway is clear.
5. Move the unit slowly and carefully.

Avoid ramps that are steeper than 10 degrees.



CAUTION

Transporting the unit

Take extra care when transporting the unit by vehicle. In addition to the moving precautions listed on page 22, follow the procedure described below.

1. Disconnect all probes and secure them in their boxes.
2. Remove the Vivid *i* system from the Cart and place it in the travel bag supplied by GE, or an equivalent suitable travel bag.

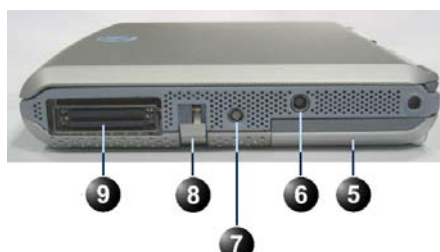
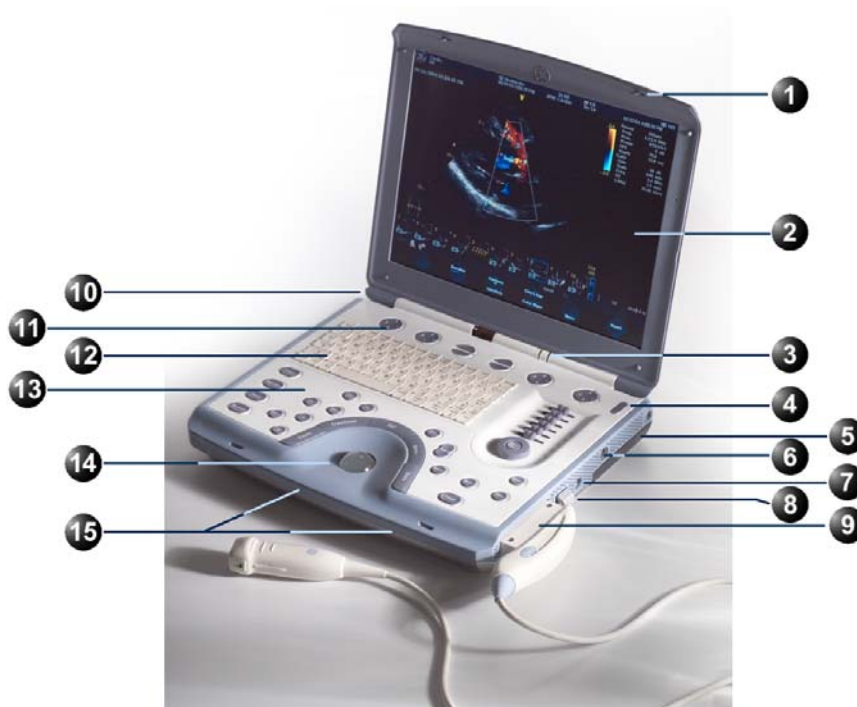
Unit acclimation time

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 °C increment when the unit's temperature is below 10 °C or above 40 °C.

°C	0	2.5	5	7.5	10	35	40	42.5
°F	32	36.5	41	45.5	50	95	104	108.5
Hours	4	3	2	1	0	0	2	3
°C	45	47.5	50	52.5	55	57.5	60	
°F	113	117.5	122	126.5	131	135.5	140	
Hours	4	5	6	7	8	9	10	

System description

System overview



- | | |
|---------------------------|--------------------------------|
| 1. Display latch | 10. Monitor hinge |
| 2. LCD display | 11. Softmenu buttons |
| 3. Power indicator | 12. Alpha-numeric keyboard |
| 4. On/Off button | 13. Functional keyboard |
| 5. Battery | 14. Trackball |
| 6. ECG cable connector | 15. Speakers |
| 7. Pedoff probe connector | 16. Rear panel connectors |
| 8. Probe locking handle | 17. Anti-theft cable insertion |
| 9. Probe connector | |

Control panel

The following pictures illustrate the layout of the Vivid *i* control panel. The buttons and controls are grouped together for ease of use. A detailed description of the buttons is provided on the following pages.



- | | |
|---|-------------------------|
| 1. Assignable keys (soft-menu elements; part of the Extended keyboard) | 7. Extended keyboard |
| 2. Soft menu rocker | 8. Trackball |
| 3. TGC sliders | 9. Trackball buttons |
| 4. GAIN rotary | 10. Mode selection keys |
| 5. Alphanumeric keyboard | 11. Navigation keys |
| 6. Alphanumeric function keys: (<i>Help</i> , <i>Config</i> , <i>Annotate</i> ...) | 12. Freeze keys |
| | 13. On/Off button |


Figure 1-6: The Vivid *i* 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 yellow:** 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.



Power On/Off key

Key	Description
	Turns the unit ON and OFF. Sets the unit to <i>Standby</i> .

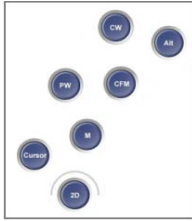
Navigation keys










Key	Description
	Displays the <i>Archiving</i> opening page. Enables the user to perform the following functions: <ul style="list-style-type: none">• Create a new patient record• Edit the current patient's information• Browse the Patient List to search for patient records• End the current examination For further information, refer to page 42.
	Displays the Select Probe and Application dialog box that enables the users to select the desired probe and application preset for the current examination. For information about selecting probes, refer to page 46 and page 263.

Key	Description
	Brings the scanner into the Image review mode, that enables the user to select images from the clipboard for analysis, activate the image browser or enter the <i>Image Review screen</i> where bigger previews of the images are shown for image selection. Refer to page 181 for details on the review of images.
	Displays the <i>Measurement worksheet</i> where the user may edit or delete measurements, change averaging etc. Refer to page 147 for details on how to operate the worksheet.

Scan Mode Selection keys



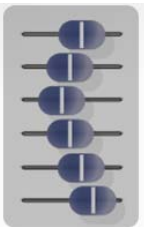




The following keys are used to select the required scan mode, and to select additional tools that enhance the application's capabilities. Refer to page 75 for detailed information about scanning.

	Key	Description
		Displays the 2D live acquisition mode that is the default scanning screen for the unit. For further information on 2D scanning, refer to page 77.
M-Mode can be added from a 2D scan also in replay.		Displays the M-Mode examination screen and enables M-Mode functions. Used for viewing motion patterns. For further information, refer to page 83.
Color		Displays the examination screen in Color Flow Mapping mode. Used to display color-coded blood flow information. For further information, refer to page 88.
		Displays the examination screen in Pulsed Wave Doppler mode. Used for displaying the Doppler spectrum of blood flow at a selected part of the anatomy. For further information, refer to page 94.
CW mode is not available on all scanning probes.		Displays the examination screen in Continuous Wave Doppler mode. Allows examination of blood flow data all along the Doppler CW cursor. For further information, refer to page 94.
		Toggles the cursor display on/off in 2D scanning mode.
		For future use

Basic Mode Parameter Adjustment Controls



The following controls are used to modify and adjust the unit's display to best suit the user's requirements, such as color, gain, zoom and image depth, according to the mode being operated by the user.

Controls	Description
Gain rotary 	Controls the total gain of the active mode: gray scale images in 2D Mode, or the total gain of other activated modes, such as, M-Mode, Color, PW, or CW Doppler mode.
Active mode 	In combined mode, switches between the mode specific assignable controls and total-gain of the currently used modes.
TGC 	Six sliding keys that compensate for depth-related attenuation in an image. The upper slider corresponds to the smallest depth.
Depth 	Controls the displayed depth of tissue scan. Has no effect in replay.
	Changes the angle of the cursor on linear probes. The steering angles are fixed for each linear probe. This key has no effect with sector imaging probes.




Freeze keys

The freeze keys are used to freeze images and cine loops in all modes for on-line analysis and storage for future use.


Key	Description
	Stops or restarts all data acquisition. When scan is frozen, the Trackball can be used to scroll through the cine loop.
	Activates or freezes 2D mode. In simultaneous mode, pressing 2D FREEZE will activate or deactivate the 2D image, leaving the other mode display unchanged. In freeze mode, stops/starts the cineloop.

Multiple Format Key



Key	Description
	Enables multiple image display windows in which two or four images can be viewed simultaneously. When reducing the number of images, the active window will always be kept.

Measurement control

The following key is used to take measurements and perform calculations.

Key	Description
	Activates the Measurement & Analysis (M&A) calculation program. This program is context sensitive and will display relevant measurements to the current mode and application. Also activates measurement tools (unassigned measurement). See page 109 for further details on M&A.




Print and Record Control




Key	Description
Record 	For future use.
Print 	Prints the current imaging screen content to a selected (configurable) printer. For more information about printing. Refer to page 281. The PRINT key can also be configured for alternative storing of images (Refer to page 318.).

Trackball operation



The Trackball area consists of the trackball and five surrounding keys.


Key	Description
Trackball 	Used for navigation and together with the surrounding keys, to move, select or activate objects on the screen.
Zoom 	Controls image magnification. Press to activate Zoom mode; use trackball and SET button toggle to pan or change zoom factor. Zoom is available in both <i>Live</i> and <i>Replay</i> .
Trackball 	Controls the trackball assignments between the mode-specific options. By pressing TRACKBALL , the trackball function will cycle through the possible assignments, which are indicated in the lower right corner of the screen (see page 54).


Key	Description
Set 	Depending on the situation (see Figure 2-3, page 55): <ul style="list-style-type: none">• Performs the selected control or highlighted menu item.• Toggles between the Trackball functions within the active group.
Update Menu 	In Freeze, activates menu with additional options and controls not available from the assignable keys. In live mode, toggles between 2D imaging and live time-motion imaging (Doppler/M-Mode).
Store 	Stores the currently active imaging window to disk. The stored information depends on the configuration of the current application. Stored images are shown on the clipboard.

Assignable keys (soft keys)




The functions of the assignable keys vary according to the mode and/or module in which the user is working.

Key	Description
Assignable Circular 	Three 4-way knobs, whose mode-specific functions vary according to the scan mode and position that is currently active. This assignable knob is used to control variable parameters. The assigned functions are indicated above the knob on the LCD display. The mode-specific functions for these knobs are described in Chapter 3, "Scanning Modes" on page 75.

Key	Description
Assignable Buttons 	Four assignable buttons, whose mode-specific functions vary according to the scan mode and position that is currently active. These assignable buttons are used as on/off toggles for different controls on the menu. The assigned functions are indicated above the button on the LCD display. The mode-specific functions for these buttons are described in Chapter 3, "Scanning Modes" on page 75.












The soft menu rocker

Key	Description
Soft Menu Rocker 	A 4-way rocker used to access mode-specific menus, select a menu option and adjust option-related values. <ul style="list-style-type: none"> The vertical arrows are used to select the menu options. The horizontal arrows are used to adjust the values. The mode-specific menus are described in Chapter 3, "Scanning Modes" on page 75.

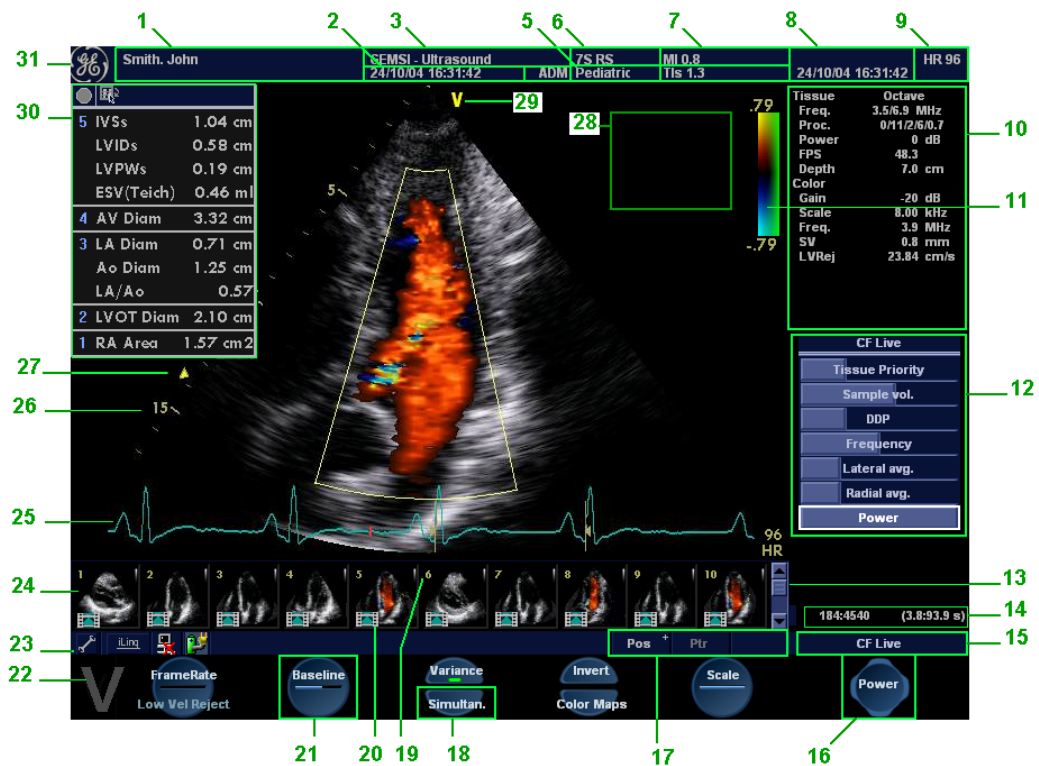


The Alphanumeric Function keys

Key	Description
Help 	Displays the on-line version of the user manual.
Config/Diag 	Displays the configuration dialog box, allowing user configuration of various settings on the scanner. Diagnostics of the system is activated by pressing Shift > CONFIG .

Key	Description
Report 	Displays the examination report.
Bodymark 	Displays the available body marks for the current application.
Page Erase 	Erases all previously-typed annotations (and body marks).
Physio 	Provides access to controls for ECG trace. The ECG controls appear on the soft-menu.
Arrow 	Displays an arrow that can be used to point at a specific structure in the image.
Text 	Enables text annotation to be inserted on the image. The annotations can be typed or selected from a (configurable) menu.
Delete 	Can be used to delete text during text annotation.

The Scanning screen



1. Current patient data
2. Date & time of original image
3. Institution
4. Operator ID
5. Application & Temperature indicator for TEE probe
6. Probe
7. Mechanical & Thermal Index
8. Current date & time
9. Heart rate
10. Parameter window - all modes
11. Greyscale/Color bar
12. Soft menu window
13. Clipboard navigator
14. Cine progress bar
15. Current menu name
16. Soft menu control button
17. Trackball assignment, Service and iLinq, Caps on/off
18. Soft menu toggle button
19. Clipboard image number
20. Loop icon
21. 4-way soft menu control
22. Watermark area for screen calibration
23. Prompt/Status information
24. Clipboard
25. Heart rate
26. Depth scale
27. Focus marker
28. TEE Scan plan indicator
29. Probe orientation marker
30. Measurement result table (measurement mode)
31. Logo

Figure 1-7: The scanning screen

The scanning screen is divided in several areas as follows:

The title bar

From the left:

The patient information displayed on the Title bar is configurable (see page 290).

Patient Information

Displays the information that uniquely identifies the patient, such as patient name, identification number and birth date. This information is entered in the *New patient window*, as described on page 42.

Institution name

The institution name is entered from the configuration package. See page 327 for more detailed information.

Operator ID

Identification code of the operator. See page 331 for creating operator ID's.

Date and time

Displays the current date and time or for a retrieved image, the date and time at which it was stored.

Probe and Application

Displays the currently selected probe and application or for retrieved image the probe and application that were used. See page 46 and page 269 for further information on how to select probe and application.

Live scanning related information

Displays, if available, the current values for

- Mechanical Index (MI), for the current active image
- Thermal Index (TI), for the current active image
- probe temperature (for TE probe)
- Heart rate (HR)

Archive Information

Displays the currently selected patient and image archives.

Parameters window

Displays scan mode or application specific parameters. In scanning mode the parameters for the active mode are highlighted. This window also displays zoom information and image groups in image browser.

Soft menu window

Displays the mode specific controls operated from the 4-way rocker on the control panel. The mode-specific menus are described in Chapter 3, "Scanning Modes" on page 75. For operating procedure of the 4-way rocker see page 53.

Clipboard

Displays the thumbnail images representing the acquired data during the current examination.

The status bar

Consists of four information fields as follows:

Service iLinq button (wrench icon)

Enable access to the GE Medical Systems on-line service center.

Connectivity status icon

Displays the network status: Connected or disconnected.

Power & Battery status

Displays the power status. Amount of battery charge and if AC adapter is connected (see page 14)

Prompt/status field

Displays system messages or prompts the user for actions.

Trackball assignments fields

Displays the available assignments of the trackball. The current assignment is highlighted.

The acquisition window

Displays the ultrasound image with relevant indicators such as depth, focus, probe orientation marker, physiological traces...etc.

Connecting and disconnecting probes

Probes can be connected or changed at any time, regardless of whether the system is powered ON or OFF.



CAUTION

Handle the probes gently while connecting and disconnecting.



WARNING

Do NOT touch the patient and any of the connectors on the ultrasound unit simultaneously, including ultrasound probe connectors.

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. **DO NOT** allow the probe head to hang freely. Impact to the probe head could result in irreparable damage.
3. Press the probe connector locking lever (refer to Figure 1-9) **downwards**.
4. Align the connector with the probe port and carefully push into place, as shown in Figure 1-8.

Probes can be connected or changed any time while the unit is on.



Figure 1-8: Probe Connection to the Vivid *i*

5. Lift the connector locking lever (see Figure 1-9) *upwards* to the full horizontal position to lock in place.



Figure 1-9: Probe Connection Locking Lever

6. Carefully position the probe cord so that it is free to move and is not resting on the floor.
When the probe is connected, it is automatically activated.



CAUTION

Fault conditions can result in electric shock hazard. Do not touch the surface of probe connectors which are exposed when the probe is removed. Do not touch the patient when connecting or disconnection a probe.

Cable Handling

Take the following precaution with probe cables:

- Do not bend the cable acutely.

Deactivating the Probe

Press the **FREEZE** key to deactivate the probe. When deactivating the probe, the probe is automatically placed in *Standby* mode.

Disconnecting the Probe

Probes can be disconnected at any time. It is recommended that the probe should not be active when being disconnected.

To disconnect a probe:

1. Freeze the image by pressing FREEZE.
2. Press the connector locking lever *down* to unlock the connector.
3. Pull the probe and connector straight out of the probe port.
4. Carefully slide the probe and connector away from the probe port and around the right side of the keyboard.
5. Ensure the cable is free.
6. Be sure that the probe head is clean before placing the probe in its storage case.

Transporting Probes

When transporting a probe a long distance, store it in its carrying case.

Storing Probes

It is recommended that all probes be stored in the carrying case provided.

- First place the probe connector into the carrying case
- Carefully wind the cable into the carrying case.
- Carefully place the probe head into the carrying case.
DO NOT use excessive force or impact the probe face.

Adjusting the display monitor

The LCD screen brightness controls may need periodic adjustment due to changes in ambient light. On the bottom left corner of the screen you should be able to see a dark, yet visible, letter **V** which is called "Watermark". If the watermark is not visible it is because the screen is adjusted too dark relative to the surrounding bright ambient light conditions. In this situation the screen brightness should be adjusted.

To adjust the Brightness of the display monitor

On the alphanumeric keyboard press **ALT+PgUp** to increase brightness or **ALT+PgDown** to decrease brightness. The brightness adjustment tool appears at bottom of screen, as shown in Figure 1-10.



Figure 1-10: Brightness Control

In a totally dark room it is recommended to set brightness down all the way (all rectangles are empty).

When ambient light becomes brighter and watermark becomes less visible, increase the brightness till watermark is visible again

To adjust the Contrast of the display monitor

On the alphanumeric keyboard press **ALT+Steer->** to increase contrast or **ALT+Steer<-** to decrease contrast. The contrast adjustment tool appears at bottom of screen, as shown in Figure 1-11.

The default setting of the screen is recommended to be at maximal contrast setting, as shown in Figure 1-11.



Figure 1-11: Contrast Control

Starting an examination

Beginning an exam consists of three steps:

- Creating a new patient record or starting a new examination from an existing patient record (see below)
- Selecting Probe and Application (see page 46)
- Start scanning (see page 46)

Creating a new Patient record or starting an examination from an existing patient record

Starting an examination

1. Press **PATIENT**.
The *Patient Handling* screen is displayed.

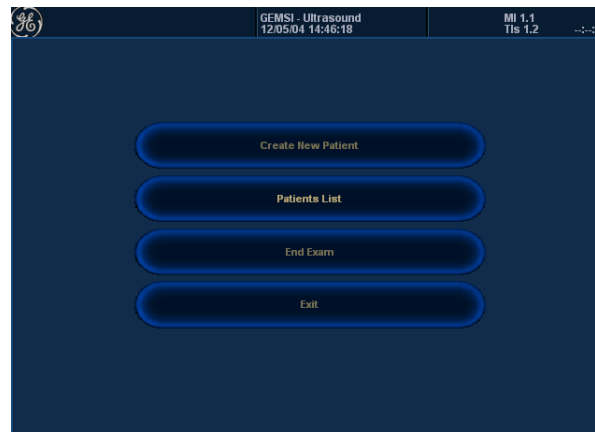


Figure 1-12: The Patient Handling Screen

2. Press **CREATE NEW PATIENT**.
If the unit is password protected a *Log In window* will appear asking for operator ID and password (as explained in Figure 1-13).

To create an operator ID, see page 331.

1. Data stored only for the duration of the current examination
2. Select the operator



Figure 1-13: The Operator login window

3. Press **Log on** when completed.
The *Search/Create Patient window* is displayed (see Figure 1-14).
4. Type the patient **Last Name**, and/or **ID**.



CAUTION

Do NOT use 'I' or '^' in patient information fields, as these characters might cause problems with some DICOM devices.

The unit can be configured to automatically generate a patient ID (see page 321).

*To restrain the search to special category of patient record, press **More** and use the searching filters.*

The automatic search tool displaying matching patient information in the Patient list can be turned off (see page 321).

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

If the Patient name is on the patient record list:

1. Trackball to the actual patient and double-click the Trackball **SET** key (or press **SET** once and then **Select patient**).
The unit is ready for scanning or the *Patient information window* is displayed (Figure 1-15) depending on system configuration (see page 321).

If the Patient name is not on the patient record list:

1. Press **Create Patient**.
The unit is ready for scanning or the *Patient information window* is displayed (Figure 1-15) depending on system configuration (see page 321).

Getting started

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, see Figure 1-15.).
2. Press **Begin exam** or any active scanning key to start the examination.
In the scanning screen, the patient information is displayed on the left side of the *Title bar* (see Figure 1-16).

Press **EXAM. LIST** to display the previous examinations and diagnosis information for the selected patient. Enter additional patient information if required.

SEARCH / CREATE PATIENT

More

1 2 3 4 5 6

Last Name	First Name	Patient ID	Birthdate	Exam Date	img	Str	Rep	Size	Code
patient1		p1	14/11/2004						
patient2		3234232	14/11/2004						
patient3		p3	15/11/2004						
patient4		t5	15/11/2004						

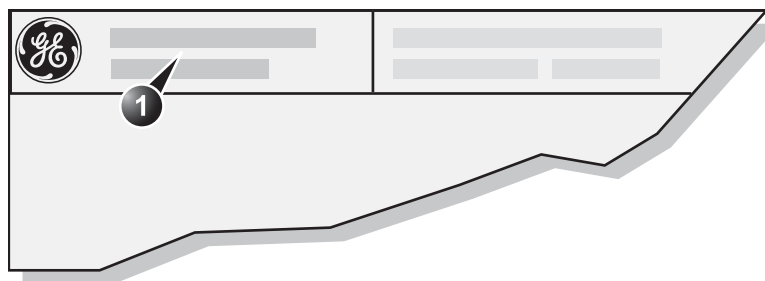
Begin Exam End Exam Exam List Search More

1. Press one of the headings to sort the list accordingly.
2. Select the column heading border and drag to adjust column width.
3. Select new archive and other pre-defined services.
4. Extended menu
5. The system can be configured to display the Advanced search tool as default (see page 321).
6. Expanded Patient record displaying belonging examinations

Figure 1-14: The Search/Create Patient window

1. The date format is configurable (see page 327).
2. The window can be configured to display the expanded patient info as default (see page 321).
3. The Address field is configurable (see page 321).
4. Select patient information category.

Figure 1-15: The Patient Information window



1. The patient information on the scanning screen is configurable (see page 289).

Figure 1-16: The Patient information on the scanning screen

Refer to page 186 for further information on connectivity setup.

The combination Probe-Application may be user-defined. See page 291 for information on probe/application configuration.

*To select a probe with the default application, press **SET** twice on the actual probe.*



CAUTION

Connectivity on the Vivid i ultrasound unit

The connectivity on the Vivid i Ultrasound unit is based on the Dataflow concept. A Dataflow is a set of pre-configured services (e.g. DICOM services like storage, worklist, verify etc. or other service types like video print, standard print or messaging). When starting an examination, the user selects a pre-configured Dataflow that will automatically customize the ultrasound unit to work according to the services associated to the Dataflow.

Selecting a Probe and an Application

Probes and their related applications are selected from the Probes and applications pop-up menus as described below. Only probes currently connected are displayed in the pop-up menu. Only applications appropriate for the type of probe selected are shown.

To select a probe and an application

1. Press **APPLICATION** on the control panel.
A list of the connected probes is displayed.
2. Trackball to the desired probe.
3. Press **SET**.
An *Application menu* for the selected probe is displayed.
4. Trackball to the desired application.
5. Press **SET** to launch the 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 (see Chapter 14, "Thermal Index" on page 353). TIB must be displayed when a fetal application is selected.

Chapter 2

Basic scanning operations

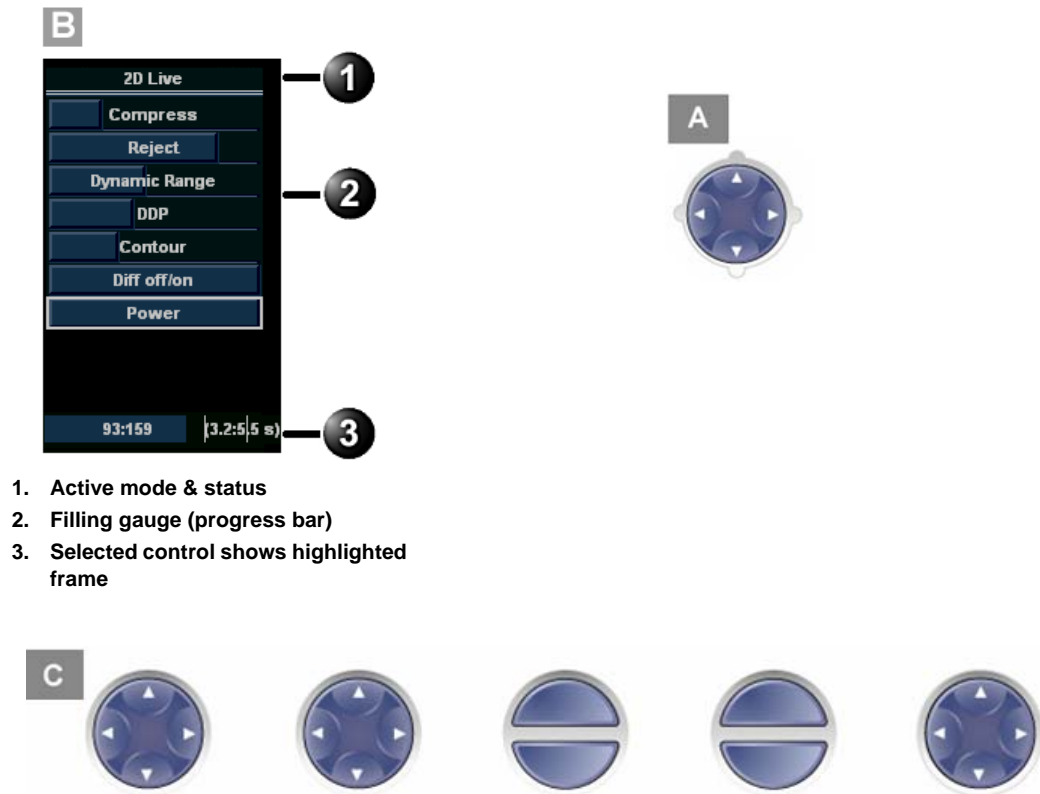
This chapter describes basic operations related to scanning. Some operations described in this chapter are fully described in the respective chapters throughout the manual.

This chapter includes the following information:

• Assignable keys and Soft Menu Rocker	49
• Using the Soft Menu Rocker	53
• Trackball operation	54
• Trackball assignment	54
• The system menu	55
• Cineloop operation	56
• Cineloop overview	56
• Cineloop controls	58
• Using cineloop	59
• Storing images and cineloops	60
• To store a single image	60
• To store a cineloop	60
• Using removable media	61
• Recommendation concerning CD and DVD handling	61
• Writing on CD or DVD media	61
• Formatting removable media	61
• Ejecting removable media	63
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• To Magnify an image	63
• Performing measurements	63
• Physiological ECG trace	64
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Assignable keys and Soft Menu Rocker



1. Active mode & status
2. Filling gauge (progress bar)
3. Selected control shows highlighted frame

Figure 2-1: A: the 4-Way Rocker; B: Soft Menu; C: the assignable keys on the control panel.

To toggle between modes in combined mode, press **ACTIVE MODE**.

The function of the assignable keys and the controls assigned to the soft menu vary according to the mode in which the system is running. A detailed description of each function is provided with each scanning mode in the following imaging mode sections. In combined modes (i.e. combined Color flow and PW Doppler), one mode is active (live) while the other is frozen. In this case, the assignable keys and Gain rotary knob controls parameters associated with the active mode. Switching the active mode will change the key and Gain rotary knob assignments accordingly.

Using the Assignable Keys Soft Menu

The bottom of the display screen contains a graphics area of soft-menu and assignable keys. This area of the screen is designed to match a parallel set of physical buttons (the assignable keys [refer to Figure 2-1]), located on the upper portion of the control panel. An example of a soft-menu is shown in below.

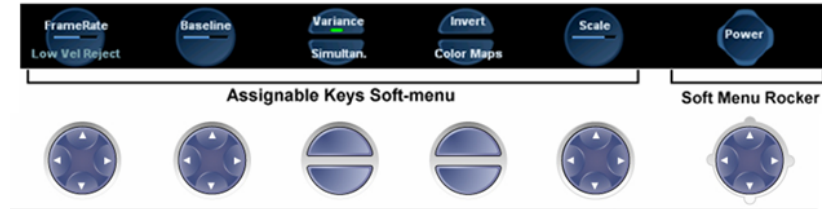


Figure 2-2: The Assignable Keys and Soft Menu

The soft-menu provides access and user control of different system parameters.

The contents of the soft-menu is different for every system *mode*. This provides access to the relevant settings in each of the different modes.

There are several different control key elements in the soft-menu area, as follows:

Variable Single parameter button



In this example, the “Baseline” parameter can be **increased** by pressing the *upper* or *right-hand* area of the corresponding assignable circular button on the keyboard. The same parameter can be **decreased** by pressing on the *lower* or *left-hand* area of the same button.

The bar in the center of the button graphic changes its length to reflect the change in the value of the controlled parameter.

An alternative method for modifying the parameter associated with this button is to click with the mouse pointer on the relevant area of the button graphic.

Variable Dual parameter button



In this example the button has access to either “**Frame Rate**” or “**Low Vel. Reject**” parameters.

When the “Frame Rate” upper label is highlighted, the parameter “Frame Rate” can be **increased** by pressing on the *right-hand* area of the circular assignable button and **decreased** by pressing on the *left-hand* area of the button.

When pressing on the bottom area of the button, the bottom label (“Low vel. Reject” in this example) will be highlighted. In this case, from now on, pressing the right or left area of the circular assignable button will either increase or decrease respectively the value of the lower (highlighted) parameter.

Pressing, at this point, on the upper part of the circular button will, again, associate the button with the upper labeled parameter.

An alternative method for modifying one of the parameters associated with this button is to click with the mouse pointer on the relevant area of the assignable button graphic.

On/Off Toggle button



In this example the active green indicator indicates that the Variance setting is set ON. The “Simultaneous” function is toggled OFF (there is no green indicator).

The user can press the matching upper button to toggle the “**Variance**” function ON or OFF.

User can press the matching lower button to toggle the “**Simultan.**” function ON or OFF.

Alternatively, the user can click with the mouse pointer on the relevant button graphic to set the function ON or OFF

Soft Menu rocker button



The circular button on the bottom-right area of the screen acts as a soft-menu rocker button. It has access to a different type of soft-menu which pops up on the *right* portion of the screen.



Using the Soft Menu Rocker

The **Soft menu Rocker** on the control panel enables the adjustment of controls mapped in the *Soft menu Window* (see Figure 2-1).

The first row of the soft menu indicates the name of the active mode and its status (freeze/live). The following rows list the mode-specific controls.

The relative setting of each control is indicated by a gauge bar filling the cell as the control value increases.

To select a control from the menu

1. Press any part of the 4-way rocker to display the soft menu.
2. Press the vertical arrows on the 4-way Rocker to navigate up or down through the menu.
The frame of the selected row is highlighted.

To adjust values

Note: when soft-menu is not accessed for a defined period of time it will time-out and disappear from the display.

1. Press one of the horizontal arrows on the 4-way Rocker to adjust the setting of the selected control.
 - **Right arrow** increases control setting.
 - **Left arrow** decreases control setting.

Trackball operation

Different functions can be assigned to the trackball depending on the current active mode. The trackball functions are organized in functional groups. The trackball functional groups are displayed in the lower right corner of the screen. Each group can have one or more controls that can be selected using the keys on the trackball area as described below.

The trackball area consists of:

- The **trackball**: used as a cursor control in acquisition mode, scrolling control in freeze mode and as a selecting tool (like a mouse cursor) in post-processing mode.
- The **ZOOM** key: enables quick access to control zoom position and/or size (see Figure 2-3).
- The **TRACKBALL** key: Toggles between the available trackball function assignments displayed in the *Status bar*.
- The **SET** key: Performs the selected control or highlighted menu item.
- The **UPDATE MENU** key: enables quick access to various functions form a pop-up menu (see Figure 2-3).
- The **STORE** key: enables digital storage of information displayed in the currently-active image window (see Figure 2-3).

Trackball assignment

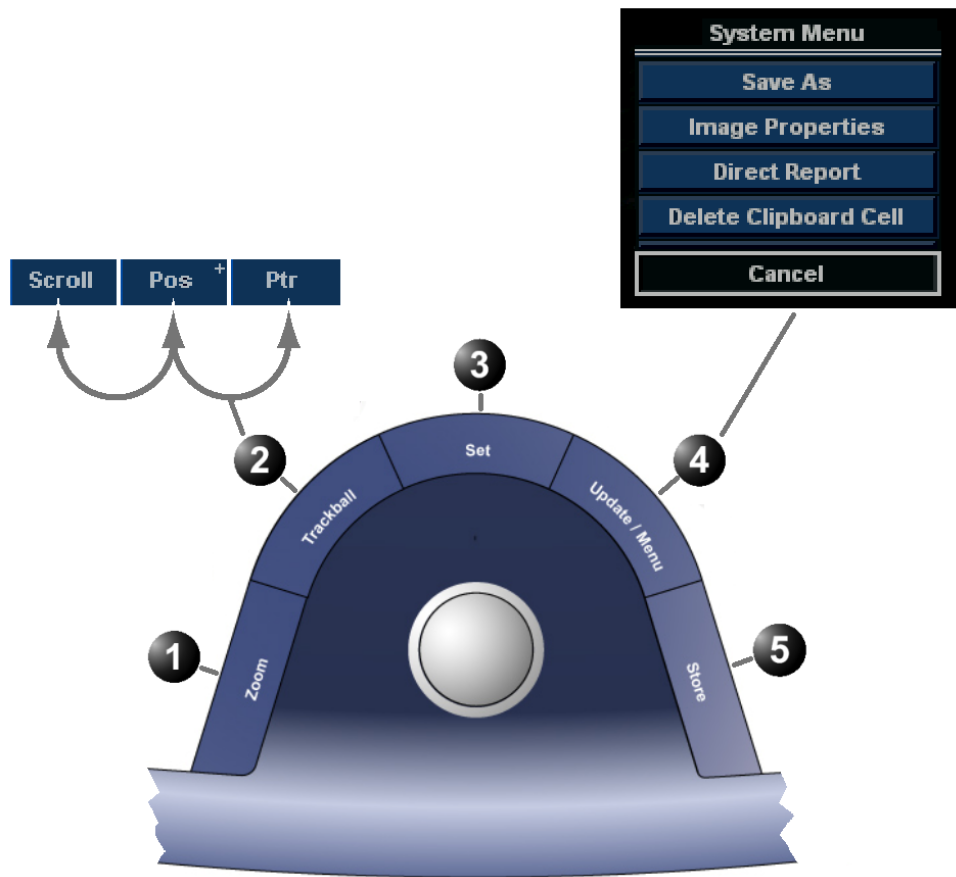
The trackball has a multi-mode function. The functions available from the trackball are mode dependent. The available trackball functions for the active mode are displayed on the right side of the *Status line* (Figure 2-3).

To change trackball assignment

1. Press **TRACKBALL** in the Trackball area until the desired function is selected highlighted.

The system menu

The system menu enables a quick access to image related functions (see Figure 2-3).



1. Zoom key: select to enlarge or reduce the image size on the screen.
2. Trackball key: select trackball assignment from the functions available in the Status line.
3. Set key: perform the selected control or highlighted menu item
4. Update Menu key: select the operation to perform from the pop-up System menu.
5. Store key: store information displayed in the currently-active image window

Figure 2-3: The Trackball area

Cineloop operation

When no ECG is connected, a cine gauge is displayed indicating the current frame, in the 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 assignable controls to cover one or more heart cycles.

Cineloop overview



- | | |
|------------------|---|
| 1. ECG | 4. Right marker |
| 2. Left marker | 5. Heart rate or Cine speed (in replay) |
| 3. Current frame | 6. Cine frame number values |

Figure 2-4: The cineloop controls display



1. Assignable keys:
 - Left marker
 - Right marker
 - Cycle select
 - Number of cycles
 - First Cycle
 - Last Cycle
 - Sync
 - Cineloop
 - Select all
2. Image Store
3. Freeze: Start/stop cineloop
4. Trackball:
 - Scroll (in freeze)
 - Cine speed (in replay)

Figure 2-5: The cineloop controls on the front panel

Cineloop controls

Cineloop assignable controls



Left / Right Marker

Move the left and right markers to expand or trim the cineloop boundaries.

Cycle select

Selects the heart cycle to be played back.

Number of cycle

Controls the number of heart cycles to be included in the loop.

Select All

Select all heart cycles.

First cycle / Last cycle

Selects the first or last heart cycle to be played back.

Cineloop

Starts cineloop acquisition.

Cineloop Freeze Control



2D Freeze

Toggles between replay and freeze modes.

Cineloop trackball controls



Scroll

When the scan mode is frozen, trackball to move the current marker and review the images

Cine speed

In cine replay mode, move the trackball left or right to adjust the speed of the cineloop playback.

Using cineloop

Selection of a cineloop

1. Press FREEZE.
The left and right markers on the ECG trace are displayed on either side of the last detected heart cycle.
2. Press the 2D FREEZE button to un-freeze the cineloop and let it run between the default setting of left and right borders.
3. To modify setting of the left or right borders, press the CINELOOP assignable.
The selected heart beat is played back.
4. Press on the assignable CYCLE SELECT to move from heart beat to heart beat to select the heart cycle of interest.
5. Press on the assignable NUM CYCLES to increase or decrease the number of heart beats to be played back.
6. Adjust LEFT MARKER and RIGHT MARKER assignables to trim or expand the cineloop boundaries.

To jump directly to the first or to the last heart beat press the assignables FIRST CYCLE or LAST CYCLE.

Adjustment of cineloop playback

1. If in freeze mode, press the assignable 2D FREEZE to start cineloop replay.
2. Use the **Trackball** to increase or decrease the speed of the cineloop playback.
The speed factor is displayed on the right side of the ECG (see Figure 2-4).

To view a cineloop frame by frame

1. If not in freeze mode, press the 2D FREEZE button to freeze the cineloop.
2. Use the **Trackball** to scroll through the cineloop frame by frame.
Or
Use the Speed/Frame softkey button.

Storing images and cineloops

Images stored on the clipboard during the scanning session are for immediate purposes. At the end of the examination, the data should be archived in the patient archiving system (refer to page 153).

Images and cine-loops can be stored at any time during the scanning session. A thumbnail of the stored image is displayed on the clipboard on the scanning screen. An icon will also be displayed in the *Image Browser* and *Image Selection* screens.

The amount of data stored from 2D live is defined by the settings of the current application. The application setting controls the number of cycles included (or time span if ECG is not active), time span before R-wave...etc (refer to page 289 and page 291 for further information).

The amount of data stored in images from 2D replay is determined by the defined cineloop.

Images can be stored in either DICOM and GE Raw Data formats or DICOM format only, depending in the dataflow configuration (refer to page 310 for further information).

To store a single image

1. Press **FREEZE**.
2. Press **STORE** to store the image digitally.
The thumbnail of the image is displayed on the clipboard.
See also page 156 for further information.

To store a cineloop

While in scanning mode, press the **STORE** button to store the last heart-cycle loop. It is possible to configure this function in several ways. Cineloops may be stored directly or after preview, depending on how the system is configured.

While in cine-loop preview mode press **STORE** to store the selected loop.

Cineloop length and loop selection is adjustable in several ways. The procedure for cineloop storage is described on page 156.

Using removable media

The following removable media can be used for data storage:

- 5 1/4" Magneto Optical disk (from Sony only, 1.3, 2.3, 2.6, 5.4, 8.6 and 9.1 Gb)
- USB Flash Card
- CD-R (CD-RW is not supported.)
- DVD-R



CAUTION

Use only 24x or higher CD-R.

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 disk surface has no visible scratches. If there are any scratches, do NOT use the disk.

Writing on CD or DVD media

Use specifically recommended for writing on CD or DVD media. ***Never*** use a solvent-based permanent marker on such media. The following pens are recommended:

- Dixon Ticonderoga "Redi Sharp Plus"
- Sanford "Powermark"
- TDK "CD Writer"
- Smart and Friendly "CD Speed Marker"

Formatting removable media

MOD, CD-R and DVD-R media must be formatted before use, as described in below.



CAUTION

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

Removable media used during Disk space management or Backup do not need to be formatted; the formatting process is part of these procedures.

To Format a removable media

1. Insert the media into the drive.
2. Press **CONFIG**.
3. If required, log on to the system. The Configuration package is opened.
4. Select the category **Connectivity** and select the sheet **Tools** (see Figure 2-6).



Figure 2-6: The Tools Sheet

5. Select the removable media from the *Media* pop-up 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, underscore (_) and hyphen (-). 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** to continue.
11. Eject the media as described below.

Ejecting removable media

Do not eject the CD using the button on the CD drive.

1. Press **ALT+E** to eject the disk.
The *Eject device menu* is displayed (Figure 2-7).



Figure 2-7: The Eject device menu

2. Select the relevant media.
The selected media is ejected.

Zoom

The Vivid *i* supports Variable display zoom. The Display zoom magnifies the image display in both frozen and live 2D, M-Mode and combined modes with Doppler.

To Magnify an image

Zoom is available in live and replay.

1. Press the **ZOOM** button. The resulting magnified image appears in the acquisition window while the un-magnified image is displayed in the control window showing the outlined zoom region.
2. Use the **Trackball** to position the zoom area over the desired portion of the image.
3. Use the **SET** button to toggle between Zoom-Scale and Zoom-location (panning). Both **Scale** and **Pan** are controlled by trackball.
4. To turn off the Display zoom, press the **ZOOM** button again.

Performing measurements

To perform measurements:

1. Press **MEASURE** to enter the Measurement mode.
Refer to page 109 for further information.

Physiological ECG trace

The physiological module consists of a single connector, which can accept either a set of electrodes cable or an External-ECG cable, capable of handling external ECG signals from other diagnostic ECG devices.

The scanned image that is displayed is synchronized with the ECG trace. In M-Mode or Doppler, the traces are synchronized to that particular mode's sweep.

The operator can control the gain, the position and the sweep rate of the traces using the assignables on the control panel.

Connecting the ECG

The ECG cable consists of a circular connector on one end of the cable and a triple color-coded electrode connectors on the other end. Each electrode cable hooks up to the appropriate stick-on electrode by a color-coded clip type connector.

The color-coding of the electrodes follows one of two standards that are common in different parts of the world. Refer to the following table:

AHA (USA)	IEC (Europe, Asia)
RA: White	L: Yellow
LA: Black	R: Red
RL: Green	N: Black



Figure 2-8: The Patient ECG Connector Port

Physio controls

Physio assignable controls

Common controls

Horizontal sweep

Adjust the refresh rate of the physiological trace. This control is active only in 2D and color modes. The sweep speed of the physio traces in M-Mode and Doppler is identical to the M-Mode or Doppler horizontal sweep adjusted by the user.

Gain

Enables the user to change the amplitude of the physiological trace displayed on the screen.

Position

Enables the user to move the physiological trace on the screen.

ECG

Turns the ECG trace on and off.

*To turn the ECG display off, press **PHYSIO** and press the assignable **ECG***

Displaying the ECG trace

Cardiac applications

The ECG is turned on by default in all cardiac applications.

Other applications

1. Press **PHYSIO** on the control panel to get access to the ECG controls.
2. Press the assignable **ECG** to display the trace.

Adjusting the display of the ECG trace

Adjusting the ECG trace sweep speed

1. Press **PHYSIO** on the control panel.
2. Adjust the assignable button **HORIZONTAL SWEEP** to change the sweep speed.

Adjusting the ECG trace amplitude

1. Press **PHYSIO** on the control panel.
2. Adjust the assignable button **GAIN** to adjust the amplitude of the trace.

Adjusting the ECG trace position

1. Press **PHYSIO** on the control panel.
2. Adjust the assignable button **POSITION** to move the trace vertically.

The ECG signal's amplitude may vary between patients due to different skin moisture and other physiological parameters.

Annotations

Text annotations may be inserted anywhere on the screen. The annotation can be free text or a pre-selected text from a mode-specific annotation menu or a user-defined library.

1. Select to display annotation for other applications
2. Free text
3. Draw an arrow
4. Edit previous annotation
5. Pre-defined application-specific annotations
6. Exit annotation mode



Figure 2-9: The mode-specific annotation menu

To insert an annotation

Free text

*While typing, use **BACKSPACE** to delete backward.*

1. Type the required text.
A suggested word corresponding to the entered characters is displayed while typing. Press **TAB** to enter the suggested word.
2. Trackball the text entered to the insertion position.
3. Press **SET** to add the annotation.

Pre-defined annotation

Word selection from the Annotation menu

1. Press the alphanumeric key **TEXT**.
A list of application specific pre-defined texts is displayed (see Figure 2-10).
To display a list from another application, select the heading and choose another application.
2. Trackball to the required abbreviation.

3. Press **SET**.
4. Trackball to the position at which the annotation is to be inserted.
5. Press **SET** to add the annotation.

To draw an arrow

1. Press **Arrow** in the *Annotation menu*.
2. Trackball to the start position of the arrow to draw.
3. Press **SET** to anchor the arrow.
4. Trackball to the end position of the arrow to draw.
5. Press **SET** to fix the arrow.

Word selection from the Library

Pre-defined text can be organized in a user configurable, application dependent library with three different sections. The user can easily select a pre-defined text from the Library using the **ARROW** keys.

Creating a Library

1. Press **CONFIG**.
2. In the Configuration package, select **Measure**.
3. In the *Measure Category* select **Customize**.
The *Customize sheet* is displayed (see Figure 2-10).
4. Select a pre-defined text in the *Application pane*.
5. Select **Add** in the desired section.
6. Repeat step 4 and 5 to populate the library.
7. To remove a pre-defined text from the library, select the pre-defined text to remove and press **Del**.
8. To order the pre-defined text in a section, select the pre-defined text to move and select **Up** or **Down** buttons to move the word accordingly.
9. To exchange sections order, enter the sections to swap next to *Swap columns button* and press **Swap columns**.
10. Press **Save** to store the library.



1. The Application pane
2. Library section
3. Insert selected pre-defined text in the section.
4. Remove selected pre-defined text from the section.
5. Move pre-defined text within the section.
6. Re-order sections.
7. Save Library

Figure 2-10: The Arrow menu sheet

Using the Library

1. Press any **ARROW** key.
The pre-defined texts from the last used group are displayed in the *Status bar* at the bottom of the screen, with the active word within square brackets.
2. To select a pre-defined text within a section, press **ARROW UP** or **ARROW DOWN** until the desired word is selected.
3. To change section, Press **LEFT ARROW** until the desired section is displayed in the *Status bar*.
4. To insert the selected pre-defined text, press **RIGHT ARROW**.

Text overlays

There are 2 layers of the text in annotations, which can be selected by toggling the TEXT key. Text1 is the default choice. This function enable the user to show/hide different (or all) annotations.

To edit annotation

1. Press the alphanumeric key TEXT.
2. Press **Edit** in the *Annotation menu*.
The pointer is changed to a cross marker.
3. Trackball to the annotation to edit.
4. Press SET.
Once selected, the annotation can be moved freely.
The text 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.
 - BACKSPACE: deletes backward.
 - DELETE: deletes the selected word.
 - INSERT: toggles the text entry state from overwrite to insert mode.
5. Do the appropriate changes to the annotation.
6. Press SET to anchor the edited annotation.

To erase annotation

The user can erase all annotations on the screen in one operation or erase annotations one by one.

To erase all annotations

1. Press the alphanumeric key PAGE ERASE.
If using text overlays, page erase applies only to the displayed layer(s).

Configuration of the pre-defined annotation list

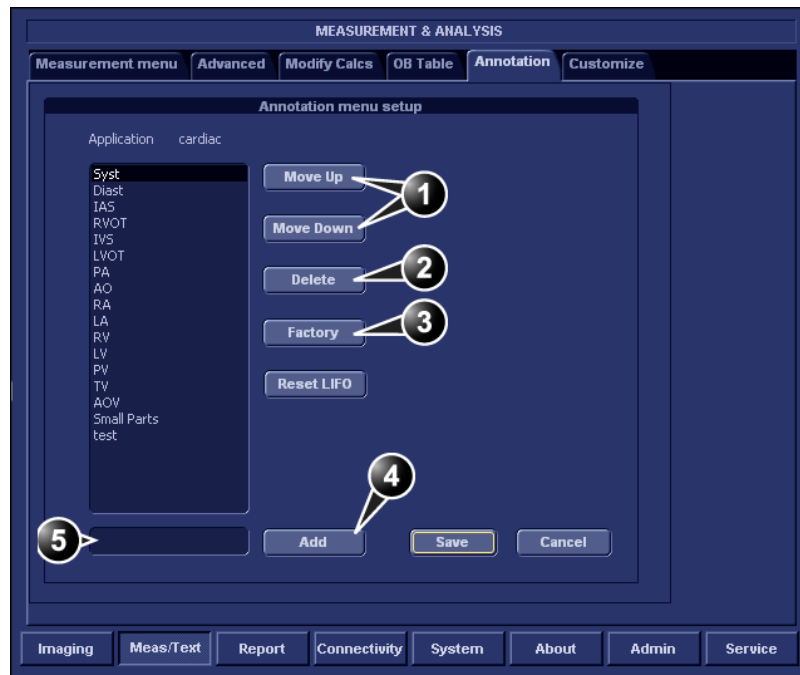
1. Press CONFIG.
2. In the Configuration package, select **Measure**.
3. In the *Measure category* select **Annotation**.
The *Annotation sheet* is displayed where the user can add, delete or re-arrange the annotation text (see Figure 2-11).

To re-arrange the annotation list

1. Trackball to the actual annotation text.
2. Press SET.
3. Press the relevant button (i.e **Delete**, **Move up** or **Move down**) to apply change.
4. Press **save** to store the new annotation list.

To add an annotation text

1. Trackball to the text entry field (see Figure 2-11).
2. Press SET to activate the text cursor.
3. Type the new annotation text.
4. Press **add**.
The new annotation text is added at the end of the list.
5. Press **save** to store the new annotation list.



1. Rearrange list
2. Delete selected text
3. Reset to factory default
4. Add new text to the list
5. Enter new text

Figure 2-11: The Annotation Menu Configuration Dialog Box

Bodymarks

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 the alphanumeric key **BODYMARK**.
The *Bodymark menu* is displayed showing a selection of bodymarks relative to the selected exam category.

1. Select and display bodymark list for other applications
2. Edit probe marker position and orientation
3. Erase bodymark
4. Bodymark list for the current application
5. Insert an arrow
6. Insert user-defined text

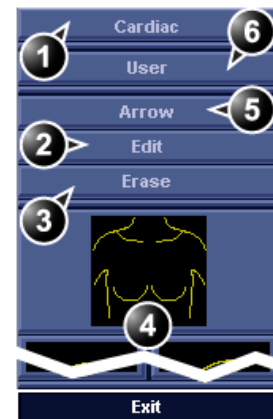


Figure 2-12: The Bodymark menu

2. Trackball to the desired bodymark and press **SET**.
The bodymark with a probe marker is displayed on the scanning screen.

1. Probe marker

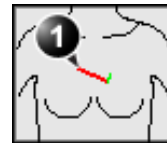


Figure 2-13: The bodymark with probe marker

3. Using the trackball, adjust the position of the probe marker and press **SET**.

4. Using the trackball, adjust the probe marker orientation and press SET.

Editing a bodymark

1. Press the alphanumeric key BODYMARK.
The *Bodymark menu* is displayed
2. Press **Edit**.
3. Using the trackball, adjust the position of the probe marker and press SET.
4. Using the trackball, adjust the probe marker orientation and press SET.

Deleting a bodymark

1. Press the alphanumeric key BODYMARK.
The *Bodymark menu* is displayed
2. Press **Delete**.

Chapter 3

Scanning Modes

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Introduction

The Vivid *i* ultrasound scanner provides several basic scanning modes and several options for combining the use of these modes.

The following scanning modes are described in this chapter:

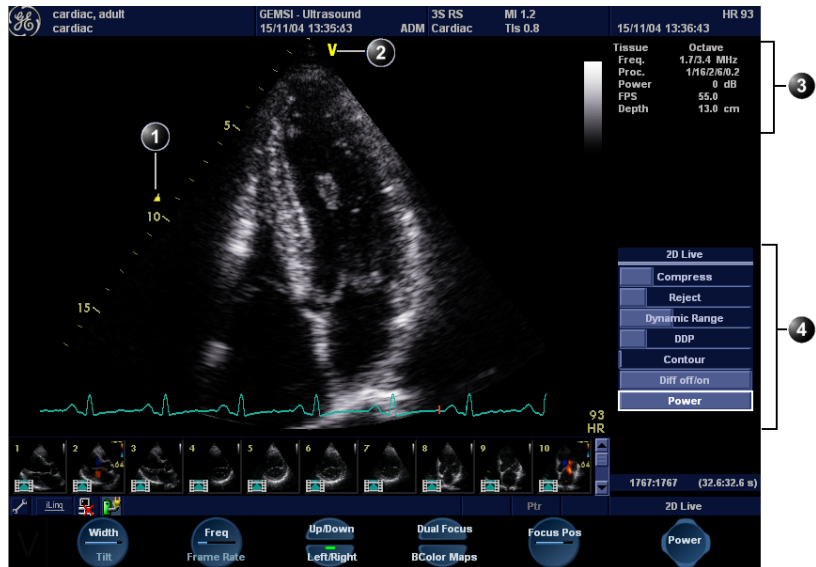
- 2D Mode Imaging
- M-Mode Imaging
- Anatomical M-Mode
- Color Mode Imaging
- Doppler Mode Imaging
- Angio

See page 156 for further information on image and cineloop storage.

When performing an examination using any of these modes, images and image sequences (cineloops) can be stored. The examination or part of it can also be stored on video tape, CD-R, DVD-R and other various media, depending on available options.

2D-Mode

2D-Mode overview



1. Focus marker
2. Probe orientation marker
3. Status window
4. Soft menu

Controls marked with R are also available in freeze and cine replay

Figure 3-1: The 2D screen (cardiac)

Scanning Modes



- | | |
|---|--|
| <p>1. Assignable keys:</p> <ul style="list-style-type: none">• Width• Frequency• Focus• Frame rate• Up/Down R• Left/Right R• Cineloop (in Freeze, only)• Dual focus• B color maps• Select all <p>2. Zoom</p> <p>3. Depth</p> | <p>4. Soft menu</p> <ul style="list-style-type: none">• Compress R• Reject R• Dynamic Range• DDP R• Tilt• Speckle reduce• Contour• Diff On/Off• Power <p>5. Freeze</p> <p>6. 2D</p> <p>7. Gain</p> |
|---|--|

Figure 3-2: The 2D controls on the front panel

*In combined mode, press **ACT. MODE** to toggle between modes and access to the mode specific controls.*

The 2D mode displays a two-dimensional gray scale image of the tissue within the probe's field of view. 2D mode can be combined with:

- M-Mode, see "M-Mode" on page 83
- Color Mode, see "Color Mode" on page 88
- CW or PW Doppler Mode, see "PW and CW Doppler" on page 94
- Color and Doppler Modes (triplex)

2D-Mode controls

2D assignable controls

Width

Controls the size or angular width of the 2D image sector. A smaller angle generally produces an image with a higher frame rate.

Focus

Changes the location of the focal point(s). A triangular focus marker indicates the depth of the focal point.

Frame rate

Adjusts frame rate (FPS). The relative setting of the frame rate is displayed in the status window. When adjusting frame rate, there is a trade off between spatial and temporal resolution.

Frequency

Enables the adjustment of the probe's operating frequency. The selected frequency is displayed in the status window. For some probes/applications the lowest frequency settings will be Octave imaging settings.

On some low frequencies, the system switches automatically to second-harmonic mode. The word "Octave" appears in the status window.

Invert

- **Left/Right Invert:** 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.
- **Up/Down Invert:** enables the 2D image to be flipped 180 degrees.

Dual focus

Activates Dual focus mode. To adjust the location of the Dual focus, activate the **FOCUS** assignable.

Color maps

Displays a color map menu to optimize the greyscale presentation. The menu enables an option from a list of non-linear gray-curves or different 2D-colored curves to be selected. Use the **trackball** to highlight a color map and press **SET** to activate the desired map.

Cineloop (in Freeze only)

Allocates different cineloop control functions to the assignable soft keys.

Gain

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

Time Gain Compensation (TGC)

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.

Depth

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

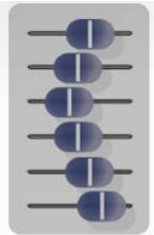
2D Soft menu controls

Compress

Controls the amount of contrast in the 2D image. An index number is displayed in the status window to indicate the relative level of compression.

Reject

Adjust reject 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 status window to indicate the relative level of rejection.



Dynamic Range

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.

DDP (Data Dependent Processing)

Performs temporal processing which reduces random noise without affecting the motion of significant tissue structures. An index number is displayed in the status window (under Proc) to indicate the relative DDP level.

Tilt

Enables the axis of the 2D image to be tilted to the left or right. By using this control in combination with angle control the image can be “aligned” to the direction of interest, and frame rates be optimized. By default the axis of symmetry of a 2D image is vertical. (Applicable only for cardiology applications).

Contour

Controls image processing related to the extent of edge enhancement applied to an image.

Diff On/Off

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. (Applicable only for cardiology applications).

Power

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.

Refer to page 291 about creating pre-sets.

Check the Display's brightness and contrast setting before adjusting the unit imaging controls (see page 41).

Using 2D

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 described in the previous section.
If necessary use preset for optimum performance with minimum adjustment.

Optimizing 2D

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

- Use the **Gain** and **TGC** controls to optimize the overall image.
- Use the **Depth** control to adjust the range to be imaged.
- Use the **Focus** control to center the focal point(s) around the region of interest.
- Use the **Frequency** (move to higher frequencies) or the **Frame rate** control (move to lower frame rate) to increase resolution in image
- Use the **Frequency** (move to lower frequency) to increase penetration.
- Use the **Reject** control to reduce noise in the image.
- Use the **DDP** control to optimize imaging in the blood flow regions and make a cleaner, less noisy image.

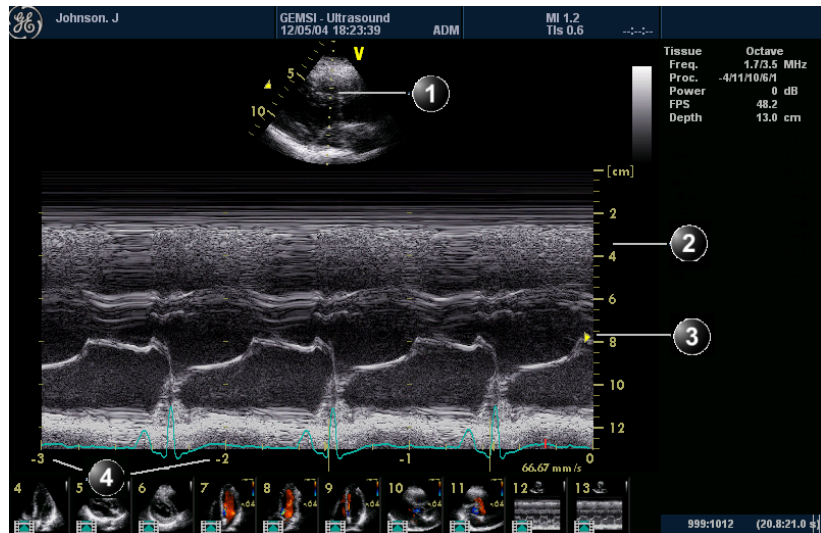


WARNING

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

M-Mode

M-Mode overview



1. Time motion cursor conventional M-Mode
2. Depth Scale
3. Focus Marker
4. Time Scale

Figure 3-3: The cardiac M-Mode screen (top/bottom)

This unit has two 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 greyscale or in color modes.

M-Mode and 2D Mode display areas can be side by side or top/bottom. Conventional M-Mode can be combined with Color (see "Color M-Mode overview" on page 89).

M-Mode controls

M-Mode assignable controls

Horizontal sweep

Adjusts the horizontal refresh rate of the M-Mode area of the display. Horizontal sweep does not change the acquisition resolution, so that user can change the horizontal sweep in replay (with no loss of quality).

Frequency/Resolution

Enables the adjustment of the probe's operating frequency. Rotate the knob clockwise to increase the frequency. The selected frequency is displayed in the status window. For some probes/applications the lowest frequency settings will be Octave imaging settings.

Focus

Changes the location of the focal point(s). A triangular focus marker indicates the depth of the focal point.

Contour

Controls image processing related to the extent of edge enhancement applied to an image.

Up/Down

Flips the M-Mode display 180 degrees.

Layout

Toggles the display arrangement to define relative dimensions of the 2D area, M-mode area, and their position which is either top/bottom or side-by-side.

Color maps

Displays a color map menu to optimize the greyscale presentation. The menu enables an option from a list of non-linear gray-curves or different colorized curves to be selected. Use the trackball to point to a color map and press SET to activate the desired map.

On some low frequencies, the system switches automatically to second-harmonic mode. The word "Octave" appears in the status window.



M-Mode Soft menu controls

Compress

Controls the amount of contrast in the image. An index number is displayed in the status window to indicate the relative level of compression.

Reject

Adjust reject level. When this control is increased, low-level echoes are rejected and appear darker in the image. An index number is displayed in the status window to indicate the relative level of rejection.

Power

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.

Dynamic Range

Enables control of the dynamic range or contrast of the image. When dynamic range is set to High, the image is softer and more low-level data is visible.

When power is reduced, it reduces the signal-to-noise ratio, so that the image, spectrum or color scan may become noisier.

Using M-Mode

Conventional M-Mode (greyscale)

1. While in 2D-Mode press cursor on the control panel.
2. Use the **trackball** to position the cursor over the required area of the image.
3. Press **MM** - the M-mode sweep will start to sweep.
4. Press **FREEZE** to stop imaging.

OR

1. While in 2D-Mode press **MM** on the control panel. The M-mode sweep will start to sweep.
2. Use the **trackball** to position the cursor over the required area of the image.

Gain, Frequency, Focus, Dynamic Range and Compression affect also the 2D image.

Gain, Frequency, Focus, Dynamic Range and Compression affect also the 2D image.

Scanning Modes

Gain, Frequency, Focus, Dynamic Range and Compression affect also the 2D image.

3. Adjust horizontal sweep, Gain, Frequency, Focus, Dynamic Range, Compression and Contour to optimize the display if necessary.
4. Press **FREEZE** to stop imaging.

Conventional Color M-Mode

1. While in Color Mode press cursor on the control panel.
2. Use the **trackball** to position the cursor over the required area of the image.
3. Press **MM** - the Color M-mode sweep will start to sweep.
4. Press **FREEZE** to stop imaging.

OR

1. While in Color Mode press **M** on the control panel. The Color M-mode sweep will start to sweep.
2. Use the **trackball** to position the cursor over the required area of the image.
3. Adjust horizontal sweep, Gain, Frequency, Focus, Dynamic Range, Compression and Contour to optimize the display if necessary.
4. Press **FREEZE** to stop imaging.

Anatomical M-Mode

Anatomical M-Mode is *only available for cardiac applications*.

1. Enter live M-mode.
2. Press the assignable **AMM** soft key to enter **Live Anatomical M-mode**. Continue to step 4 below.

OR

1. From the 2D Live, press **FREEZE**.
2. Press **MM** to access the **Freeze Anatomical M-Mode**.
3. Use the **trackball** to position the cursor over the required area of the image.
4. Press **TRACKBALL** to allow free rotation of the solid full-length cursor line throughout the 2D image.
5. Rotate the solid cursor line to the desired direction.
6. Press **TRACKBALL** twice and reposition the intersection point to the desired position along the cursor line.

Anatomical M-Mode can also be used with previously acquired digitally stored 2D images.

*The Trackball assignable **Pos** (Position) is activated.*

*The Trackball assignable **Angle** is activated.*

*The Trackball assignable **Pos** is activated.*

The M-Mode area of the display updates as the M-Mode signal is constructed.

7. Repeat steps 4. and 5. to change the angle of the solid cursor line if necessary.
8. Press **TRACKBALL** to activate scrolling control on the trackball.
9. Use the **trackball** to scroll through the data acquired at that location. The M-Mode display will vary accordingly.

Optimizing M-Mode

Refer to page 291 about creating presets.

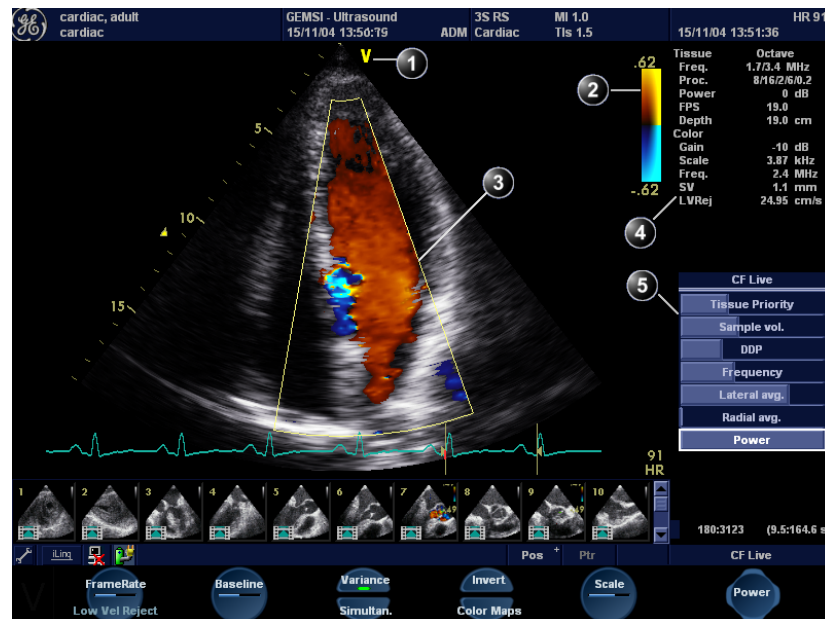
The use of preset gives optimum performance with minimum adjustment. If necessary, the following controls can be adjusted to further optimize the M-Mode display:

*Except for **Contour**, all the controls listed in the optimizing M-Mode section will also affect the 2D image.*

- Adjust **Horizontal sweep** to optimize the display resolution.
- Adjust **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.
- **Use the Frequency (move to lower frequency) to increase penetration.**
- Adjust **Focus** to move the focal point(s) around the region of interest in the M-Mode display.
- Adjust **Dynamic range** to optimize the useful range of incoming echoes to the available greyscale.
- Adjust **Compress** and **Contour** to further optimize the display.
- Adjust **Reject** to reduce noise while taking care not to eliminate significant low-level diagnostic information.

Color Mode

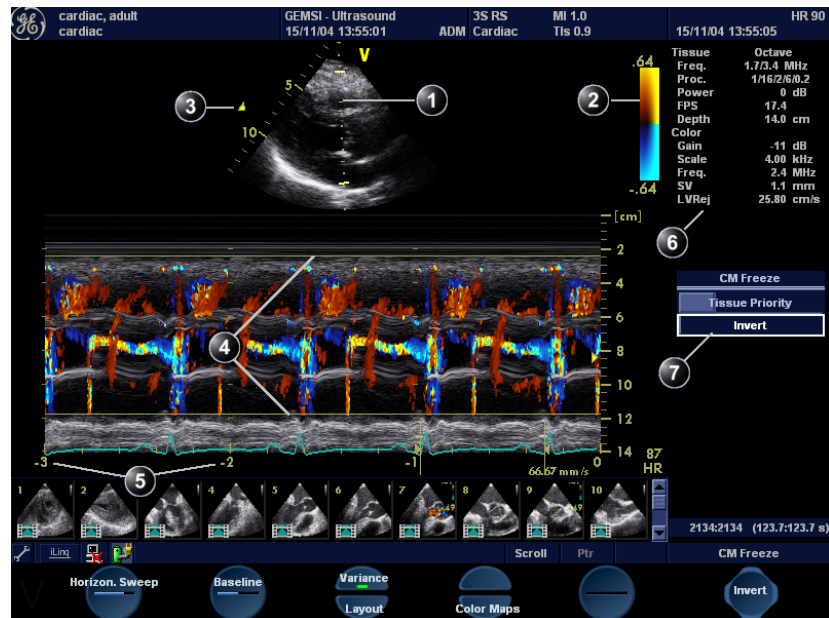
Color Mode overview



1. Probe orientation marker
2. Color bar
3. Color sector marker
4. Status window
5. Soft menu

Figure 3-4: The Color Mode screen

Color M-Mode overview



1. Time motion cursors
2. Color bar
3. Focus marker
4. Flow sector marker
5. Time scale
6. Status window
7. Soft menu

Figure 3-5: The Color M-Mode screen (top/bottom display)

Color Mode controls

Color Mode assignable controls

Horizontal sweep (Color M-Mode only)

Adjusts the horizontal refresh rate of the M-Mode area of the display.

Scale

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.

Baseline

Adjusts the color map to emphasize flow either toward or away from the probe. Baseline is available in both Live and Freeze.

LVR (Low Velocity Rejection)

LVR, also called Wall motion filter, enables the extent of low velocity removal to be adjusted.

Invert

Enables the color scheme assigned to positive and negative velocities to be inverted. Invert is available in live and cine replay.

Variance

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

Displays a menu of color map options. Use the **trackball** to point to a color map and press **SET** to activate the desired color map. Each color map is assigning different color hues to different velocities.

Cineloop (in Freeze, Color 2D mode only)

Allocates different cineloop control functions to the assignable soft keys.

Color data produced by very low flow may cause interference.



Color-Mode Soft menu controls

Tissue priority

Emphasize either the color of the color mode or the greyscale tissue detail of the 2D image. Tissue priority is available in both Live and Freeze.

Sample volume

Adjusts the size of the color flow Doppler sampling area. Lower setting gives better flow resolution while a higher setting increases sensitivity and helps to locate turbulent flows.

Frequency

Enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration. The selected frequency is displayed in the status window. Adjusting Frequency may affect Sample Volume and LVR settings.

Lateral Averaging (Color 2D only)

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

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.

Power

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.

Use Averaging controls with caution so as not to obscure significant diagnostic information

When power is reduced, it reduces the signal-to-noise ratio, so that the image may become noisier.

Trackball controls

ROI (Region Of Interest) size

When the trackball command **Size** is selected (see also "Trackball operation" on page 54), the height and width of the color area (or ROI) is adjusted from the trackball.



ROI (Region Of Interest) position

When the trackball command **Pos** (position) is selected (see also "Trackball operation" on page 54), the position of the color area (or ROI) is adjusted with the trackball.

Using Color Mode

Color 2D

The assignable controls of the trackball are displayed in the trackball status bar in the bottom right corner of the screen.

1. From an optimized 2D image press COLOR.
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. If not, press SET again to select **Size**.
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 dimensions of the ROI.
To enlarge or narrow the ROI, move the **trackball** to the left or right.
To lengthen or shorten the ROI, move the **trackball** up or down.
5. Press SET when the desired size is obtained, to allow repositioning of the ROI if desired.
6. Press FREEZE to stop imaging.

Color M-Mode

The assignable controls of the trackball are displayed in the trackball status bar.

1. From M-Mode press COLOR, or from Color-Mode press MM.
2. Use the **trackball** to position the color area in the M-Mode display.
3. Press the SET button. The instruction **Size** should be highlighted in the trackball status bar. If not, press SET again to select **Size**.
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 color area.
To enlarge the color area, move the **trackball** up
To narrow the color area, move the **trackball** down.
5. Press SET when the desired size is obtained.

Optimizing Color Mode

Refer to page 291 about creating presets.

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

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

The Power setting affects all other operating modes.

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:

- Adjust the **Active mode gain** to set the gain in the color flow area.
- Adjust **Scale** to the highest setting that provides adequate flow detection.
- Adjust **Low Velocity Reject** to remove low velocity blood flow and tissue movement that reduces image quality.
- Adjust **Variance** to detect flow disturbances.
- Adjust **Sample volume** (SV) to a low setting for better flow resolution, or a higher setting to more easily locate disturbed flows
- 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.
- Adjust **Power** to obtain an acceptable image using the lowest setting possible.

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 greyscale tissue detail.
- Use **Baseline** to emphasize flow either toward or away from the probe.
- Use **Radial** and **Lateral Averaging** 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.

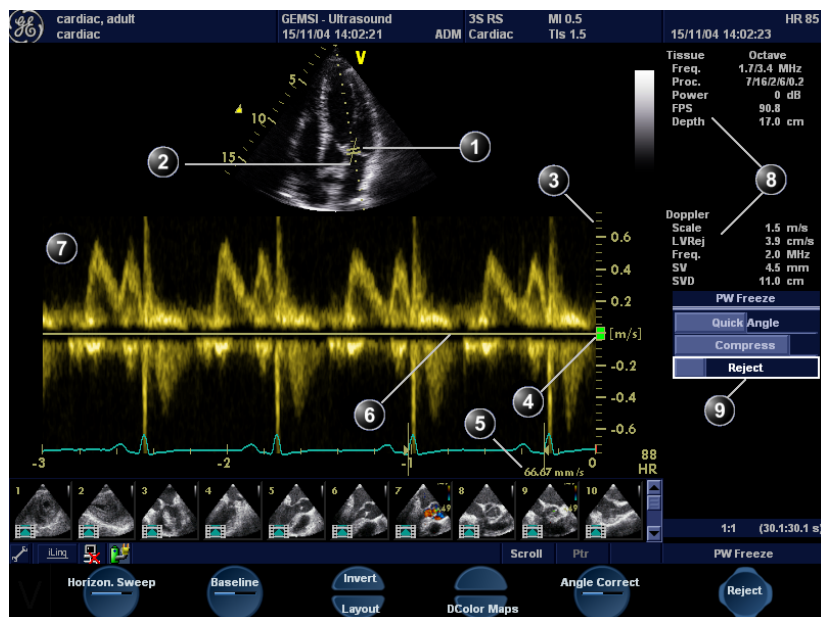


CAUTION

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 (optional, see page 288)
8. Status window
9. Soft menu

Figure 3-6: The PW/CW Doppler Mode screen

PW and CW Doppler controls

PW and CW Doppler assignable controls

Horizontal sweep

Adjusts the horizontal refresh rate of the Doppler area of the display. Horizontal sweep is available in live and cine replay.

Baseline

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.

Maximum velocity depends on sample volume size, sample volume position and frequency settings.

Velocity range

Enables the vertical scale of the Doppler spectrum and the maximal detectable velocity to be modified. Velocity range directly controls the pulse repetition frequency, which is responsible for the setting of the Nyquist limit (the ability to detect maximum velocity without aliasing).

Scale

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.

If the Doppler mode is combined with Color mode, the color map will be also inverted.

Invert

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.

LPRF (PW mode)

Sets the pulse repetition frequency for the PW Doppler acquisition of flow data. Enables toggling between high and low Pulse Repetition Frequency (PRF). When the Doppler PRF is raised beyond a certain limit, more than one Doppler gate is displayed on the screen.

Layout

Toggles the display arrangement to define relative dimensions of the 2D area, Doppler-spectrum area, and their position which is either top/bottom or side-by-side.

Color maps

Displays a drop down menu of different Doppler colorization maps. Use the **trackball** to select the desired map and press **SET** to activate the map.

Quick angle and Angle correction

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.

Quick angle adjusts the angle by 60 degrees.

Angle correction adjusts the angle between zero and 90 degrees with one degree increment.

PW/CW Doppler Soft menu controls

Sample volume

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.

Compress

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.

Reject

Enables undesirable background noise to be removed from the Doppler spectrum resulting in a darker background. Reject is available in both Live and Freeze.

*In non-cardiac applications, **Angle correction** is controlled from the Trackball.*



Frequency

Adjusts the transmission frequency in Doppler to control sensitivity or level of penetration. The selected frequency is displayed in the status window. Adjusting Frequency may affect Sample Volume (PW) and LVR settings.

Frame rate

Adjusts the frame rate. The relative setting of the frame rate is displayed in the status window (under 2D).

Power

When power is reduced, it reduces the signal-to-noise ratio, so that the image may become noisier.

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.

Controls and operations for PW and CW mode are the same unless otherwise noted.

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

Refer to page 291 about creating presets

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

Using PW/CW Doppler modes

There are two ways to start PW/CW Doppler:

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, with the **Soft menu rocker key**, adjust the sample Volume (SV):
To enlarge the SV, press the **Right arrow** of the rocker
To narrow the SV, press the **Left arrow** of the rocker.

Alternative 2

1. Press **CURSOR** on the control panel. A cursor line is displayed on the 2D image.
2. With the **trackball** adjust the position of the cursor line.
3. 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:

- Adjust the **Active mode gain** to set the gain in the spectral Doppler area.
- Adjust **Low velocity reject** to reduce unwanted low velocity blood flow and tissue movement.
- In PW mode, adjust **Sample volume** 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.

The Doppler Power setting affects only Doppler operating modes.



CAUTION

- 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).

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

Chapter 4

Purposely left empty

For Future purposes

Purposely left empty

Chapter 5

Contrast Imaging

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- **Left Ventricular Contrast Imaging .. 104**
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Introduction

Vivid *i* supports **Left Ventricular Contrast imaging**: Optimized for endocardial border detection and assessment of wall motion and wall thickening.

Left Ventricular Contrast Imaging

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

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



WARNING

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.

Default machine settings are set to minimize the amount these artifacts, but the operator has to take these artifacts into account while analyzing the data and confirm the results using other techniques.

LV Contrast overview

1. Status window
2. Soft menu

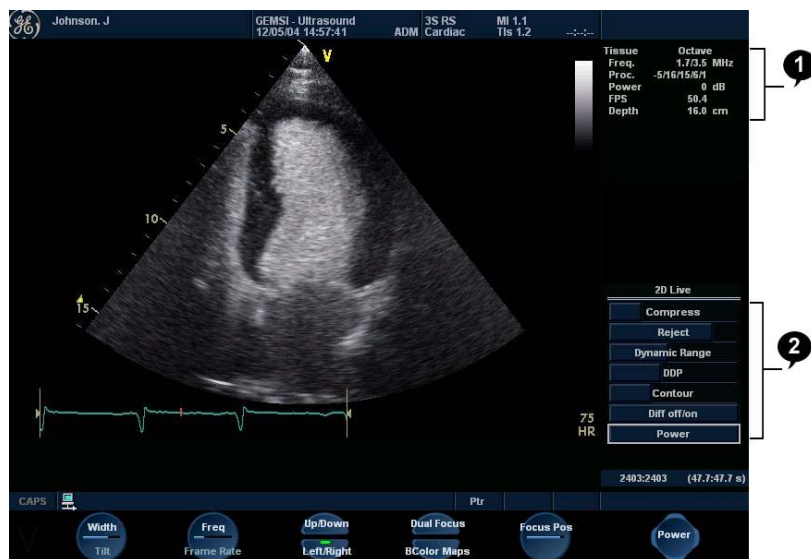


Figure 5-1: The LV Contrast acquisition screen

LV Contrast controls

LV Contrast assignable controls

Width

Controls the size and angular width of the image sector. A smaller angle generally produces a scan with a higher frame rate.

Frequency

Enables the adjustment of the probe's operating frequency. A higher frequency gives better resolution.

Focus

Changes the location of the focal point. A triangular marker on the depth scale along the image sector indicates the position of the focal point.

*Lower frame rate
gives better resolution.*

Frame rate

Controls the line density.

Up/Down

Enables the 2D image to be flipped 180 degrees.

Left/Right

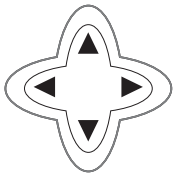
Enables the display of a mirrored image. When applied, the reference marker **V** moves to the other side of the image.

Angio

Turns Coded harmonic angio (color) on/off.

B Color maps

Displays a 2D maps menu to optimized the grey scale presentation. The menu enables an option from a list of non-linear grey-curves or different 2D-colored curves to be selected.



*Too high Power level
will destroy the
contrast agent.*

LV Contrast Soft menu controls

Power

Controls the amount of acoustic power applied to the transmitted pulse.

Compress

Controls the degree of image contrast.

Reject

Controls the Echo rejection level. When increased, low level echoes are rejected and appear darker in the 2D image.

Dynamic Range

Controls the image contrast. A high dynamic range setting gives a softer image.

Tilt

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

Contour

Controls the image processing related to the extent of edge enhancement applied.

The Diff control decreases the frame rate and the number of focal zones when turned on.

Diff on/off

Affects the level of reverberation in the image. The reverberation in the image is reduced when Diff control is turned on.

DDP (Data Dependant Processing)

Performs temporal processing, which reduces random noise without affecting the motion of significant tissue structures.

Running LV Contrast

The LV Contrast application works with the 3S-RS, and 6T-RS probes.

1. Press **APPLICATION** on the control panel.
A list of the connected probes is displayed.
The *Application menu* for the selected probe is listed.
2. Trackball to **LV Contrast** application.
3. Press **SET** to launch the application.
4. Perform the acquisition.



WARNING

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

Optimizing LV Contrast

The default setting for the LV contrast application is optimal setting for the application (On 3S probe: MI=0.5; Freq.=1.7/3.4; Focus=9 cm). However, depending on the acoustic window of the patient or the specific contrast agent being used, there may be a need for further adjustment.

If image quality is not acceptable before contrast injection, the power level should be increased. When contrast is observed in the left ventricle, the power should be reduced to a level giving homogenous opacification with no destruction (shown as a swirling pattern) of the contrast agent in the LV cavity. If a swirling pattern is observed and persists after the LV cavity has been filled with contrast, the power should be reduced until homogenous opacification is obtained.



CAUTION

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

Chapter 6

Measurement and Analysis

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Introduction

A study is a set of related measurements, or measurements that are logically grouped together. The measurements in a study are sometimes used in a formula to calculate new parameters (e.g. biplane volume with EF, SV and CO).

The Vivid *i* 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. 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 only (see page 296).

- **Measure and Assign (Free style):** the user performs a measurement and assigns a label.

Only assigned measurements will be saved. Measurements without assignment will be lost when scanning is resumed.



CAUTION

The Assign and Measure modality

In this measurement modality, the user selects a study consisting in a set of related pre-labelled measurements.

Starting the Assign and Measure modality

1. Press **MEASURE** on the control panel.
The *Measurement Menu* is displayed in the *Parameters window* (see example Figure 6-2).
The trackball cursor is in the scanning window, ready for starting measurement.

1. Active application
2. Study
3. Selected study
4. Opened study
5. Measurements related to the area study for the cardiac application

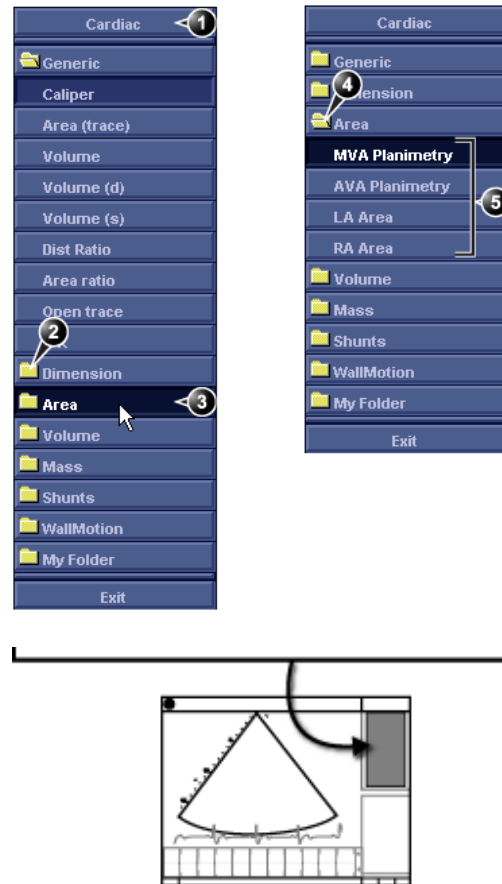


Figure 6-1: Example of a measurement study

Entering a study and performing measurements

Note: When entering the Measurement mode for the first time, the Caliper tool is selected by default.

When re-entering the Measurement mode, the first measurement in the actual study that has not been performed is selected by default.

1. Press **MEASURE** on the front panel to enter the **Assign and Measure** modality.
The *Measurement menu* with a list of studies is displayed in the *Parameters window* (see example Figure 6-2).
2. Select any required study (other than **Generic** study which is reserved for the *Measure and Assign* modality).
3. Within the selected study, select the required parameter which you intend to measure.
4. Perform the measurement. The parameter's name and measured value will appear in the result window.

To perform a measurement from another study

1. Trackball to the required study.
2. Press **SET** on the trackball area.
The study folder is opened displaying the measurements related to this study. Other related studies may also be available from within the study.
3. Trackball to the measurement to perform.
4. Press **SET** on the trackball area to activate the measurement tool.
The cursor is moved back to the scanning window.
5. Perform the measurement.
Completed measurements are marked with a check mark (Figure 6-2).
When the measurement operation is completed the next measurement on the list is automatically selected.

To skip a measurement in a study

1. Trackball to the desired measurement
2. Press **SET** to activate the measurement tool.

1. Performed measurement
2. Next measurement is automatically selected



Figure 6-2: Display of a performed measurement (example)

Measure and Assign modality

In this measurement modality, the user performs a measurement and assign a label.



CAUTION

Only assigned measurements will be saved.

Starting the Measure and Assign modality

1. Press **MEASURE** on the control panel.
The *Measurement Menu* is displayed in the *Parameters window* (see example Figure 6-3).
2. Select the **Generic** study if not already selected, and trackball to the required measurement tool.
3. Press **SET** on the trackball area to activate the measurement tool.
The cursor is moved back to the scanning window, ready for measurement.

1. Measurement tools

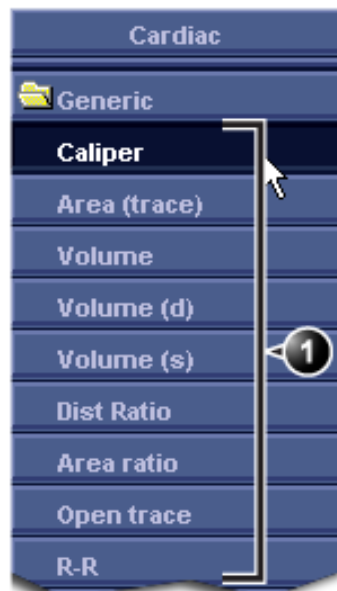


Figure 6-3: The 2D Mode Measurement tools (Cardiac application)

Post-measurement assignment labels

Each type of measurement, within each mode, can be associated with a set of pre-defined parameter labels. Parameter labels can be assigned to the highlighted measurement by the user.

To assign a parameter label to a measurement:

1. Trackball to the actual measurement in the *Measurement result table* (see Figure 6-4).
2. Press SET.
A *Parameter label menu* is displayed.
3. Trackball through the *Parameter label menu* to highlight the required label.
4. Press SET to assign the highlighted parameter label to the measurement.

*The selection of a measurement without pre-defined labels will not display the **Parameter label menu**.*

The assigned measurements may be reviewed in the Worksheet (see page 147). Up to five assigned measurements with the same label can be stored in the patient archive.



CAUTION

Only assigned measurements will be saved. Measurements without assignment will be lost when scanning is resumed.

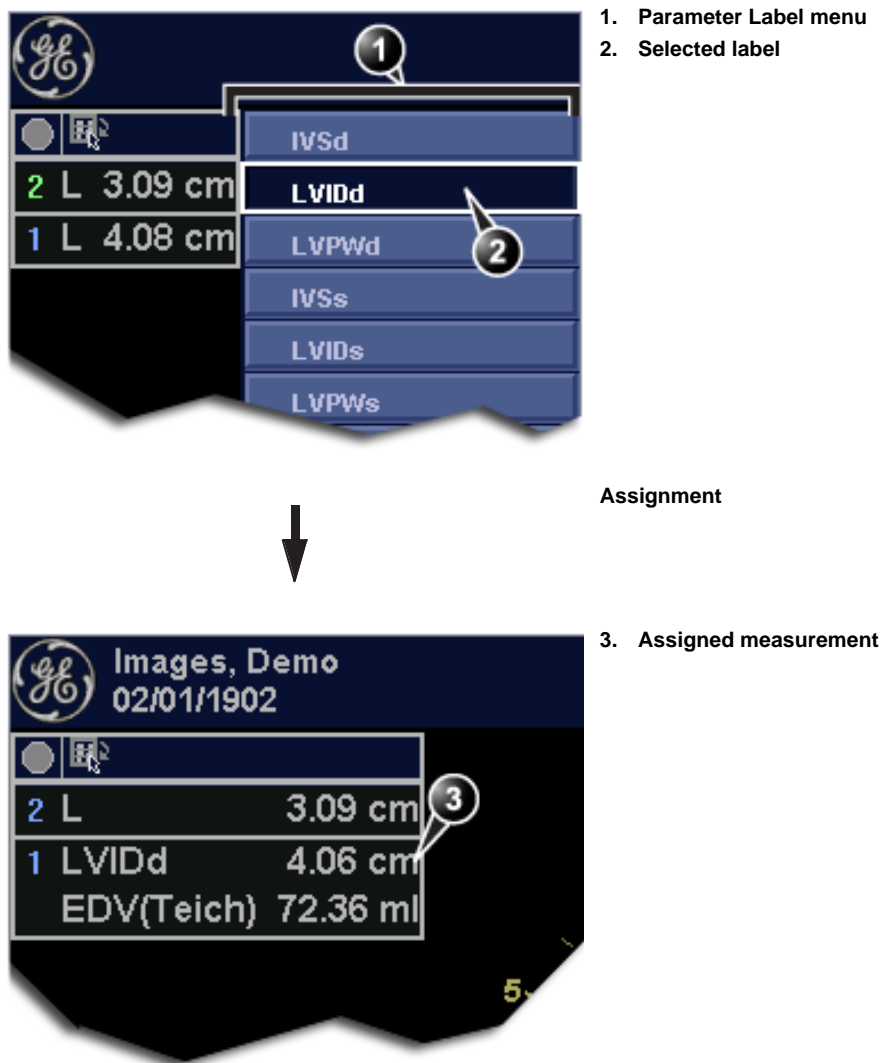


Figure 6-4: Measurement assignment

To assign a user-defined parameter label

1. Trackball to the actual measurement in the *Measurement result table* (see Figure 6-4).
2. Press SET.
A *Parameter label menu* is displayed.
3. Trackball to **User** and press SET.
The *Enter new parameter window* is displayed.

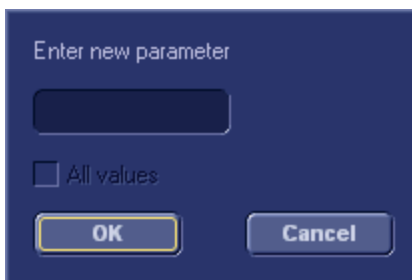


Figure 6-5: The Enter new parameter window

4. Type a name for the parameter label.
5. Press **OK**.
The user defined parameter label is assigned to the selected measurement.

Cardiac measurements

2D Measurements

2D Length measurements

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Caliper** in the *Measurement Menu* (see Figure 6-1).
5. Trackball the cursor to the start point of the measurement.
6. Press **SET** to anchor the start point of the measurement.
7. Trackball the cursor to the measurement end point.
The current distance value is displayed in the *Measurement result table* and is instantaneously updated when moving the cursor.
8. Press **SET** to anchor the end point of the measurement.
The measurement result is displayed in the *Measurement result table*.
9. To assign a label to the measurement, see page 115.
10. Repeat steps 5 through 8 to make additional length measurements.

*See the **Status bar** to get the next step to perform.*

The measurement display color on the 2D image changes from green to red after completion of the measurement.

The measurements displayed on the 2D image and the corresponding results are numbered.

2D length measurement ratio

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Dist. ratio** in the *Measurement Menu* (see Figure 6-1).
5. Perform two length measurements as described in steps 5 through 8 in the above section.
The measurement results including the ratio (%) of the two measured lengths are displayed in the *Measurement result table*.

Editing 2D Length measurements

1. Trackball the cursor to one of the anchor points of the measurement to modify.
2. Double-click the **SET** key to select the anchor point.
The selected marker turns green and is unanchored.
3. With the **Trackball**, reposition the marker.
4. Press **SET** to anchor.

2D Area measurements

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Area (trace)** in the *Measurement Menu* (see Figure 6-1).
5. Trackball the cursor to the start point of the measurement.
6. Press **SET** to anchor the start point of the measurement.
7. Trace the area (planetary) with the **Trackball**.

The current area and circumference values are displayed in the *Measurement result table* and are instantaneously updated when moving the cursor.

8. Press **SET** to complete the measurement.
The measurement result is displayed in the *Measurement result table*.
9. To assign a label to the measurement, see page 115.

See the Status bar to get the next step to perform.

The measurement display color on the 2D image changes from green to red after completion of the measurement.

The measurements displayed on the 2D image and the corresponding results are numbered.

10. Repeat steps 5 through 8 to make additional area measurements.

2D area measurement ratio

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Area ratio** in the *Measurement Menu* (see Figure 6-1).
5. Perform two area measurements as described in steps 5 through 8 in the above section.

The measurement results including the ratio (%) of the two measured areas are displayed in the *Measurement result table*.

See the Status bar to get the next step to perform.

Editing 2D Area measurements

1. Trackball the cursor to the anchor point of the area measurement to modify.
2. Press **SET** twice (Double-click) to select the anchor point. The selected marker turns green and is unanchored.
3. With the **Trackball**, reposition the marker.
4. Press the **SET** to anchor.

2D Volume measurements

The measurements described in this section enable volume measurement in a defined zone. The measurements tool generates results by two methods:

- Method of Disk (displayed as **Vmod** in the *Measurement result table*), known as Simpson's method.
- Area/Length method (displayed as **Va-l** in the *Measurement result table*).

For measurement formulae, refer to the Reference Manual.

To perform a volume measurement:

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Volume** in the *Measurement Menu* (see Figure 6-1).
5. Trackball the cursor to the start point where a volume is to be measured.

Measurement and Analysis

See the **Status bar** to get the next step to perform.

The measurement display color on the 2D image changes from green to red after completion of the measurement.

The measurements displayed on the 2D image and the corresponding results are numbered.

See the **Status bar** to get the next step to perform.

The measurements displayed on the 2D image and the corresponding results are numbered.

6. Press **SET** to anchor the start point of the measurement.
7. Trackball the cursor to draw the length.
8. Press **SET** to anchor the second point.
9. Drag the cursor with the **Trackball** to outline the area of interest.

The current area, circumference and Area/Length Volume (Va-l) values are displayed in the *Measurement result table* (see Figure 6-1) and are instantaneously updated when moving the cursor.

10. Press **SET** to complete the measurement.
The measurement results including Vmod (Simpson) are displayed in the *Measurement result table* (see Figure 6-1).
11. To assign a label to the measurement, see page 115.
12. Repeat steps 5 through 10 to make additional volume measurements.

2D Depth measurements

The measurements described in this section enable depth measurement from the probe to a selected point.

To perform a depth measurement:

1. Generate the 2D image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Press the assignable **POINT** to select the depth measurement function.
5. Trackball the cursor to the position to measure.
The current distance from the probe is displayed in the *Measurement result table* and is instantaneously updated when moving the cursor.
6. Press **SET** to anchor the point.
The depth value (cm) is displayed in the *Measurement result table*.

M-Mode Measurements

In M-Mode, the user can perform distance and time measurements. This measurement package has also the following pre-defined measurement studies:

- LA/Ao
- LV
- RV

M-Mode Length measurements

1. Generate the M-Mode image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **caliper** in the *Measurement Menu*.
5. Trackball the cursor to the start point of the measurement.
6. Press **SET** to anchor the start point of the measurement.
7. Trackball the cursor to the measurement end point.
The current distance value is displayed in the *Measurement result table* and is instantaneously updated when moving the cursor.
8. Press **SET** to anchor the end point of the measurement.
The measurement result is displayed in the *Measurement result table*.
9. To assign a label to the measurement, see page 115.
10. Repeat steps 5 through 8 to make additional length measurements.

*See the **Status bar** to get the next step to perform.*

The measurement display color on the M-Mode changes from green to red after completion of the measurement.

The measurements displayed on the M-Mode image and the corresponding results are numbered.

Editing M-Mode Length measurements

1. Trackball the cursor to one of the anchor points of the measurement to modify.
2. Press **SET** twice (double-click).
The selected marker turns green and is unanchored.
3. With the **Trackball**, reposition the marker to a new position.
4. Press **SET**.

Ao/LA study

1. Generate the M-Mode image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.

See the **Status bar** to get the next step to perform.

The current value is updated while moving the cursor.

4. Select **Ao/LA** in the *Measurement Menu*.
5. Trackball the cursor along the time axis to the required point to start measurement of Aorta root diameter.
6. Press **SET**.
The starting point for the measurement is anchored.
7. Trackball to the end point of the measurement.
8. Press **SET**.
The measurement end point is anchored and the value is displayed in the *Measurement result table*.
A new free-moving cursor is displayed on the image, ready for the next measurement.
9. Repeat steps 5, through 8 to measure Left Atrium.
The LA value is displayed in the *Measurement result table*.
The Ao/LA ratio is displayed in the *Measurement result table*.

LV study

The LV study consists of measurements in fixed-time mode in both systole and diastole of:

- Interventricular septum thickness (IVS)
- Left ventricular internal dimension (LVID)
- Left ventricular posterior wall thickness (LVPW)

The following parameters are also calculated:

- EDV (End diastole volume)
- ESV (End systole volume)
- SV (Stroke volume)
- EF (Ejection Fraction)

To perform LV study

1. Generate the M-Mode image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **LV study** in the *Measurement Menu*.
5. Trackball the cursor along the time axis to the required point to start measurement of IVSd.
6. Press **SET**. The starting point for the measurement is anchored.
7. Trackball to the end point of the measurement.

8. Press **SET**. The IVSd measurement end point is anchored and the value is displayed in the *Measurement result table*.

The end point of the IVSd is also the start point for the LVIDd.

1. Trackball to the end point of the LVIDd measurement.
2. Press **SET**. The LVIDd measurement end point is anchored and the value is displayed in the *Measurement result table*.

The end point of the LVIDd is also the start point for the LVPWd.

1. Trackball to the end point of the LVPWd measurement.
2. Press **SET**. The LVPWd measurement end point is anchored and the value is displayed in the *Measurement result table*.
3. Repeat steps 5, through 2 to measure IVS, LVID and LVPW in systole.

RV study

The RV study consists of measurement in fixed-time mode of Right ventricular internal dimension (RVID) in both diastole and systole.

To perform RV study

1. Generate the M-Mode image.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **RV study** in the *Measurement Menu*.
5. Trackball the cursor along the time axis to the required point to start measurement of RVIDd.
6. Press **SET**. The starting point for the measurement is anchored.
7. Trackball to the end point of the measurement.
8. Press **SET**. The measurement end point is anchored and the RVIDs measurement value is displayed in the *Measurement result table*.
A new free-moving cursor is displayed on the image, ready for the next measurement.
9. Repeat steps 5, through 8 to measure RVIDs.
The RVIDs value is displayed in the *Measurement result table*.

The current value is updated while moving the cursor.

Doppler Measurements

The following measurements may be calculated on Doppler mode spectra:

For measurement formulae, refer to the Reference Manual.

- Maximum (peak) and mean velocity
- Maximum and mean pressure gradient
- Pressure half-time (PHT)
- Velocity time integral (VTI)
- Mitral valve area (MVA), derived from PHT

Velocity and Pressure point measurements

1. Generate the spectrum to be measured.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Point Caliper** in the *Measurement Menu*.
5. Trackball the cursor to the position to measure.
The current velocity is displayed in the *Measurement result table* and is instantaneously updated when moving the cursor.
6. Press **SET** to anchor the point.
The velocity (m/s) and pressure (mmHg) values are displayed in the *Measurement result table*.

The measurement display on the spectrum and the corresponding results are numbered.

Velocity and Pressure caliper measurements

1. Generate the spectrum to be measured.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Caliper** in the *Measurement Menu*.
5. Trackball the cursor to the start point of the measurement.
6. Press **SET** to anchor the start point of the measurement.
7. Trackball the cursor to the measurement end point.
The current velocity and pressure values are displayed in the *Measurement result table* and are instantaneously updated when moving the cursor.
8. Press **SET** to anchor the end point of the measurement.
The following measurement results are displayed in the *Measurement result table*:
 - Velocity and pressure at anchor point positions
 - Velocity (V3) and pressure (p3) differences between

The measurement display color on the spectrum changes from green to red after completion of the measurement.

The measurement display on the spectrum and the corresponding result are numbered.

Adjust Compress and reject controls to optimize the Doppler signal.

The measurement display color on spectrum changes from green to red after completion of the measurement.

Adjust Compress and reject controls to optimize the Doppler signal.

anchor point position

- Time difference (dT) between anchored points position
9. To assign a label to the measurement, see page 115.
 10. Repeat steps 5 through 8 to make additional measurements.

Manual Doppler trace measurements

1. Generate the spectrum to be measured.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Manual trace** in the *Measurement Menu*.
A vertical green cursor is displayed on the spectrum.
5. Trackball the cursor to the start point on the left side of the trace.
6. Press **SET** to anchor the start point of the measurement.
7. With the **trackball**, trace the Doppler envelope.
The trace can be adjusted, while tracing, by moving the cursor backward to erase portion of the trace (or the entire trace) and then create the trace again.
8. Press **SET** to complete the trace.
The following measurement results are displayed in the *Measurement result table*:
 - Maximum and mean Velocities
 - Maximum and mean pressures
 - Env. Ti
 - Velocity time integral (VTI)
9. Trackball the cursor to the start point of the next heart beat.
10. Press the **SET** to anchor the next heart beat starting point.
The heart rate (BPM) is displayed in the *Measurement result table*.

Automatic Doppler trace measurements

1. Generate the spectrum to be measured.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **Auto Trace** in the *Measurement Menu*.
A vertical green cursor is displayed on the spectrum.
5. Trackball the cursor to the starting point.

6. Press **SET** to anchor the start point of the measurement.
7. Trackball to the end trace position.
8. Press **SET** to anchor the end point of the trace.
The trace is automatically generated and the following measurements are displayed in the *Measurement result table*:
 - Maximum and mean Velocities
 - Maximum and mean pressures
 - Env. Ti
 - Velocity time integral (VTI)
9. Trackball the cursor to the next heart beat.
10. Press **SET** to anchor the next heart beat starting point.
The heart rate (BPM) is displayed in the *Measurement result table*.

MV E/A ratio

*Adjust Compress
and reject controls
to optimize the
Doppler signal.*

1. Generate the spectrum to be measured.
2. Press **FREEZE** to stop the cineloop.
3. Press **MEASURE** on the Control Panel.
4. Select **MV E/A ratio** in the *Measurement Menu*.
5. Trackball the cursor to the peak of the E wave.
6. Press **SET** to anchor the point.
7. **Drag** cursor to baseline to mark dT.
8. Press **SET** on the trackball area to anchor the second point.
9. Trackball the cursor to the peak of A wave.
10. Press **SET** to anchor the point.
the velocity at peak for E and A waves and the calculated E/A ratio are displayed in the *Measurement result table*.

Vascular measurements

B-Mode measurements

The following instructions assume that you first scan the patient and press **FREEZE**.

% Stenosis

% Stenosis by diameter

1. Press **MEASURE** on the control panel.
2. Open **% Stenosis** in the *Measurement menu*.
3. Select **% Sten (Diam)**.
4. Make a distance measurement of the inner area of the blood vessel.
5. Make a distance measurement of the outer area of the blood vessel.

The distance measurements and the % Stenosis are displayed in the *Measurement result table*.

% Stenosis by area

1. Press **MEASURE** on the control panel.
2. Open **% Stenosis** in the *Measurement menu*.
3. Select **% Sten (Area)**.
4. Make a trace measurement of the inner area of the blood vessel.
5. Make a trace measurement of the outer area of the blood vessel.

The area measurements and the % Stenosis are displayed in the *Measurement result table*.

Volume

The volume calculation can be made from one, two or three distance measurements.

1. Press **MEASURE** on the control panel.
2. Select **Volume** in the *Measurement menu*.
3. When doing volume calculation from three distance measurements (i.e. biplane volume), the measurements should be done in dual mode displaying a sagittal and an axial view. One measurement is usually made in the sagittal plane and two measurements in the axial plane.

When doing volume calculation from one or two distance measurements, make one or two distance measurements and press MENU or CLEAR.

The distance measurement(s) and the volume calculation are displayed in the *Measurement result table*.

A/B Ratio

In B-Mode, A/B Ratio can be measured by diameter or area.

A/B Ratio by diameter

1. Press MEASURE on the control panel.
2. Open **A/B Ratio** in the *Measurement menu*.
3. Select between:
 - **Ratio (Diam)**
 - **Ratio (Area)**
4. Make the corresponding two measurements.
The measurements and the corresponding A/B Ratio are displayed in the *Measurement result table*.

M-Mode Measurements

The following instructions assume that you first scan the patient and press FREEZE.

% Stenosis

1. Press MEASURE on the control panel.
2. Select **% Stenosis** in the *Measurement menu*.
3. Make a distance measurement of the inner area of the blood vessel.
4. Make a distance measurement of the outer area of the blood vessel.
The distance measurements and the % Stenosis are displayed in the *Measurement result table*.

A/B Ratio

In M-Mode, A/B Ratio can be measured by diameter, time or velocity.

1. Press MEASURE on the control panel.
2. Open **A/B Ratio** in the *Measurement menu*.
3. Select between:

- **Ratio (Diam**
 - **Ratio (Time)**
 - **Ratio (Velocity)**
4. Make the corresponding two measurements.
The measurements and the corresponding A/B Ratio are displayed in the *Measurement result table*.

Doppler measurements

The system can detect the trace automatically or the user can draw the trace manually.

Auto vascular calculation

The system performs calculation automatically on the spectrum trace.

The auto vascular calculation can operate in live, freeze or be turned off (**Live**, **Frozen** and **Off** commands in the *Measurements menu*).

From the *Modify Calcs menu*, the user can:

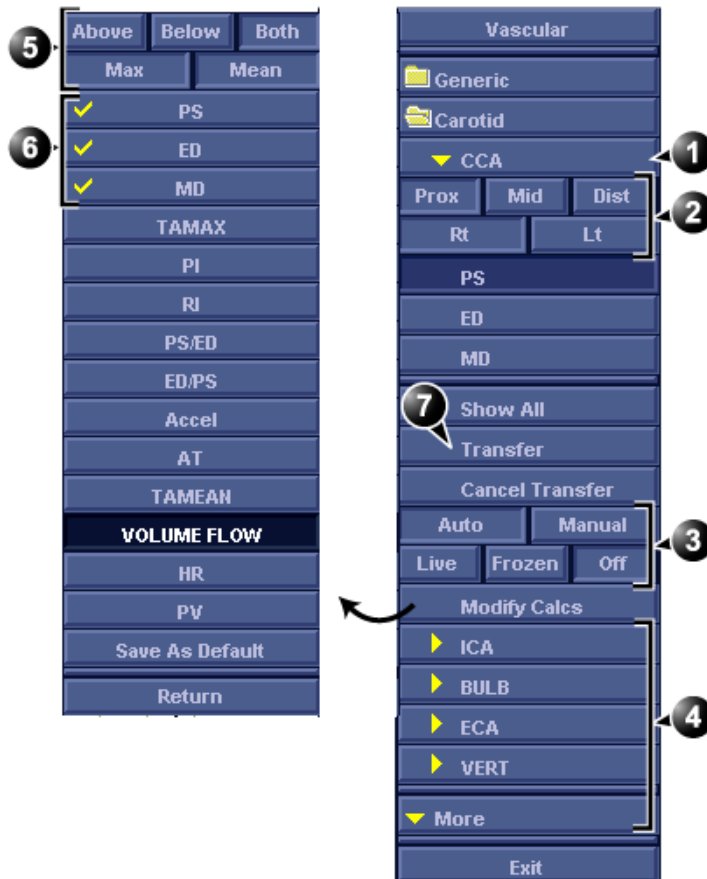
- select the calculations to be displayed in the *Measurement result table*.
- set the calculations that should be default when an exam is started (**Save as default** command).
- turn on the automatically detected trace to display max and/or mean trace (**Max** and **Mean** commands).
- display forward flow, reverse flow or both flows (**Above**, **Below** and **Both** commands).

Setting up auto vascular calculation

1. Press **MEASURE**.
The *Vascular measurement menu* is displayed (Figure 6-6).
2. Press **Auto** and select between:
 - **Live**: calculation displayed on the real-time image.
 - **Freeze**: calculation displayed on the frozen image.
 - **Off**: auto vascular calculation is turned off.
3. Press **Modify Calcs**.
The *Modify Calcs menu* is displayed (Figure 6-6).
4. Select:

Measurement and Analysis

- **Above**, **Below** or **Both** to select the spectrum to perform the calculations on, i.e. above or below the baseline or both.
 - **Max** and/or **Mean** to display max and/or mean velocities.
5. In the *Modify Calcs menu*, select the measurements and calculations to be displayed in the *Measurement result table*.
 6. Press **Save as default** to set the selected calculations to be default when a new study or exam is started.



1. Selected vessel
2. Vessel location parameters
3. Manual/auto calculation controls
4. Other vessels
5. Trace parameters
6. Selected measurements and calculation to appear in the *Measurement result table*.
7. Assign measurement and calculation

Figure 6-6: Vascular measurement menu (example)

Using Auto vascular calculation

1. Perform the scan and press **FREEZE**.
The system performs the calculation automatically and the pre-defined measurements and calculation are displayed in the *Measurement result table*.
2. The following controls may be adjusted from the control panel:
 - **CYCLE SELECT**: change the selected cycle.
 - **TRACE SENSITIVITY**: optimize the trace contour.
 - **CURSOR SELECT**: select Peak systolic or End diastolic marker. The selected marker can be moved to a new location. Press **SET** to anchor the marker to its new location.

Assigning auto calculations

1. In the *Vascular Measurement menu* (Figure 6-6), select:
 - The actual vessel name
 - **Prox**, **Mid** or **Dist**: the location of the vessel (Proximal, Middle or Distal).
 - **Rt** or **Lt**: right or left side of the patient.
2. Press **Transfer** to assign the measurements and calculations.

*To undo the assignment, press **Cancel transfer**.*

The *Measurement result table* is updated accordingly and the measurements and calculations are added to the worksheet and report.

Manual vascular calculation

When doing manual measurements, the system can detect the trace automatically or it can be drawn by the user. This is controlled by the **Auto** and **Manual** commands in the *Measurement menu*.

The following instructions assume that you first scan the patient and press **FREEZE**.

1. Adjust the vessel location parameters in the *Vascular measurement menu* (Figure 6-6).
2. Select the measurement to be performed from the *Measurement menu* or from the *Show All menu* for additional measurements.
3. Perform the measurement as described below.

Acceleration, Acceleration time (AT)

1. Select **Accel** or **AT**.
2. Position the caliper at the start point and press **SET** to anchor the caliper.
3. Position the second caliper at the end point and press **SET** to anchor the caliper and complete the measurement.
The acceleration and/or the acceleration time is displayed in the *Measurement result table*.

Heart rate

Heart rate is calculated by selecting two identical points over four heart cycles.

1. Select **HR**.
2. Position the caliper at a recognizable point in the first cycle and press **SET** to anchor the caliper.
3. Position the second caliper at the identical point in the fourth cycle and press **SET** to anchor the caliper and complete the measurement.
The Heart rate is displayed in the *Measurement result table*.

Peak systole (PS), End diastole (ED) and Mid diastole (MD)

1. Select **PS**, **ED** or **MD**.
2. Position the caliper at the corresponding measurement point and press **SET** to complete the measurement.
The selected measurement is displayed in the *Measurement result table*.

Pulsatility index (PI)

With Auto trace on

1. Select **PI**.
2. Position the caliper at the beginning of the wave form and press **SET** to anchor the caliper.
3. Position the second caliper at end diastole and press **SET**.
A trace is displayed between the two calipers and PS, MD, ED, TAMAX and PI are displayed in the *Measurement result table*.

With Manual trace on

1. Select **PI**.
2. Position the caliper at the beginning of the wave form and press **SET** to anchor the caliper.

3. Using the trackball, draw the trace to the end diastole and press **SET**.
The trace is displayed and PS, MD, ED, TAMAX and PI are displayed in the *Measurement result table*.

Peak systole/End diastole (PS/ED) and End diastole/Peak systole (ED/PS) ratio

1. Select **PS/ED** or **ED/PS**.
2. Position the caliper at Peak systole or End systole and press **SET** to anchor the caliper.
3. Position the second caliper at End diastole or Peak systole and press **SET** to anchor the caliper and complete the measurement.
The Peak systole, End diastole and PS/ED or ED/PS ratio are displayed in the *Measurement result table*.

Resistive index (RI)

1. Select **RI**.
2. Position the caliper at Peak systole and press **SET** to anchor the caliper.
3. Position the second caliper at end diastole and press **SET**.
The Peak systole, End diastole and RI are displayed in the *Measurement result table*.

TAMAX/TAMEAN/Volume Flow

With Auto trace on

1. Select **TAMAX**, **TAMEAN** or **Volume Flow**.
2. Position the caliper at the start point and press **SET** to anchor the caliper.
3. Position the second caliper at the end point and press **SET** to anchor the caliper and complete the measurement.
A trace is displayed between the two calipers and corresponding measurements are displayed in the *Measurement result table*.

With Manual trace on

1. Select **TAMAX**, **TAMEAN** or **Volume Flow**.
2. Position the caliper at the start point and press **SET** to anchor the caliper.
3. Using the trackball, draw the trace to the end point and press **SET**.

The trace is displayed and the corresponding measurements are displayed in the *Measurement result table*.

Measurement package configuration

A list of all cardiac calculations with needed measurements and location in the Measurement package can be found in the Reference manual.

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.

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.

Measurement package configuration - example

Calculation of Cardiac Output by Aortic Flow requires 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 **CONFIG** and select the category **Measure**. The *Measurement menu sheet* is displayed (see Figure 6-7).

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*.
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 6-7: 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 **CONFIG** and select the category **Measure**.
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**.
3. In the folder *Aortic*, select **AV Trace** measurement.
A list of all available calculations for the selected 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.



CAUTION

GE Ultrasound does not take any responsibility for the correctness of the user-defined 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 follow: $\text{My LIMP} = (\text{MCO-AV ET}) / \text{AV ET}$.

Creation of a user-defined folder

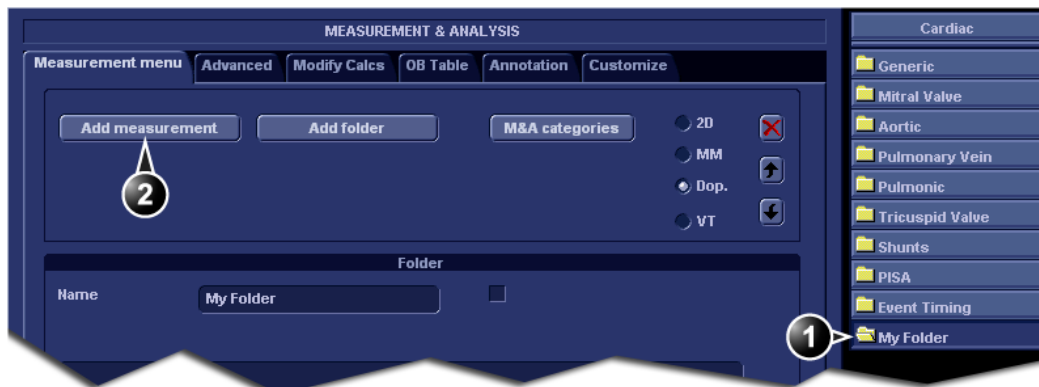


1. Select the appropriate scanning mode.
2. Create a folder in the Measurement menu.

Figure 6-8: The Measurement menu sheet

1. Press **CONFIG** 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 6-9: 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.

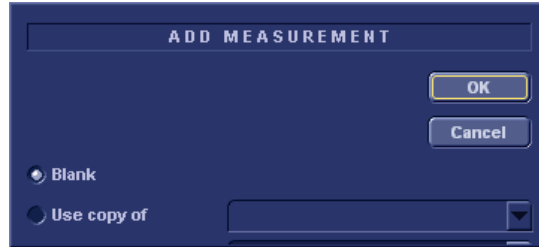


Figure 6-10: The Add measure window

3. MCO and AV ET 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 AV ET 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 6-11: The Measurement menu sheet

The formula for this example is as follow:

My LIMP = (MCO-AV ET)/AV ET


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.



Figure 6-12: The Edit formula window

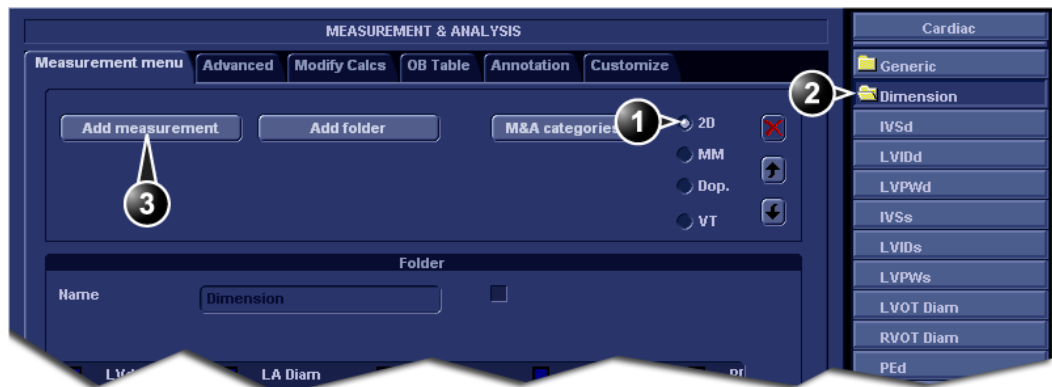
5. Select "(" from the *Operators drop-down menu*.
6. In the *Doppler drop-down list*, select **MCO [My Folder, MCO]**.
Make sure to select the measurement located in the user defined folder (e.g. "My Folder").
7. Select "-" from the *Operators drop-down menu*.
8. In the *Doppler drop-down list*, select **AV ET [My Folder, AVET]**.
9. Select ")" from the *Operators drop-down menu*.
10. Select "/" from the *Operators drop-down menu*.
11. In the *Doppler drop-down list*, select **AV ET [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 143).

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 6-13: The Measurement menu sheet

1. Press **CONFIG** 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 sheet* (e.g. Dimension).
4. Press **Add Measurement** in the *Measurement menu sheet*.
The *Add measure window* is displayed.

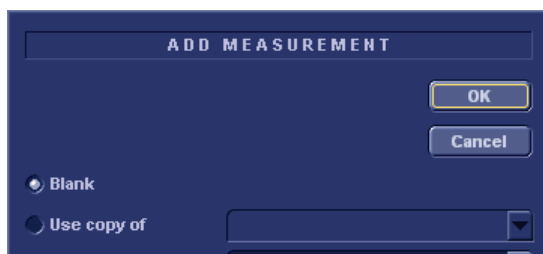
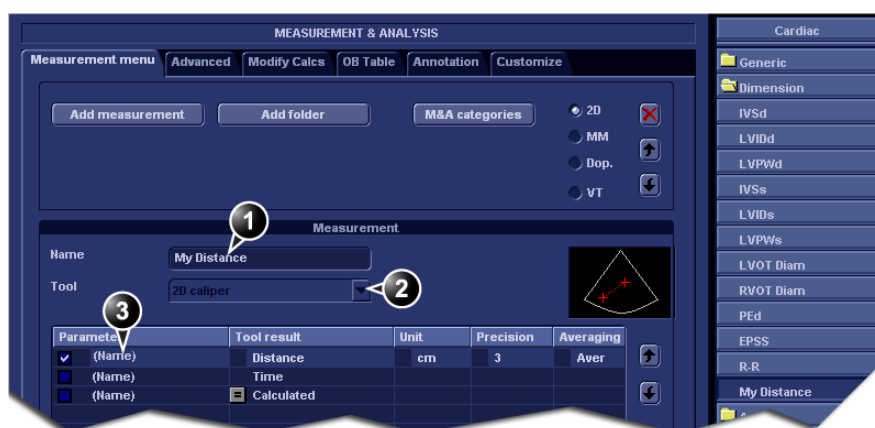


Figure 6-14: The Add measure window

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 6-15: 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 143).

About units

Be aware of the following:

- All units 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 desired unit the resulting value should use. E.g. if Y in the formula $Y=f(x)$ is to be displayed in cm, enter cm in the *Unit* field.
The *Unit* field is case sensitive, make sure to enter the exact unit as shown in the table below (Alternative unit column).
2. When creating the formula, be sure that all parameters (all the X's in $Y=f(x)$) are in SI units. All default parameters in the system are in SI units.
If the resulting value of a user-defined formula is set to be displayed in a unit that is not SI, you must apply the correct conversion factor to all the parameters (X's).
Example: if you have the formula $Y=a*X$ and you set the formula result to be in cm, you have to convert the parameter X from meter (default SI unit) to cm by dividing the parameter by 100. The formula with a result in cm should be defined as follow: $Y=a*X/100$.

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/s ² - cm/s ² - mm/s ² - inch/s ²
Area	m ²	dm ² - cm ² - cm ^{^2} - mm ² - inch ²
Volume	m ³	dm ³ - cm ³ - l - dl - cl - ml - gallon - quart


Measurement and Analysis

Calculation	SI	Alternative unit
Volume flow	m ³ /s	dm ³ /s - cm ³ /s - l/s dl/s - cl/s - ml/s - m ³ /min dm ³ /min - cm ³ /min - l/min - L/min - dl/min cl/min - ml/min - ml/m ²
Pressure	mmHg	Pa - kPa - bar - torr - atm - psi
Pressure/time	mmHg/s	mmHg/s
Mass	kg	g - ounce - pound
Other		mmHG - Date - WeekDay - Day - NoUnit l/minm ² - g/m ² - cm/m ²

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. Trackball to the symbol  on the heading of the *Measurement result table* (see Figure 6-16).
2. Press **SET**.

The *Measurement result table* is minimized to the heading bar.

*Repeat step 1 to enlarge the **Measurement result table**.*

Moving the Measurement result table

1. Trackball to the symbol  on the heading of the *Measurement result table* (see Figure 6-16).
2. Press **SET** to grab the table.
3. Trackball the *Measurement result table* to a new position.
4. Press **SET** to anchor the table.

*Alternative: Rotate the assignable **RESULT WINDOW** to move the **Measurement result table** from corner to corner on the **Acquisition window**.*

1. **Minimize/maximize table**
2. **Move table**

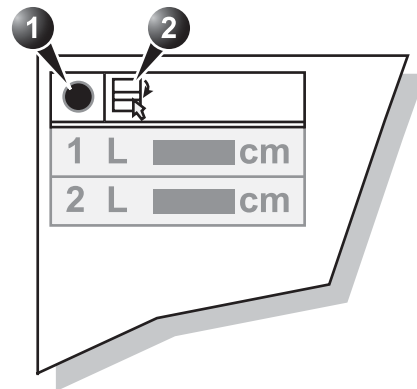


Figure 6-16: Measurement result table display tools

Deleting measurements

1. Trackball to the measurement to delete in the *Measurement result table* and press SET.
A menu is displayed.
2. Select **Delete Measurement**.

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

M-Mode Measurements		Value	Mth	m1	m2	m3	m4	m5
Dimens								
LA/Ao								
Ao Diam	2.41 cm	Av	2.41					
LA Diam	2.36 cm	Av	2.36					
LA/Ao	0.98		0.98					
Ao/LA	1.02		1.02					
CRT								
MVO	21.37 ms	Av	21.37					
MVC	49.82 ms	Av	49.82					

- | | |
|---------------------------------------|---------------------------------|
| 1. Measurement type | 4. Measured / calculated values |
| 2. Measurement parameter | 5. Value type |
| 3. Value: Averaging, Max, Min or Last | 6. Measurement type selection |

Figure 6-17: The Worksheet screen (Cardiac)

Using Worksheet

1. Press WORKSHEET on the control panel and select the measurement type (see Figure 6-17).

To scroll through pages

1. Select PAGE DOWN or PAGE UP.

To select the type of value

1. Trackball to the relevant cell in the *Method column*.
2. Press SET.
A pop-up menu is displayed showing the different options available (Figure 6-18).

1. Average of the measurements taken
2. Maximum measurement
3. Minimum measurement.
4. Last measurement that was taken



Figure 6-18: The Calculation method options list.

3. Trackball to the required option.
4. Press SET.
The value is updated accordingly.

Excluding or including measurements

One or more measurement values from a set of measurements for a parameter can be excluded when doing average calculation.

To exclude a measurement

1. Trackball to the measurement value to exclude.
2. Press UPDATE MENU.
The *Worksheet menu* is displayed.
3. Trackball to **Exclude Value**.
4. Press SET.

When excluded the measurement display turns grey.

To include a measurement

1. Trackball to the measurement value to include.
2. Press UPDATE MENU.
The *Worksheet menu* is displayed.
3. Trackball to **Include Value**.
4. Press SET.

Manually changing a value

Individual measured values can be manually changed using the alphanumeric keyboard.

To manually change a value

1. Trackball to the value that is to be changed.
2. Press SET.
3. Use the alphanumeric keyboard to enter the required value.

*An asterisk indicates that the value has been manually altered. The calculation type is changed to **Edit**.*

To restore automatic calculation

1. Trackball to the relevant cell in the *Method column*.
2. Press SET.
A pop-up menu is displayed showing the different calculation options available (Figure 6-18).
3. Press SET.
The value is re-calculated according the method selected.

Deleting measurement parameter

1. Trackball to the measurement parameter to delete.
2. Press UPDATE MENU.
The *Worksheet menu* is displayed.
3. Trackball to **Delete Value**.
4. Press SET.

Chapter 7

Purposely Left Empty

For Future purposes

Chapter 8

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Introduction

During an examination, the operator stores data, images and cineloops for immediate purposes. The Vivid *i* ultrasound unit includes an integrated patient archiving system for data and image storage.



CAUTION

Do not use the internal harddrive for long-term image storage.

The Vivid *i* ultrasound unit enables also storing of data and images to external databases (EchoServer, Magneto Optical (MO) disk, CD-R or DVD-R). The patient and image archives are set by the selected dataflow (see page 310 about available dataflows and default dataflow selection).

Storing images and cineloops

DICOM images are stored to formatted Magneto Optical disks separately from patient data.

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 (i.e. probe and application selected, image setting, annotations or measurements...).

The image archive is set by the dataflow selected (see page 310 about available dataflows and default dataflow selection).



CAUTION

Do not use the internal harddrive for long-term image storage.

A formatted (see page 320) Magneto Optical Disk is recommended for image archive.



CAUTION

If working off-line with a dataflow pointing to a DICOM server, the images stored during the examination will have to be manually resent in the DICOM spooler (page 232) when reconnecting the unit. Resend all jobs that are failed or on hold (See page 232 for more information on DICOM spooler.).

In addition, stored images and cineloops can be saved to a removable media in the standard formats JPEG, AVI (cineloop), MPEG and DICOM (see page 158).

Storing an image

Images are displayed chronologically on the clipboard.

1. While scanning in any mode, press **FREEZE**.
2. Trackball to scroll through the cineloop and select the required image.
3. Press **STORE**.
The image is stored and a thumbnail is displayed on the clipboard. A serial number appears on each thumbnail, start from "1" in chronological order.

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. Press the Assignable **CINELOOP**.
3. Determine the best cineloop to store using the assignables (see page 56 for further information on cineloop operation).
4. Press **STORE**.
The cineloop is stored and a thumbnail is displayed on the clipboard. The "loop" icon appears on the thumbnail image indicating that the image stored is a loop. A serial number appears on each thumbnail, starting from "1" in chronological order.

Direct storage of a cineloop

Depending on whether the system has been configured to enable or disable the **Preview Loop before store** function (see page 289), the following procedures enable the cineloop to be stored directly.

Storing cineloop without preview

The function **Preview Loop before store** is disabled (see page 289).

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 289).

1. While scanning, press **STORE**.
The last valid cineloop is previewed on the screen (but not stored).
2. If desired, press **CINELOOP** and adjust the cineloop to be stored using the assignables (see page 56).
3. Press **STORE** to save the cineloop.
A thumbnail is displayed on the clipboard.

Saving stored images and cineloops to a standard format

Stored images and cineloops can be saved to a removable media 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 160.

Procedure:

1. Trackball to the required image or loop icon on the clipboard.
2. Press **SET**.
The selected image is displayed.
3. Press **UPDATE/MENU** on the control panel.
The *System menu* is displayed.

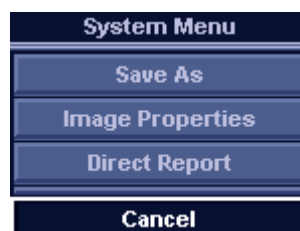


Figure 8-1: The System menu

4. Trackball to **Save as**.
5. Press SET.
The *Save as menu* is displayed.

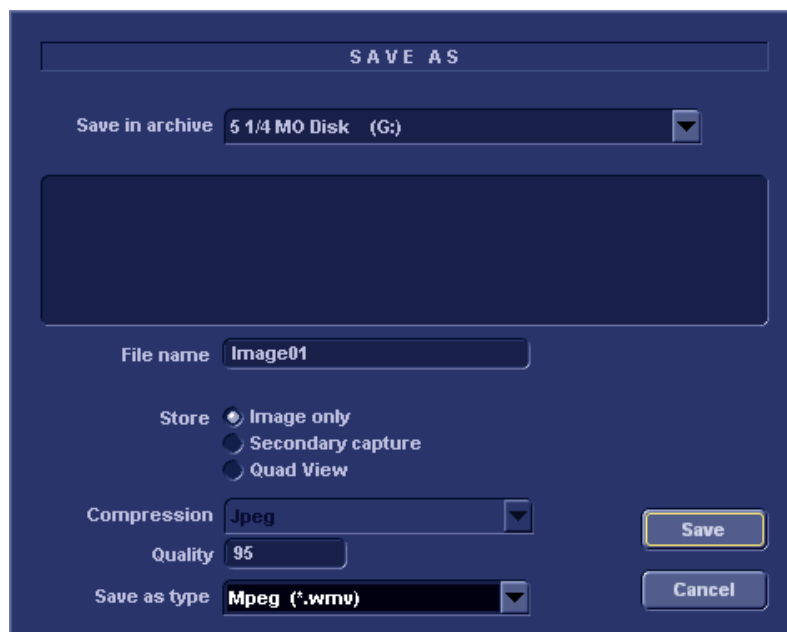


Figure 8-2: The Save as menu

6. Select the desired removable media from the *Save in archive pull-down menu*.
7. 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.
8. Select between:
 - **Store image only:** saves the image or cineloop only.
 - **Store secondary capture:** creates a still image of the

image area and the Title bar.

The secondary capture is not available when saving images as DICOM or RawDICOM.

9. Select the image compression type (JPEG or Rle) or no compression.
10. Enter in the desired **Image quality** (between 10 and 100). A high quality setting will give a lower compression.
11. 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.
12. 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.

MPEG exams can be created using the Export function (MPEGVue) or by using the dataflow *Local Archive - Int.HD/eVue* (eVue).

The MPEGVue option is used to create MPEG exams on finished exams. The eVue option is used to create MPEG exams when performing the exam, upon saving the images.

Creating an MPEG exam using the Export function (MPEGVue)

Refer to "Exporting patient records/examinations" on page 209.

Creating a MPEGVue exam using the dataflow Local Archive - Int. HD/eVue (eVue)

The dataflow must be configured before first time use as follows:

1. Press **CONFIG** 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** in the *Name* pull-down menu.



Figure 8-3: The Dataflow Sheet

4. Select the **eVue** device in the *Selected devices* pane and press **Properties**. The *eVue properties* window is displayed.

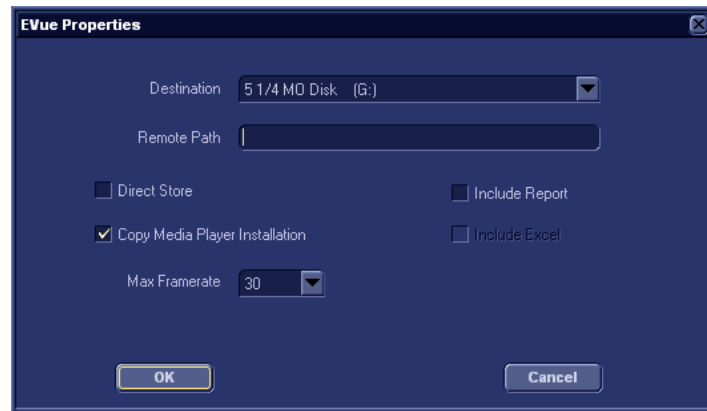


Figure 8-4: The eVue properties window

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.

5. Select a removable media or a network volume remote path as the destination in the *Destination* pull-down menu.
6. Check the options as required.
7. Select **OK** and press **CONFIG**.

To create an MPEG exam using the dataflow Local Archive-Int. HD/eVue

1. Press **ARCHIVE**.
The *Search/Create patient* window is displayed.
2. Select the dataflow **Local Archive - Int. HD/eVue**.
3. Perform an exam.

When saving an image, it is stored as raw data to the local machine, an MPEG copy is created and stored to the destination set during the configuration of the dataflow.

Reading an MPEG exam

A MPEG exam can be read from any computer with Windows 98/2000/XP, provided that DirectX 8.1 or later and Windows Media Player 7.1 or later are installed.

In addition, the following requirements should be met:

- CPU speed: 700 MHz or faster
- RAM memory: 128 MB or more
- Screen resolution: 1024 x 768 pixels (recommended)
- Colors: 24 bit or higher
- The PC should be configured for Auto-play

To read an MPEG exam:

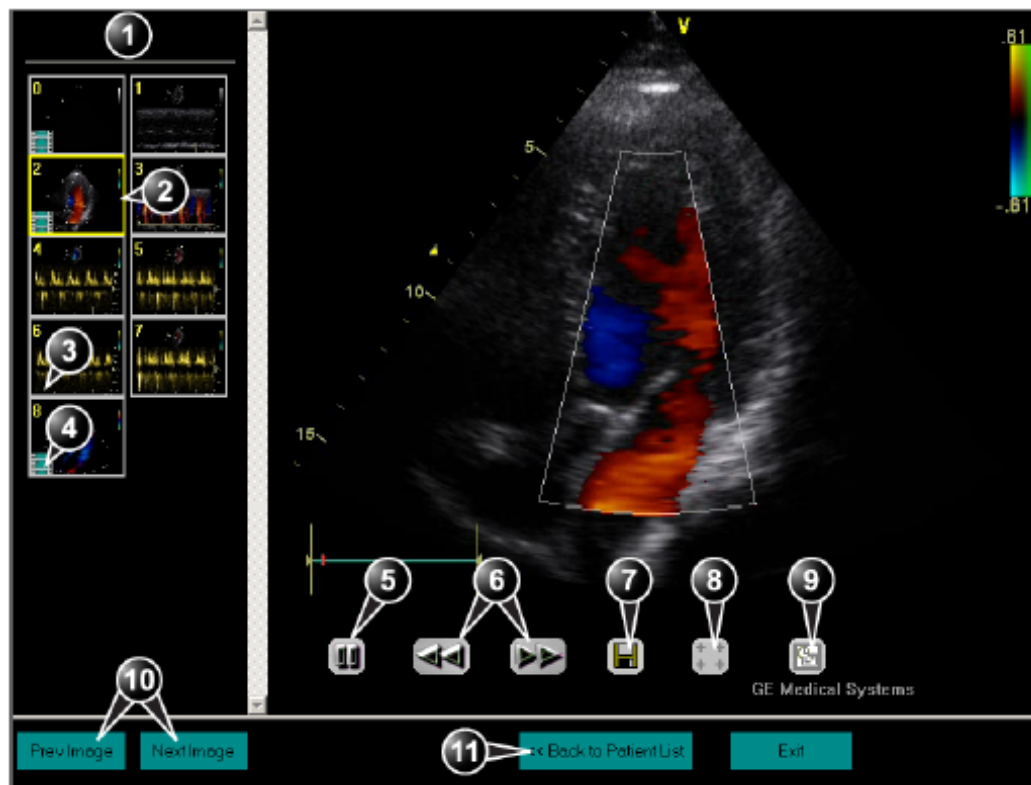
1. Access the media by following one of the options below:
 - To read MPEG exams stored on a CD, insert the MPEGVue CD into the drive.
The *Patient List* is displayed (Figure 8-5).
 - To read MPEG exams stored on other media, insert the media or locate the network shared folder containing the MPEG exams and double-click on the file:
START_MPEGVue.bat.
The *Patient List* is displayed (Figure 8-5).

Patient List			
ID	NAME	Exam Date	Num. Images
QTS030303093645	Patient1, Test	03/03/2003	14
QTS06032003	Patient2, Test	06/03/2003	25
QTS07032003	Patient3, Test	07/03/2003	35

1. Select the examination date.

Figure 8-5: The MPEGVue Patient List

2. Select the desired examination date to display the belonging images.
The *MPEGVue* screen is displayed (Figure 8-6).



- | | |
|---|--------------------------------------|
| 1. Clipboard: select the image to display | 7. Save image as MPEG or Bitmap file |
| 2. Selected image | 8. Measurement tool |
| 3. Single frame image | 9. E-mail support |
| 4. Cineloop | 10. Display previous/next image |
| 5. Freeze/run cineloop | 11. Display the MPEGVue patient list |
| 6. Scrolling tool during freeze | |

Figure 8-6: The MPEGVue screen

Performing measurements on MPEGVue images

The following measurements can be performed on MPEGVue images:

- Distance and area in 2D images
- Height, time and slope in M-mode images
- Velocity and time in Doppler modes

To perform measurements on MPEGVue images:

1. In a 2D image, select the **Measurement Tool** (see Figure 8-6)
The distance measurement tool is automatically selected.
2. Perform the distance measurement.

To perform an area measurement, right-click on the image and select **Area**. Then perform the area measurement.

In other modes, select the **Measurement Tool** (see Figure 8-6) and perform the measurement.

E-Mail support for MPEGVue**Sending images or examinations via E-mail**

The selected image or the entire examination can be send by e-mail as an attachment. providing that the computer has a mail client application (e.g. MS Outlook, MS Outlook Express).

To send an image:

1. Select the image to send on the clipboard and press the **E-mail** button (see Figure 8-6).
The *E-Mail* dialog window is displayed (Figure 8-7).

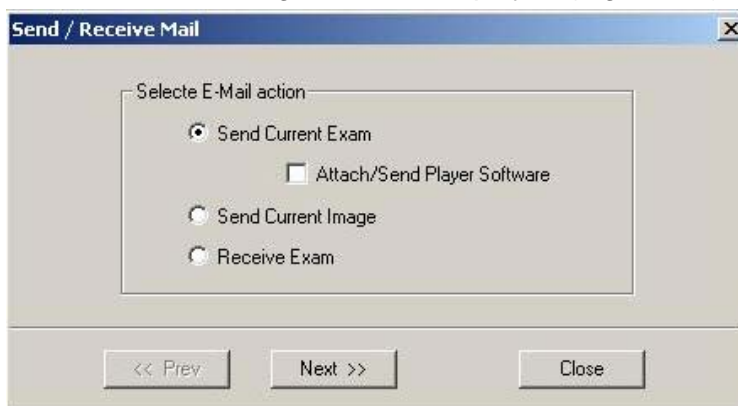


Figure 8-7: The E-mail dialog window

2. Select **Send Current Image**.
The *E-mail address* window is displayed (Figure 8-8).

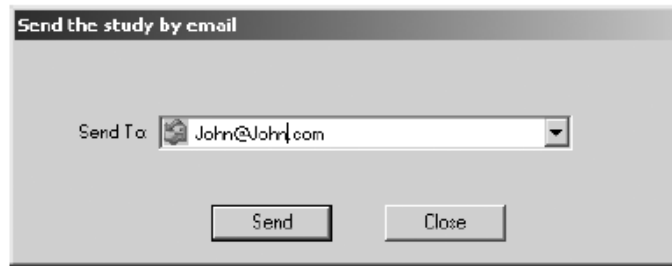


Figure 8-8: The E-mail address window

3. Select an existing address or enter a new address. Up to 10 addresses can be entered.
4. Select **Send**.

The E-mail with the image is sent and a *Confirmation* window is displayed. Select **OK**. The person receiving the E-mail can open the image in Windows Media Player.

To send a complete examination:

Examinations sent by E-mail as attachments are zip-compressed, encrypted and password protected. If the size of the exam is too large to be sent as a single attachment, it is divided in several file attachments sent with several E-mails.

1. Open the examination to send in MPEG viewer and press the **E-mail** button (see Figure 8-6)
The *E-mail* dialog window is displayed (see Figure 8-7, page 165)
2. Select **Send Current Exam**.
The *E-mail address* dialog window is displayed (see Figure 8-8, page 166)
If the recipient has never installed the MPEGVue viewer on his PC before, you would need to check the flag "**Send software...**"
3. Select an existing address or enter a new one.
4. Select **Send**.
The *Password* window is displayed (Figure 8-9).

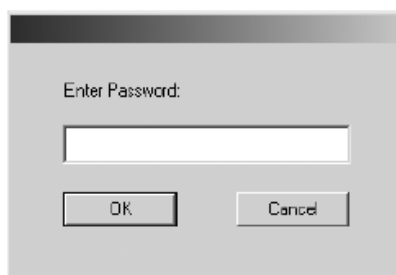


Figure 8-9: The Password window

5. Enter a password and select **OK**.
The exam is sent and a confirmation window is displayed.
6. Click **OK** in the confirmation window.

Opening an MPEGVue exam from one or more E-mails

1. In the MPEG viewer press the **E-mail** button (see Figure 8-6, page 164)
The *E-mail* dialog window is displayed (see Figure 8-7, page 165).
2. Click **Receive exam**.
The *Password* dialog window is displayed (see Figure 8-9, page 167).
3. Enter the password and click **OK**.

The exam is decompressed and opened in the viewer. Then the E-mail(s) containing the MPEG examination is deleted.

Retrieving and editing archived information

Locating a patient record

To create an operator ID, see page 331.

1. Press **PATIENT** on control panel.
If the unit is password protected a *Log In window* (Figure 8-10) will appear asking for user ID, and password.

1. Select the operator



Figure 8-10: The Operator login window

The unit can be configured to automatically generate a patient ID (see page 321)

2. Press **Log on** when completed.
The *Archive entry* screen is displayed (Figure 8-11).

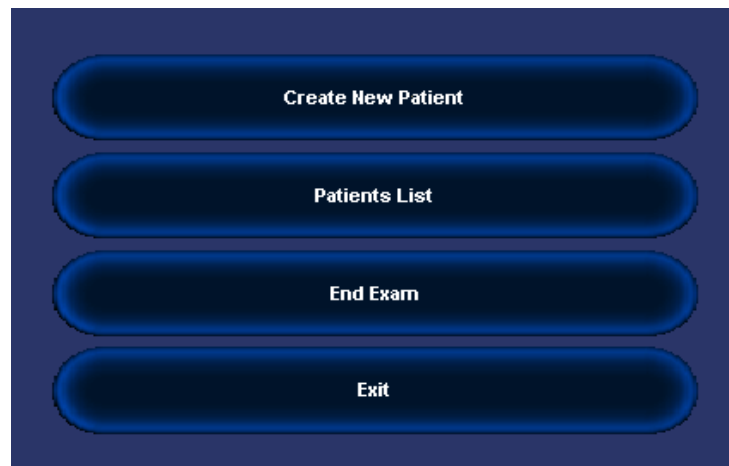


Figure 8-11: Archive entry screen

3. Click the **Create New Patient** button.
The *Search/Create patient* window is displayed (Figure 8-12).
4. Type the patient **Last Name**, and/or **ID**.



CAUTION

Do NOT use '\' or '^' in patient information fields, as these characters might cause problems with some DICOM devices.

The automatic searching tool displaying matching patient information in the Patient list can be turned off (see page 321)

- When default configured, the system automatically searches to see if the patient is already in the database. The result of this search is displayed in the *Patient list field*.
5. Trackball to the actual patient and press the Trackball **SET** key.
The patient record is highlighted.
6. Press **SELECT PATIENT**
Or
Press **[+]** in front of the actual patient record and select the desired examination.
The *Examination List window* for the actual patient is displayed (refer to Figure 8-14).



1. Press one of the headings to sort the list accordingly.
2. Select new archive and other pre-defined services
3. Extended menu
4. Select the column heading border and drag to adjust column width
5. Expanded Patient record displaying belonging examinations

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

Figure 8-12: The Search/Create Patient window

Advanced search

The list of searching filters may vary depending on the Dataflow selected

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
Diag. code
Date of birth (time span)
Examination date (time span)
Current date
Images
Stress examinations
Report

The unit can be configured to display the Advanced search tool as default (see page 321)

Searching with filter:

1. Trackball to the **More** button in the *Search/Create Patient window*.
2. Press **SET** on the control panel.
The *Search/Create Patient window* is extended displaying the searching filters (see Figure 8-13).
3. Type the information in the required searching filter field.
4. Type the patient **Last Name**, and/or **ID**.
The matching data is displayed in the *Patient list* when the automatic search function is turned on.

Sorting data

The search result can be sorted according to the fields displayed in the patient list, in ascending or descending order.

To sort data:

1. In the *Patient list field*, Trackball to the field header by which the sort is to be performed (Figure 8-13, page 171).
2. Press **SET** on the control panel.
The patient list is sorted in ascending order according to the field selected.

- Press **SET** once more.
The patient list is sorted in descending order according to the field selected.

SEARCH / CREATE PATIENT

More

Last Name: i Patient ID: Birthdate: (dd/mm/yyyy) Ag: 3

Category: Cardiac Sex: female male

Echolab: Born between: Exam between: Today

Diagn. code: Images Stress No Report Category Diagn. Phys

Patient List 2 records fetched of total 16 (Show All)

Last Name	First Name	Patient ID	Birthdate	Exam Date	Img	Str	Rep	Size	Code
Images	Demo	020202	02/01/1902	24/04/2003	9	4	41.3 MB		
				15/02/2002	1	✓	2.1 MB		
				21/02/2002	1	✓	7.2 MB		
				03/02/2003	1	✓	0.0 KB		
Image	Some	370		10/12/2002	16		58.3 MB		
				10/12/2002					

Dataflow: Local Archive - Int. HD Operator: ADM

15/11/04 11:55:04 HR 68

Operator Login ADM

Dataflow Name Local Archive - Int. H Images \\VIVID_I-000110\Arc

Image disk Capacity 45.1 GB Free space 45.1 GB

0.1 %

Spooler Status READY Jobs 0

Preview:

Create Patient Clear search Select Patient Export More

- Press one of the headings to sort the list accordingly.
- Select new archive and other pre-defined services
- The system can be configured to display the Advanced search tool as default (see page 321)
- Select the column heading border and drag to adjust column width
- Expanded Patient record displaying belonging examinations

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

Figure 8-13: The extended Search/Create Patient window

Printing the patient list

- In the *Search/Create patient* window, select **More** to display the additional menu.
- Select **Print Patients**.
The displayed patient list is printed.

Selecting a patient record and editing data in the archive

After locating the patient in the database (see page 168 page 171), the user must select the patient record, to be able to review and edit archived data.

Selecting a patient record from the patient list

1. In the *Search/Create patient window*, trackball to the actual patient and press the Trackball **SET** key.
The patient record is highlighted.
2. Press **SELECT PATIENT**.
The *Examination List window* is displayed showing previous examinations and diagnosis information related to the selected patient (see Figure 8-14).

The screenshot shows the 'EXAMINATION LIST [Local Archive - Int. HD]' window. It contains a table with the following data:

OperId	Date	DiagCode	Tape	MA	Report	Image	Disk
.SRV	15/02/2002			✓	✓	✓	Local HD:
adm	21/02/2002			✓		✓	Local HD:
ADM	03/02/2003					✓	Local HD:
ADM	24/04/2003			✓			
ADM	19/08/2004						

Below the table, there are three main sections:

- Referral Reasons:** A text area with an 'Insert Text' button.
- Comments:** A large text area with an 'Insert Text' button.
- Diagnosis:** A section with a 'Code' field and an 'Insert Text' button.

1. The information displayed in the Patient list is configurable (see page 321).
2. Go to Search/Create Patient window (see page 169)
3. Insert pre-defined text in the Comment field
4. Select the column heading border and drag to adjust column width

Figure 8-14: 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.

Text edition

1. In the *Examination list window* (Figure 8-14), trackball to the required field.
2. Press **SET**.
3. Using the alphanumeric keyboard, edit the information.
4. Press **ARCHIVE** on the control panel to quit the archive.

Use the Arrow keys to move text marker.

Inserting pre-defined text input

1. In the *Examination list window*, trackball to **Insert Text** over the actual field.
2. Press **SET**.
The *Insert text window* is displayed (see Figure 8-15). 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.

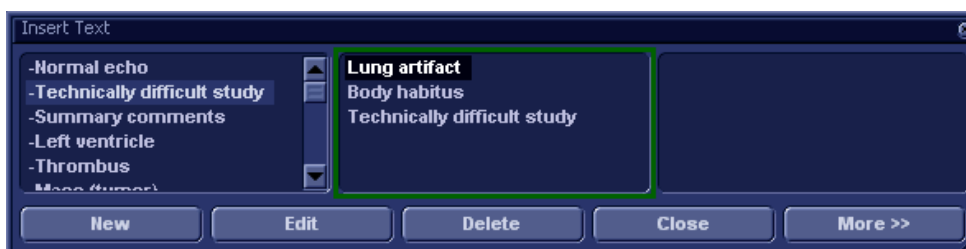


Figure 8-15: The Insert text window

Creating, editing and deleting text input

These features are described in "The Comment texts sheet" on page 306.

Diagnosis code

Entering a Diagnosis code

1. In the *Examination list window*, select **Code** (see Figure 8-14).
The *Entered Code window* is displayed.
2. Select **Add**.
The *Code list window* is displayed.
3. Double-click the code to enter.
The selected code is displayed in the *Examination list window*.

1. The Entered Code window
2. The Code list window

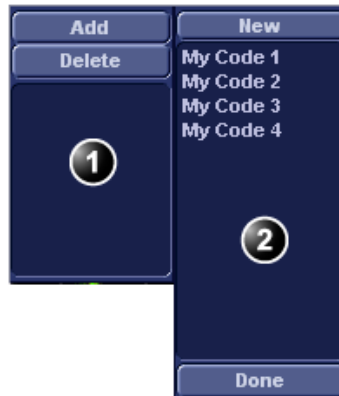


Figure 8-16: Entering Diagnosis codes

Deleting an entered Diagnosis code

1. In the *Examination list window*, select **Code** (see Figure 8-14).
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 8-14).
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.

See also "The diagnostic codes sheet" on page 305.

Editing Demographic details



WARNING

If you modify the Patient ID, Last name, First name or Date of birth on a patient in the archive, be aware that the contents of the archived images for that patient is not updated. If the images are still in the buffer and not yet archived, the image files are updated if you modify any patient information, but not if the images are archived. So if any of these images are later on exported to DICOM media or DICOM server, they will still contain the original patient information, as it was before you did the modification in the archive. The system does not alter the contents of the image files at all when doing DICOM export.**

1. Press the PATIENT button on the control panel.
2. Select **Patient Details**.
The *Patient information window* is displayed.
3. Trackball to the field to edit.
4. Press SET on the control panel.
5. Using the alphanumeric keyboard, edit the information.



CAUTION

Do NOT use 'I' or '^' in patient information fields, as these characters might cause problems with some DICOM devices.

Alternative: Press any active scanning mode key.

6. Press the EXAM LIST assignable to go back to the *Examination list window*. **OR**
Press PATIENT on the control panel to quit the archive.

Only user logged in with full operator rights can delete patient records (see page 331 for further information).

Deleting archived information

To delete a patient record

1. Press **PATIENT** on the Front panel.
2. Select **Patient List**.
The *Search/Create Patient window* is displayed (Figure 8-12, page 169).
3. Type the patient Last Name, and/or ID.
4. Trackball to the actual patient record.
5. Press **SET** to highlight the patient record to delete.
6. Press **Delete** in the *Search/Create Patient window*.
A dialogue box is displayed asking for confirmation of the deletion (Figure 8-17).
7. Trackball to **OK** and press **SET** on the control panel.

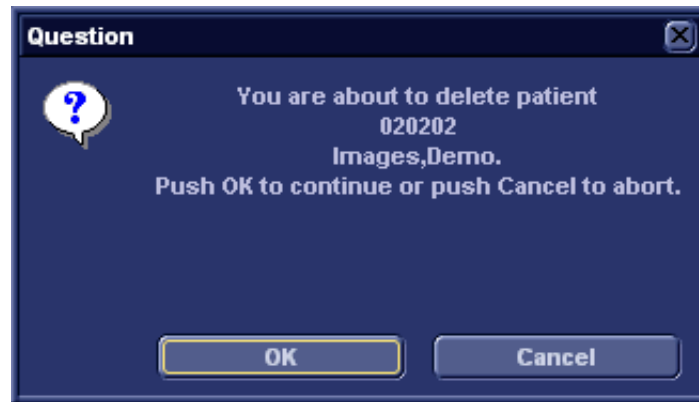


Figure 8-17: Delete patient record confirmation prompt

To delete an examination

1. Press **PATIENT** on the Front panel.
2. Select **Patient List**.
The *Search/Create Patient window* is displayed (Figure 8-12, page 169).
3. Type the patient Last Name, and/or ID depending on system configuration.
4. Trackball to the actual patient record and double-click the Trackball **SET** key (or press **SET** once and **SELECT PATIENT**) to select the patient.
The *Examination list window* is displayed.
5. Trackball to the examination to delete.

6. Press the trackball **SET** key.
7. Press **More** in the *Examination list window* (see Figure 8-14, page 172).
8. Press **Del Exam** to delete the examination.
A warning message is displayed asking the user to confirm the action to perform (see Figure 8-18).
9. Trackball to **OK** and press **SET** to delete the selected examination.
Trackball to **Cancel** and press **SET** to abort deletion.

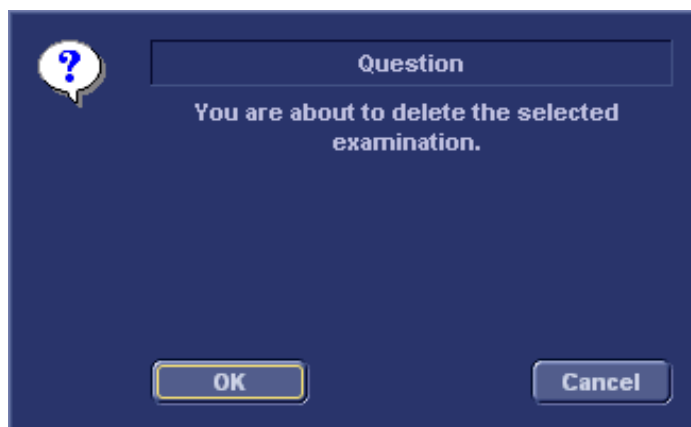


Figure 8-18: Delete Examination prompt

To delete an image

1. Press **PATIENT** on the Front panel.
2. Select **Patient List**.
The *Search/Create Patient window* is displayed.
3. Type the patient Last Name, and/or ID.
4. Trackball to the required patient to highlight the record.
5. Press the trackball **SET** button.
The *Examination list window* is displayed.
6. Trackball to the actual examination in the *Examination list window*.
7. Press the trackball **SET** button.
8. Press **REVIEW**.
The images for the selected examination are displayed on the *Review screen* (Figure 8-21, page 182).
9. Trackball to the image to delete.
10. Press **SET** on the control panel.

Repeat steps 9 and 10 to delete several images.

11. Press **Delete**.
A pop-up dialog box is displayed asking for confirmation of the deletion.
12. Trackball to **OK** and press **SET** on the control panel.
The image is deleted.

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 and select the image to delete in the clipboard.
4. Press the **Update/Menu** button.
5. Select **Delete clipboard cell** from the *Update menu*.
A pop-up dialog box is displayed asking for confirmation of the deletion.
6. Trackball to **OK** and press **SET** on the control panel.
The image is deleted.

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 8-12, page 169).
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.

Move Exam To New Patient More

Last Name Patient ID

First Name Birthdate (dd/mm/yyyy) Age

Category Cardiac Sex ☐ female ☐ male

Echolab Born between - Today

Diagn. code Exam between - Today

☐ Images ☐ Stress ☐ No Report ☐ Category Diagn. Phys

Patient List 16 records fetched of total 16 (☐ Show All)

Last Name	First Name	Patient ID	Birthdate	Exam Date	Img	Str	Rep	Size	Code
+ Images	Demo	020202	02/01/1902						
+ Images	Some	370							

Dataflow Local Archive - Int. HD Operator ADM

Figure 8-19: The Move exam window

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 (see Figure 8-20).



CAUTION

Make sure that the patient record selected is correct.

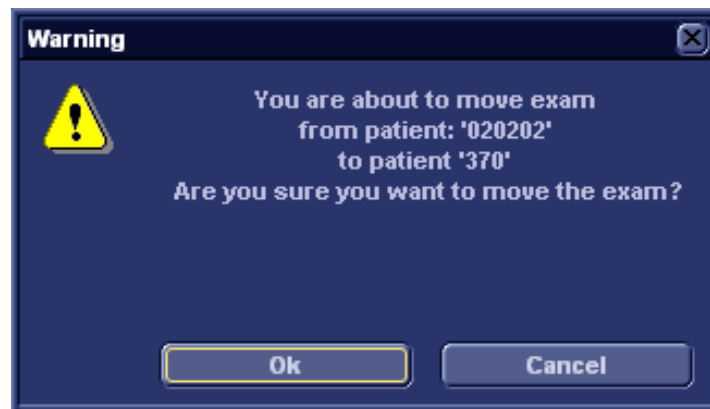


Figure 8-20: Moving examination prompt

7. Trackball to **OK** and press SET.
An information window is displayed to confirm the operation.
8. Press **OK**.

Review images in archive

There are two ways to access to archived images:

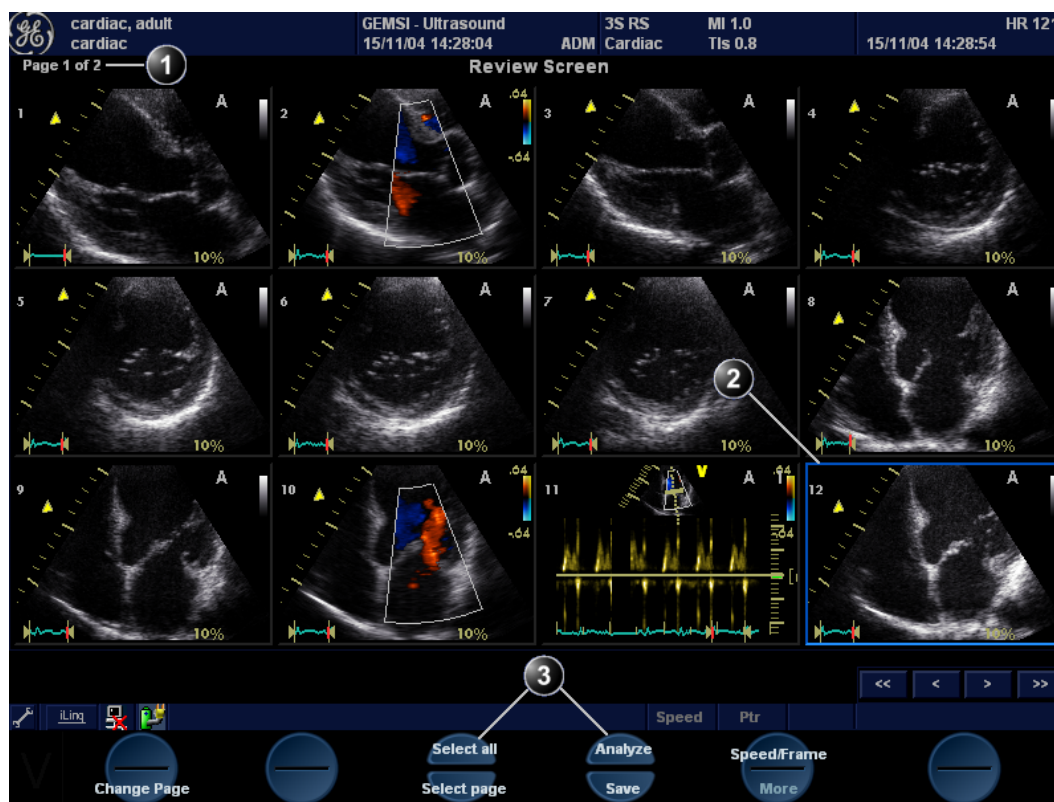
- Review the images from a selected examination.
- Select images from the *Image list screen* displaying all the images sorted by examination sessions for the actual patient.

Review the images from a selected examination

1. In the *Examination list window* (see Figure 8-14, page 172), trackball to the actual examination.
2. Press SET on the control panel to highlight the examination.
3. Press REVIEW on the control panel.
The stored images for the selected examination are displayed in the *Review screen* (see Figure 8-21).

To analyze images:

1. Press SET on the images to analyze.
2. Press ANALYZE.



1. Page number
2. Selected image (bold frame)
3. Selection tools

Figure 8-21: 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 8-14, page 172),

press **Image list**.

The *Image list screen* is displayed (see Figure 8-24) 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. Press **SET** on the images to review or press **ANALYSE** 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.

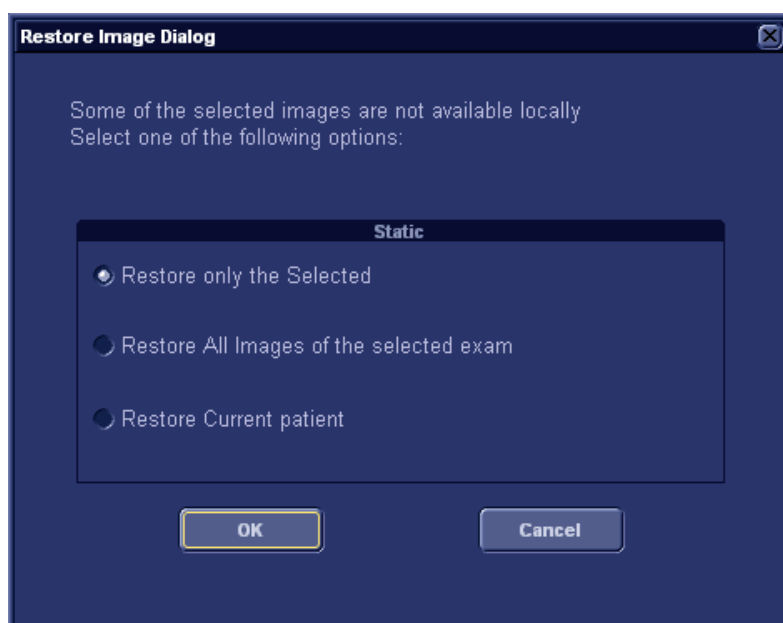


Figure 8-22: The Restore images window

3. Select between:
 - **Restore only the selected images:** only selected images that are not available locally are restored.
 - **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**.

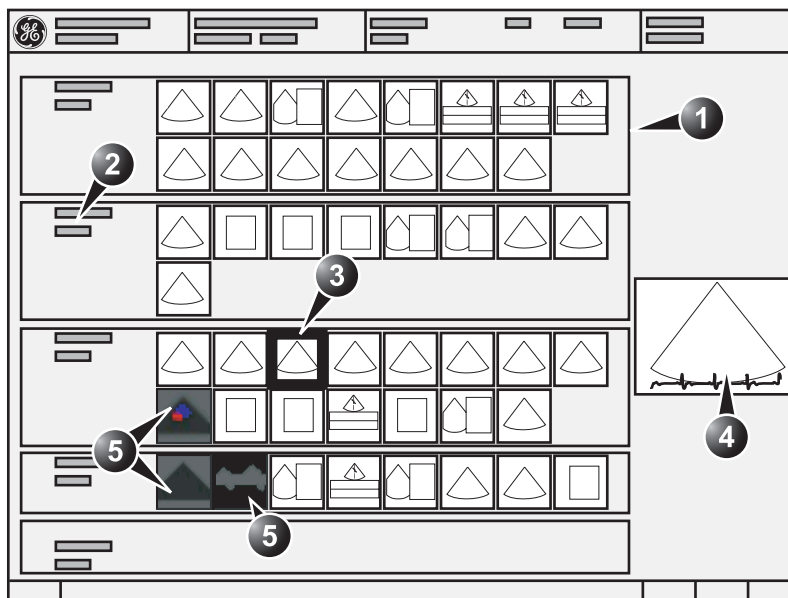
The *Insert media window* is displayed.



Figure 8-23: 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 media required 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.

The selected images are displayed for review.



1. Examination
2. Examination date and archive location
3. Selected image
4. Preview of selected image
5. Missing images

Figure 8-24: The Image list screen

Connectivity

This section describes the communication and connection options for the Vivid *i* ultrasound unit with other devices in the hospital information system. This section covers the procedures for configuration and optimal data management from a Vivid *i* in the following scenarios:

- A stand-alone Vivid *i* (page 189).
- A Vivid *i* and one or several EchoPAC PC workstations in a sneaker net environment (page 190).
- A Vivid *i* and an EchoPAC PC workstations in a direct connect environment (page 192).
- A Vivid *i* and a DICOM server in a network (page 198).
- A Vivid *i* and one or more PC stations in MPEGvue or eVue environment.

The dataflow concept

Communication between the Vivid *i* 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 *i* 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

Refer to "Dataflow" on page 310 for a complete list and description of supported dataflows.

Stand-alone scanner

The figure below illustrates two different dataflows for a stand-alone scanner.

A: LocalArchive-Int.HD dataflow:

The local database is used for patient archiving. Images are stored to internal harddrive.

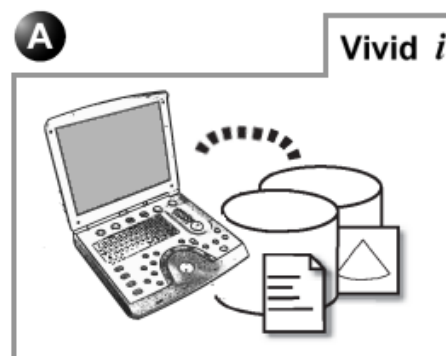


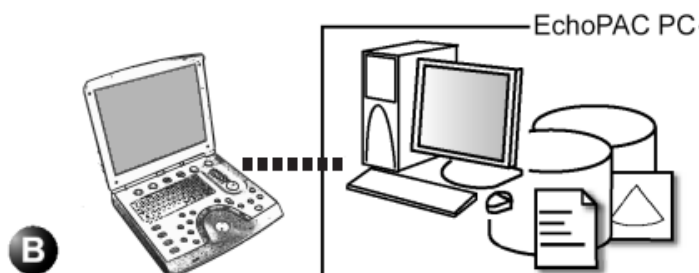
Figure 8-25: Stand-alone scanner dataflows

Scanner in a network

The figure below illustrates two different dataflows for a scanner connected to a network.

B: RemoteArch-Remote HD dataflow:

A remote database (here EchoPAC PC) is used for patient archiving. Images are stored to a remote archive (here EchoPAC PC).

**C: Worklist/LocalArchive-DICOM Server/Int.HD dataflow:**

Search in the DICOM Modality Worklist, the patient found is copied into the local database. Images are stored to a DICOM server and to the internal hard drive.

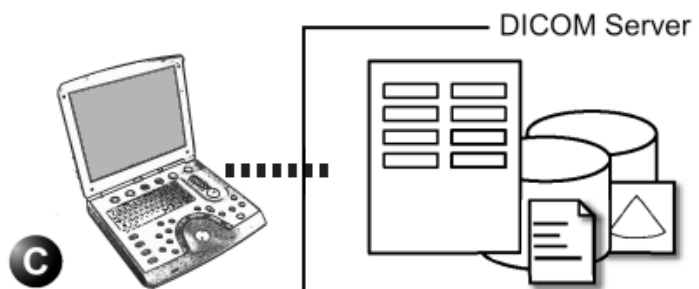


Figure 8-26: Scanner in a network dataflows (example)

Dataflow selection

Select a dataflow from the *Search/Create Patient window* (see "Creating a new Patient record or starting an examination from an existing patient record" on page 42) or configure the system with a **default** dataflow from the Configuration management package as described below.

Default dataflow selection

1. Press **CONFIG** and log on as administrator if required.
2. Select the **Connectivity** category and **Dataflow** subgroup. The *Dataflow sheet* is displayed (see Figure 8-27).
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 **Connectivity** category
2. Select **Dataflow** subgroup
3. Select a dataflow
4. Default option for the selected dataflow

Figure 8-27: Default dataflow setting

Stand-alone scanner scenario

In this scenario images will most likely be reviewed from images stored in the internal archive. If digital images are stored, they should be stored on the scanner's internal harddrive.

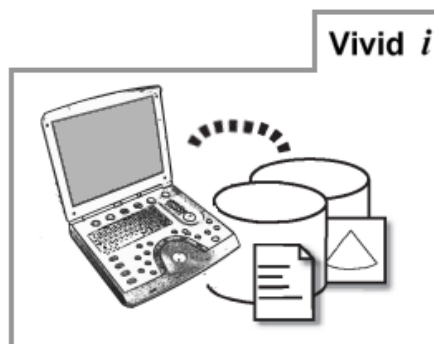


Figure 8-28: Stand-alone scanner with LocalArchive-Int.HD dataflow

Data management

Data acquisition

1. Select the **LocalArchive-Int.HD** dataflow as default dataflow.
In this configuration the local database is used for patient archiving. Images are stored to internal harddrive.

Image review

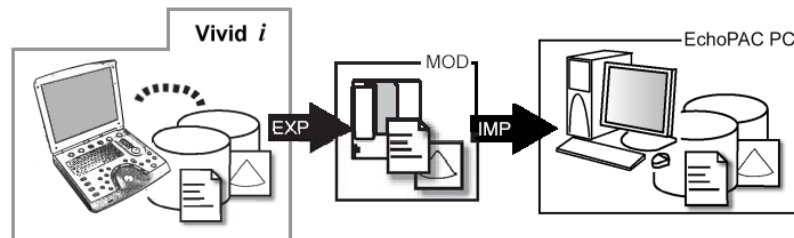
The same dataflow is used for review on the system.

A stand-alone scanner and a stand-alone EchoPAC PC environment

In this scenario the EchoPAC PC (one or several) is used for review of studies acquired on one or more Vivid *i* without being connected via a private or a local area network.

Images can be stored on the scanner's internal harddrive (recommended) or on a dedicated MOD.

Images stored on the internal harddrive



Vivid *i*: dataflow LocalArchive-Int.HD

EXP: export from LocalArchive-Int.HD to Removable MOD Archive

IMP: import from Removable MOD Archive to LocalArchive-Int.HD

EchoPAC PC: dataflow LocalArchive-Int.HD

Figure 8-29: A stand alone scanner and a stand alone EchoPAC PC environment with images stored on the scanner's harddrive

In this configuration images are first stored on the scanner's harddrive and then exported from the scanner's harddrive to a MOD and finally imported from the MOD to the EchoPAC PC's internal harddrive.

Data management

Scanner's dataflow configuration

1. Select the **LocalArchive-Int.HD** dataflow as default dataflow.
The local database is used for patient archiving. Images are stored to internal harddrive.

Export from Vivid *i*

1. Export the data (images, demographics, measurements and report) for the patient(s) to be reviewed on a blank

dedicated formatted MOD as described in "Export/Import patient records/examinations" on page 209.

Export from **LocalArchive-Int.HD** to **Removable MOD Archive**.

Make sure that the option **Copy images** is checked.

Import on EchoPAC PC

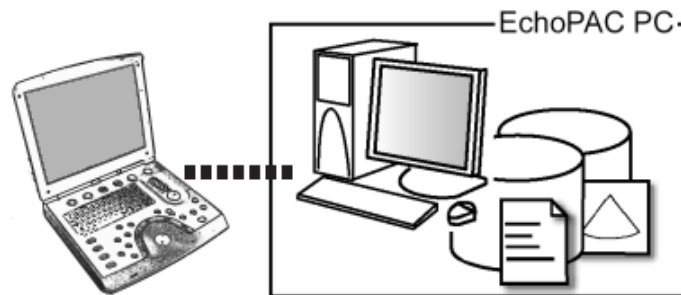
1. Select the **LocalArchive-Int.HD** dataflow on the EchoPAC PC (can be configured as default dataflow).
2. Import the data from the Export/import MOD to EchoPAC PC internal harddrive using the Import function as described in the workstation user manual.
Import from **Removable MOD Archive** to **LocalArchive-Int.HD**
Make sure that the option **Copy images** is checked.
3. Press **Archive** and select the patient to be reviewed.

The MOD dedicated to Export/Import can be reformatted and reused.

A scanner and EchoPAC PC in a direct connect environment

In this scenario the data is transferred from the Vivid *i* 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.



Vivid *i*: dataflow RemoteArch-RemoteHD

EchoPAC PC: dataflow LocalArchive-Int.HD

Figure 8-30: A scanner and EchoPAC PC in a direct connect environment (peer to peer or network)

The acquisition can be done online or offline. Both situations are described below.

Scanner's connectivity configuration

If working in a peer-to-peer connection with a crossover cable between a Vivid *i* and an EchoPac PC, the default delivery TCP/IP settings should be used.

If working in a network, follow the procedure described below to configure the scanner.

Scanner's TCP/IP settings

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 in the network administrator.

1. Press **CONFIG** and log on as administrator.
2. Select the **Connectivity** category and **TCP/IP** subgroup. The *TCPIP* subgroup is displayed.

1. Computer name: device's name of type VIVID7-00nnnn or ECHOPAC7-00nnnn, where "nnnn" is the system's serial number. Do not change the computer name.
2. IP settings: system IP settings
3. Remote archive setup: remote archive IP address and name (EchoPAC PC or EchoServer)
4. Save TCP/IP settings. The changes will be effective after the system is rebooted.

Figure 8-31: TCP/IP setting

3. In the *IP settings* area enter:
 - The IP address for the scanner
 - The subnet mask for the scanner
 - 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.

Direct connect with online acquisition

Data management

Scanner's dataflow configuration

1. Select the **RemoteArch-RemoteHD** dataflow as default dataflow.

When saving the study on the scanner, the images are transferred from the scanner's image buffer to the harddrive of the EchoPAC PC. Patient demographics, measurements and reports are transferred on the fly when entering the information on the Vivid *i*.

Review on the EchoPAC PC workstation

1. Select the **LocalArchive-Int.HD** dataflow on the EchoPAC PC (can be configured as default dataflow).

Do NOT open a study on the EchoPAC PC workstation before the study is closed on the scanner.



CAUTION

2. Press **Archive** and select the patient to be reviewed.

Direct connect with offline acquisition

Data management

Scanner's dataflow configuration for offline acquisition

1. When offline, select the **LocalArchive-IntHD** dataflow. The local database is used for patient archiving. Images are stored to internal harddrive.

Export examinations done offline from the scanner to EchoPAC PC

1. When reconnected, export the data (images, demographics, measurements and report) for the examination(s) done offline to EchoPAC PC as describes in "Export/Import patient records/examinations" on page 209.

Export from **LocalArchive-Int.HD** to

RemoteArch-RemoteHD.

Make sure that the option **Copy images** is checked.

The examination done offline can now be reviewed on the workstation.

*Press **Today** to display today's exams to ease the search.*

A scanner and EchoPAC PC in a network environment

In this scenario the Vivid *i* is configured to work with an ImageVault 3 or an EchoServer 7 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.

The acquisition can be done online or offline. Both situations are described below.

Network environment with online acquisition

Data management

Scanner's dataflow configuration

1. Select the **RemoteArch-RemoteHD** dataflow as default dataflow in the sublevel *Dataflow* in the subgroup *Connectivity* of the Configuration management package (see page 310 and following pages).
When saving the study on the scanner, the images are transferred from the scanner's image buffer to the server. Patient demographics, measurements and reports are transferred on the fly when entering the information on the Vivid *i*.

Review on the EchoPAC PC workstation

1. Select the **RemoteArch-RemoteHD** dataflow on the EchoPAC PC (can be configured as default dataflow).

Do NOT open a study on the EchoPAC PC workstation before the study is closed on the scanner.



CAUTION

2. Press **Archive** and select the patient to be reviewed.

Network environment with offline acquisition

Data management

Scanner's dataflow configuration for offline acquisition

1. When offline, select the **LocalArchive-IntHD** dataflow. The local database is used for patient archiving. Images are stored to internal harddrive.

Export examinations done offline from the scanner to the server

1. When reconnected, export the data (images, demographics, measurements and report) for the examination(s) done offline to the server as described in "Export/Import patient records/examinations" on page 209.

Export from **LocalArchive-Int.HD** to

RemoteArch-RemoteHD.

Make sure that the option **Copy images** is checked. To free space in the internal harddrive on the scanner, check the command **Delete selected patient(s) after copy** in the *Export patient window* (see Figure 8-41, page 211).

The examination done offline can now be reviewed on the workstation.

*Press **Today** to display today's exams to ease the search.*

A scanner and a DICOM server in a network

In this scenario the Vivid *i* is configured to work with a DICOM server in a network environment. Images are first saved on the local image buffer on the scanner. At the end of the examination the images are sent to the DICOM server via a DICOM spooler.

The DICOM server dataflow supported are:

- **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.

This scenario requires that the scanner is configured to be connected to the DICOM server as described below.

Scanner's connectivity configuration

The scanner's TCP/IP settings must be configured as described in "Scanner's TCP/IP settings" on page 193.

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 in the network administrator.

Setup of the DICOM server in the scanner's configuration management package

DICOM dataflow selection

1. Press **CONFIG** 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 in the *Name pull-down menu* (see Figure 8-32).

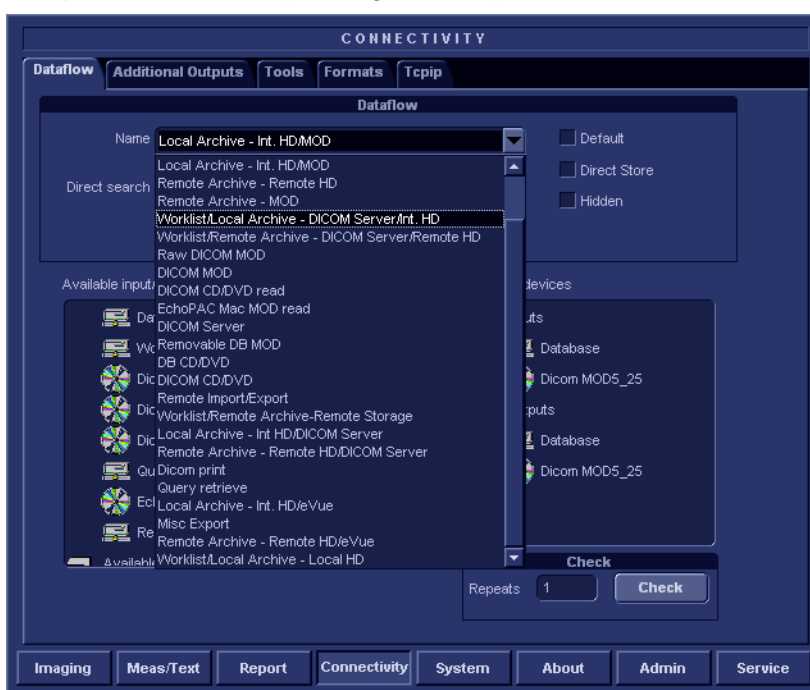


Figure 8-32: The Dataflow sheet

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 8-33).




1. Select the DICOM device.
2. Press Properties.

Figure 8-33: Display of the DICOM device Properties window

The *Properties* window for the selected DICOM device is displayed (Figure 8-34).

Worklist properties

IP-address (DICOMSERVER) 10.0.0.4  Verification

Name Worklist1

AE Title MERGE_WORK_SCP

Port No 107

Max. Result 500

Search Criteria

Retry

Max # 0

Interval 1 [S]

Timeout 30

OK Cancel

Figure 8-34: 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.
 - Enter the name and/or IP address of the server and press **OK** to return to the *Properties window*.

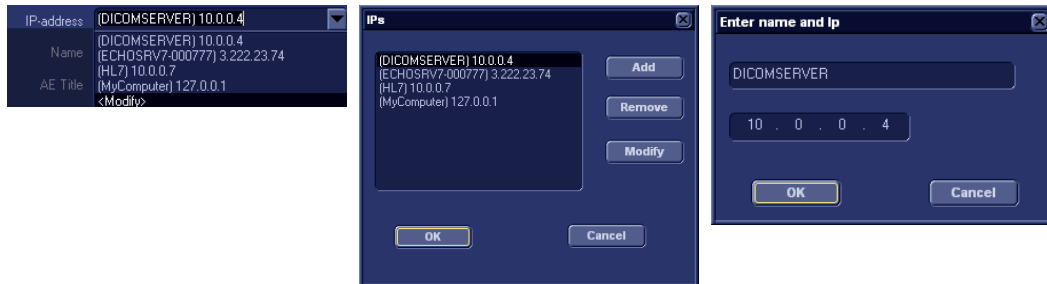


Figure 8-35: Modifying/Creating the IP address

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.

When configuring the DICOM storage device, the following image settings should be entered in the *Properties window*:

- 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**.

DICOM SR

DICOM Structured Reporting (SR) is a standardized format for medical results. Vivid *i* and EchoPAC PC support the specialized form for Adult Echo Ultrasound ("Supplement 72") 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.

"Supplement 72" does not support all M&A results from Vivid *i* and EchoPAC PC. "Supplement 72" limits the information that is possible to send to the following:

- Publicly coded parameters, no pediatric or fetal cardiac or unassigned measurement. Refer to the Vivid *i* Reference manual for a complete list of supported parameters.
- Basic modes: 2D, M-mode, Color Flow, PW and CW Doppler.
- Publicly coded methods, not Modified Simpson or Bullet. Refer to the Vivid *i* Reference manual for a complete list of supported methods.
- Basic derivations (Average, Last), 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).

Activating DICOM SR

DICOM SR must be activated for each DICOM device.

1. Press **CONFIG** 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 in the *Name* pull-down menu (see Figure 8-32).
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.

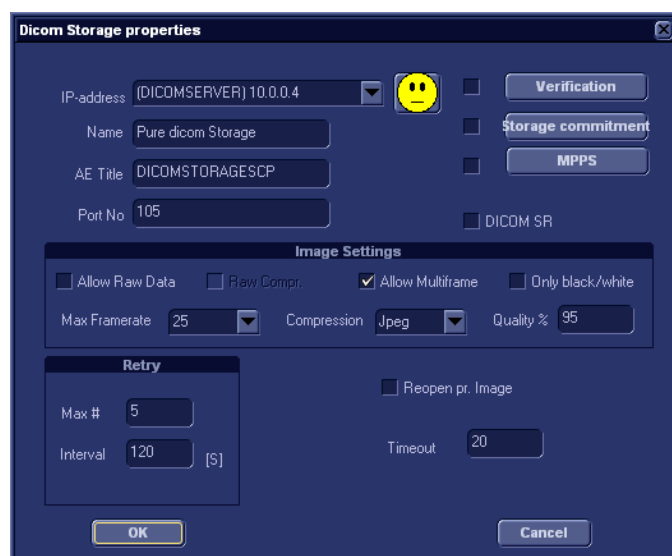


Figure 8-36: DICOM storage properties window

5. Check the option **DICOM SR**.
6. Select **OK**.
7. Press CONFIG.

Storing as DICOM SR

When ending an exam the measurements are sent together with the images to the DICOM storage device selected.

To end an exam and store the measurements as DICOM SR:

1. Press PATIENT and select **End Exam**.
The *DICOM SR Information* window is displayed informing the user that not all measurements may be sent as DICOM SR.

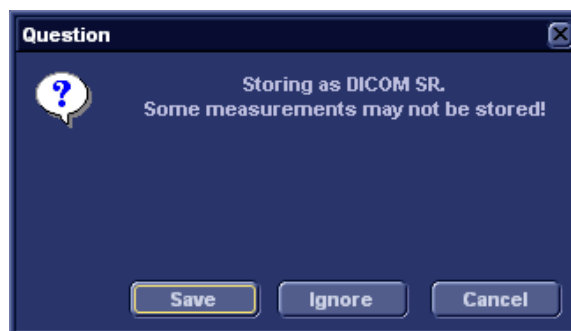


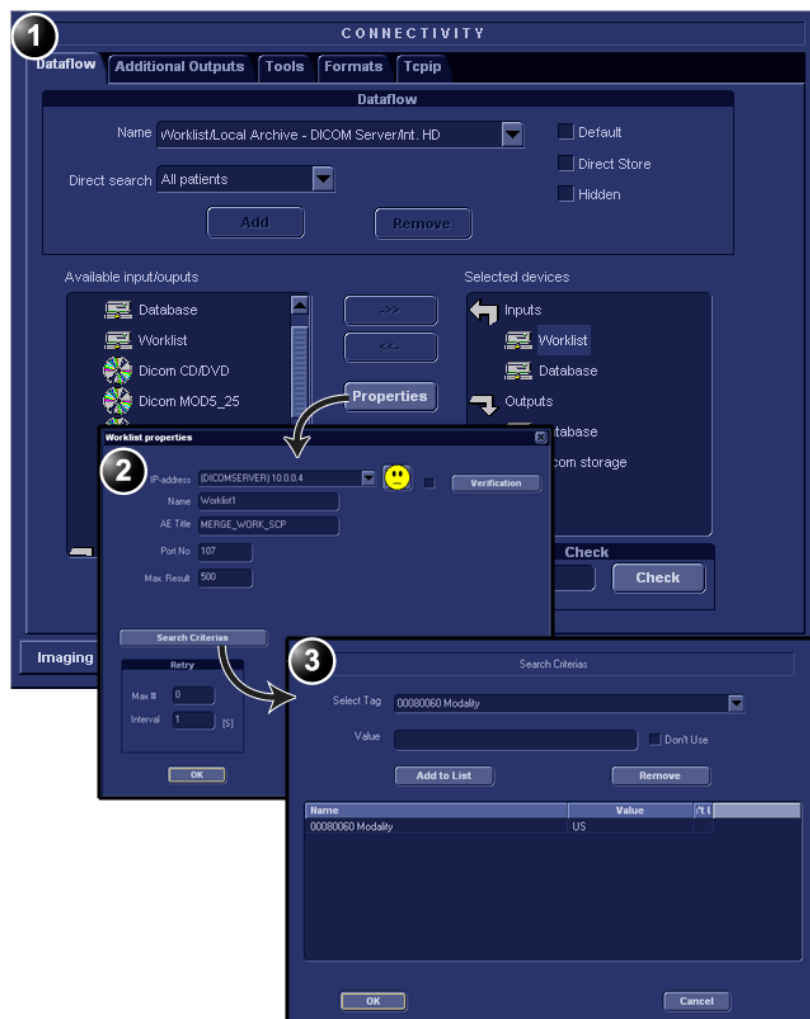
Figure 8-37: The DICOM SR information window

2. Select one of the following:
 - **Save:** the supported measurements are stored as DICOM SR.
 - **Ignore:** no measurements are saved as DICOM SR.
 - **Cancel:** cancels the end exam process.

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 **CONFIG** and log on as administrator.
2. Select the **Connectivity** category and **Dataflow** subgroup. The *Dataflow sheet* is displayed (see Figure 8-38).
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.
6. Select a Search criteria from the *Select tag pull-down menu*.
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.



1. The dataflow sheet
2. The Properties window for the Worklist device.
3. The Search criteria window

Figure 8-38: Adjusting the Search criteria

Checking the connection to the DICOM server

1. In the Dataflow sheet, select the DICOM device to verify the connection to.
2. Press **Check**.
The verification process may takes several seconds.

- A green check mark is displayed in front of the DICOM device if the verification is successful.
- A red cross is displayed in front of the DICOM device if the verification failed.

Data management

Scanner's dataflow configuration

1. Press **CONFIG** and log on as administrator.
2. Select the **Connectivity** category and **Dataflow** subgroup. The *Dataflow sheet* is displayed.
3. Select a DICOM server dataflow.
4. Press **CONFIG** to exit. Press **OK** in all messages appearing under exit.
5. Reboot the scanner.

Performing a study

Online scanner

1. Create a new patient and perform the examination in a usual manner.
During the examination images are temporarily stored in the local buffer on the system.
2. At the end of the study press **END EXAM** on the Control panel.
The save images dialogue window is displayed.

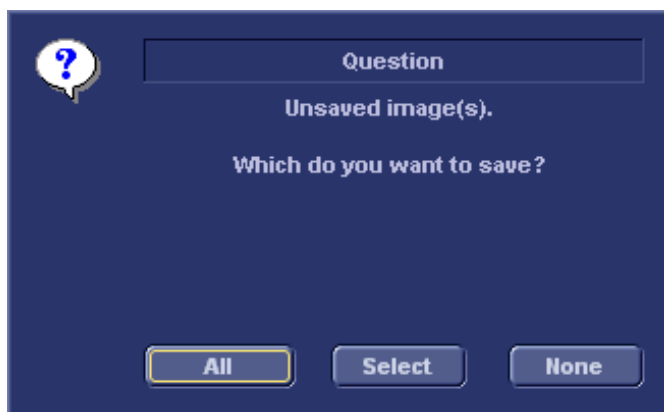


Figure 8-39: The Save images dialogue window

3. Press **All** to save all images on the DICOM server or press **Select** to display the *Image review screen* where to select specific images to be saved.
The images are transferred to the server via the DICOM spooler.
4. Press **ALT+S** to display the DICOM spooler (see "DICOM spooler" on page 232 for further details).

Offline scanner

When working offline the images are stored in the DICOM spooler. Images can be sent to the DICOM server when re-connecting the system to the network.

To save images acquired offline on the DICOM server:

1. With the scanner connected, press **ALT+S** to display the DICOM spooler.
2. Select one or several studies in the *DICOM spooler window*.
3. Press **Resend**.
The images of the selected studies are transferred to the DICOM server.

Export/Import patient records/examinations

Patient records/examinations from the local archive on one system (Vivid *i* or EchoPAC PC) 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 (Echo server, DICOM server or EchoPAC PC depending on the environment). In addition patient records/examinations from a remote archive (Echo server or EchoPAC PC depending on the environment) can be exported to a removable media or to a DICOM server. Database information (patient and report archives) can be exported with or without images. No data is deleted from the source archive when exporting data unless the command **Delete selected patient(s) after copy** is checked in the Export patient window (see Figure 8-41, page 211).

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. Database information can be imported with or without images. 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 (Echo server).



CAUTION

If an examination is opened, it must be closed before performing Export/Import of patient records/examinations to guarantee that all data is included in the transfer.

Exporting patient records/examinations

1. Insert a blank formatted (see page 320) removable media in the drive.
2. Press **PATIENT** on the Front panel, then select **Patient List**. The *Search/Create Patient window* is displayed (Figure 8-12, page 169).
3. Select the source archive in the *Dataflow field*:
 - **LocalArchive-Int.HD**: exports data from the local archive.
 - **RemoteArch-RemoteHD**: exports data from an Echo server.
4. Press **Export** in the *Search/Create Patient window*.

The *Export dialogue window* is displayed.

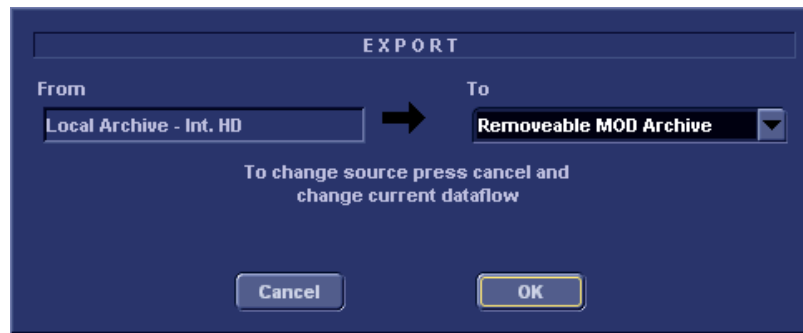


Figure 8-40: The Export Dialogue window

5. Select one of the following destinations from the *Destination drop-down menu*:
 - **Removable MOD Archive**: exports raw and DICOM (if present) data to a removable MOD.
 - **Pure DICOM MOD525**: export DICOM data only to a removable MOD.
 - **Removable CD Archive**: exports raw and DICOM (if present) data to a CD-R.
 - **Pure DICOM CD-R**: export DICOM data only to a CD-R.
 - **Remote Import/Export Archive**: exports raw and DICOM (if present) data to an Echo server (network) or EchoPAC PC (direct connect or network).
 - **Pure DICOM Storage**: exports DICOM data only to a DICOM server.
 - **Excel file**: exports data to a spreadsheet. The excel file is stored in the location defined in the *Sublevel Tools* in the Configuration package (see page 214).
 - **HL7**: exports examination results to the “Vivid HL7 Gateway”, which “feeds” the results to HIS through HL7 protocol. M&A and diagnosis-codes are stored as an Excel file, reports are stored as CHM-files.

The file path to the shared volume on “Vivid HL7 Gateway” must be pre-configured in the *Sublevel Tools* in the Configuration package (see page 215).
 - **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, and saved reports as CHM-files. The export destination must be configured (see page 213).

6. Press **OK**.

The *Export patient window* is displayed (see Figure 8-41).

Figure 8-41: The Export patient window

7. Search and Select the patient records/examinations to export in the *Patient list*.

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 *Export patient window* to export all patient records.
- Press **Today** to display today's examinations and select the actual examinations.
- Fill in the *Exam between field* to display the patient records done during a specific time period and select the actual records.

*Press **More** to display the extended **Export patient window** if necessary.*

- 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**
 - **Copy only exams with on-line images:** when checked only selected examinations with accessible images will be copied.
 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 8-42). 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 8-42: 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.

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** in the *Export patient window* to complete the process.

Do not eject the CD using the button on the CD drive.

12. Press **ALT+E** to eject the disk.
The *Eject device menu* is displayed.



Figure 8-43: The Eject device menu

13. Select the relevant media.
The selected removable media is ejected.

Export Configuration

The destination for Export of patient records to Excel, HL7 and MPEG must be configured prior to use. This is done from the *Dataflow sheet* in the Configuration package. To display the *Dataflow sheet*:

1. Press **CONFIG** and log on as administrator.
2. Select **Connectivity** category and **Dataflow** subgroup.
The *Dataflow sheet* is displayed (Figure 8-3, page 161).
3. Select the dataflow **Misc Export** in the *Name* pull-down menu.

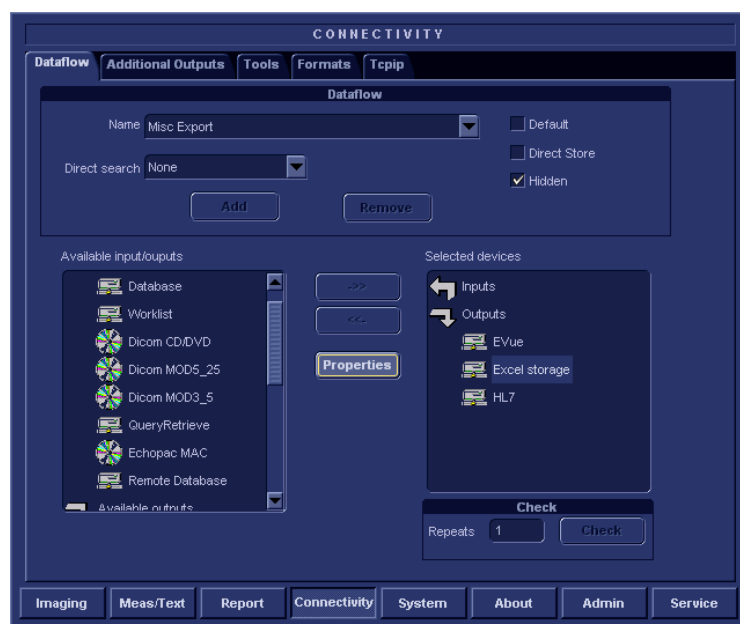


Figure 8-44: The Dataflow Sheet

Configuring an Excel Export

1. Select the **Excel storage** device in the *Selected devices* pane and press **Properties**.

The *Excel properties* window is displayed.

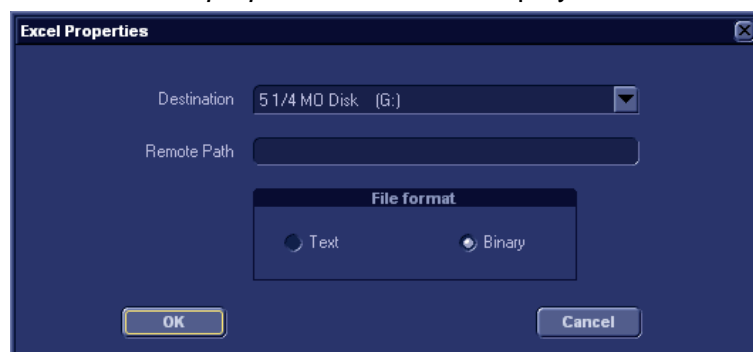


Figure 8-45: The Excel properties window

*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.*

2. Select a removable media or a network volume remote path as the destination in the *Destination* pull-down menu.
3. Select **OK** and press **CONFIG**.

Configuring an HL7 Export

1. Select the **HL7** device in the *Selected devices* pane and press **Properties**.
The *HL7 properties* window is displayed.

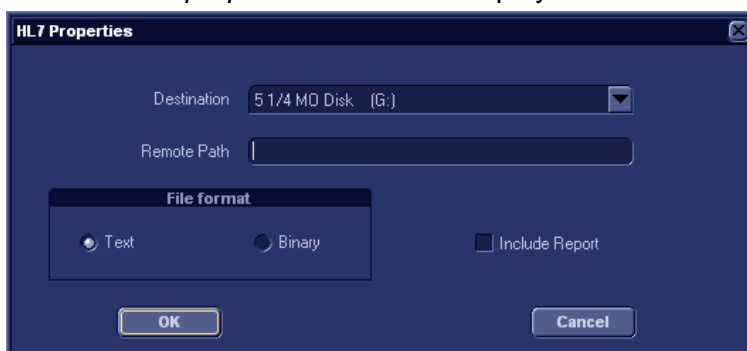


Figure 8-46: The HL7 properties window

2. When configuring this feature for the first time, the path for the HL7 export destination must be entered in the *Remote path* field (format: \\server-name\share-name).
3. Select **OK** and press **CONFIG**.

Configuring an MPEGVue Export

1. Select the **eVue** device in the *Selected devices* pane and press **Properties**.
The *eVue properties* window is displayed (Figure 8-4, page 162).
2. Select a removable media or a network volume remote path as the destination in the *Destination* pull-down menu.
3. Check the options as required.
4. Select **OK** and press **CONFIG**.

*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.*

Importing patient records/examinations

1. Insert the removable media of the source archive in the corresponding drive (MO drive or CD-ROM).
2. Press **PATIENT** on the Front panel, then select **Patient List**. The *Search/Create Patient window* is displayed (Figure 8-12, page 169).
3. Select destination archive in the *Dataflow field*:
 - **LocalArchive-Int.HD**: imports data to the local archive.
 - **RemoteArch-RemoteHD**: imports data to an Echo server (network) or an EchoPAC PC (direct connect).
4. Press **Import** in the *Search/Create Patient window*. The *Import dialogue window* is displayed (see Figure 8-47).

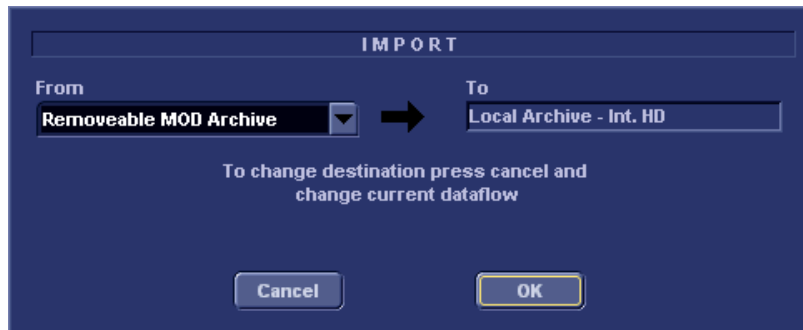


Figure 8-47: The Import Dialogue window

5. Select one of the following source archive from the *Source drop-down menu*:
 - **Removable MOD Archive**: imports raw and DICOM data (if present) from a MOD.
 - **Pure DICOM MOD525**: imports DICOM data only from a MOD.
 - **Removable CD Archive**: imports raw and DICOM data (if present) from a CD-R.
 - **Pure DICOM CD-R**: imports DICOM data only from a CD-R.
 - **Remote Import/Export Archive**: imports raw and DICOM (if present) data from an Echo server (network) or EchoPAC PC (direct connect or network).
 - **Query Retrieve**: imports data from a DICOM server.
6. Press **OK**.

The *Import patient window* is displayed (see Figure 8-48).

Figure 8-48: The Import patient window

7. Search and select the patient records to import in the *Patient list*.

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.
- 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. Adjust the following settings as desired:

Press **More** to display the extended *Import patient window* if necessary.

- **Copy images**
 - **Copy only exams with on-line images:** when checked only selected examinations with accessible images will be copied.
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 8-42). 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 8-49: The Export/Import conflict window

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.

10. 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.

11. Press **Done** in the *Import patient window* to complete the process.

Disk Management

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 reports from the oldest patient records (configurable). The Disk management function has also an auto-purge feature that automatically deletes images and reports that have already been copied if the local hard disk is approaching its capacity limit.

When moving or copying files a copy of the patient archive is also created on the media.

Three different disk management scenarios are possible depending on the system configuration:

- **Moving 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.
- **Copying 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.
- **Deleting Files:** the user runs the Disk management function on a regular basis to delete images and reports from older patient records.

*When using this setting, the images location displayed in the **Examination list** screen is 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 is 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 are retrieved.*

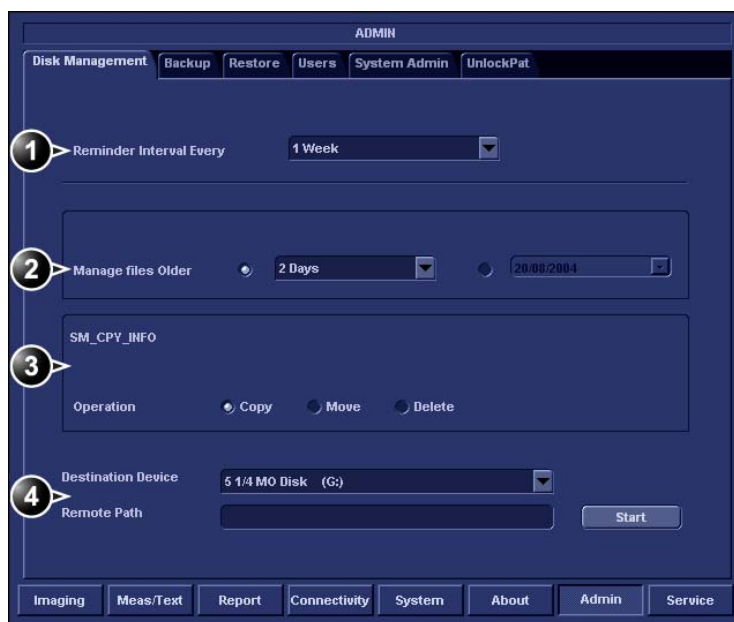
Ensure that you have established a data management protocol for your office/institution. The user **MUST** manage the removable media used when running Disk management by keeping a log and by creating a media filing system.

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 time span.

Configuring the Disk management function

Configuration of the Disk management system can only be done by user with administration rights.

1. Press **CONFIG**.
If required, log on as administrator.
2. Select the **Admin** category.
3. In the *Admin category*, select the sheet **Data 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

Figure 8-50: The Disk management sheet

Disk management schedule settings

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 is displayed.

Disk 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 are copied or moved. If **None** is selected, all files are copied or moved.
2. Next to **Operation**, select one of the following options:
 - **Copy**: the images and reports from the examinations older than the specified setting defined in step 1 are copied to the specified destination. After using this setting, the files exist in two locations, the local hard drive and the media used to copy to.
 - **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. After using this setting, the files exist in one location, the media used to move the files to. They are removed from the local hard drive.
 - **Delete**: the images and reports from the examinations older than the specified setting defined in step 1 are deleted from the hard drive.

Check **Keep dates together** to prevent the system from saving examinations with same date on different removable media.

Destination device settings

1. Next to **Destination device**, select a removable media or a network shared folder.

*To be able to select a network shared folder in the **Destination device** field, its path must have been entered once in the field next to **Remote path**.*



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 221), or if the local hard drive is about to reach its capacity limit.

Disk management manual start

1. Press **PATIENT** on the control panel, then select **Patient list**. The *Search/Create patient* window is displayed.
2. In the *Search/Create patient* window press **More** to display additional menu options and select **Disk management**. The *Disk management welcome* screen is displayed (Figure 8-51). The Disk management operation either copies, removes or deletes files from the local archives depending on the Disk management configuration (see page 221). Make sure that the correct configuration is set.

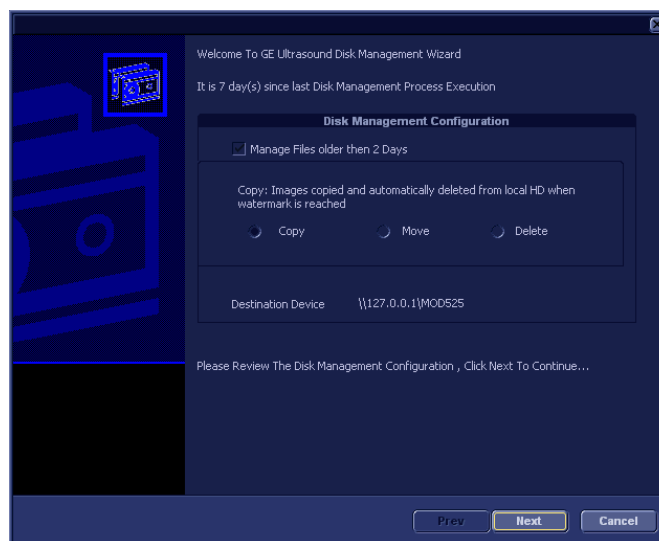


Figure 8-51: The Disk management welcome screen

3. Press **Next**. The *Storage size information* window is displayed (Figure 8-52). Verify the information displayed. If using removable media, the operation may require several media as specified on the screen. Make sure to gather the necessary number of disks.

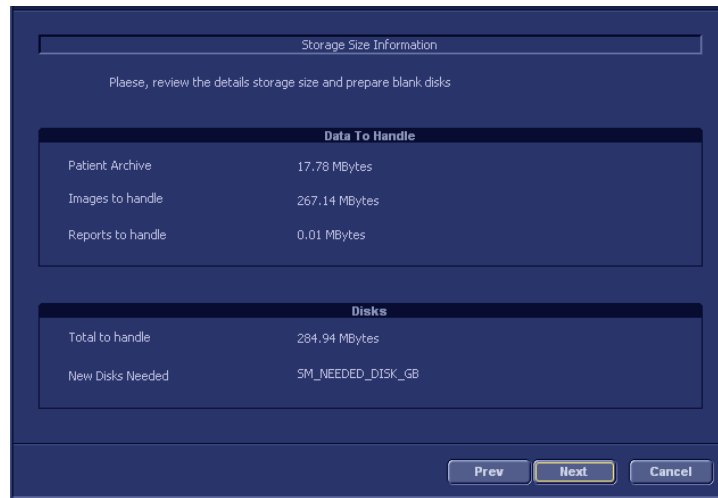


Figure 8-52: The Storage size information window

The media does not need to be formatted.

4. Insert a removable media into the specified drive.
5. Press **Next**.
The *Copying files* window is displayed (Figure 8-53).

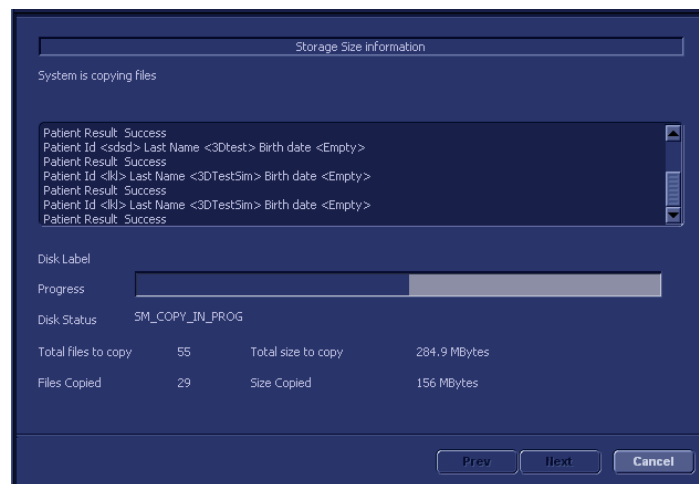


Figure 8-53: The copying files window

The system automatically formats and labels new disks. If the media contains backup or export data, a Warning window is displayed.

6. Select one of the following options:
 - **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:** (Export disk only) the export data on the disk is deleted and the Disk management process is resumed. This choice is not available if the disk contains backup data.

The information displayed on the *Copying files* window is updated while the files are being copied.

7. 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.
8. Press **Next** to continue. The *Summary* window is displayed (Figure 8-54), showing a list of the disks used.

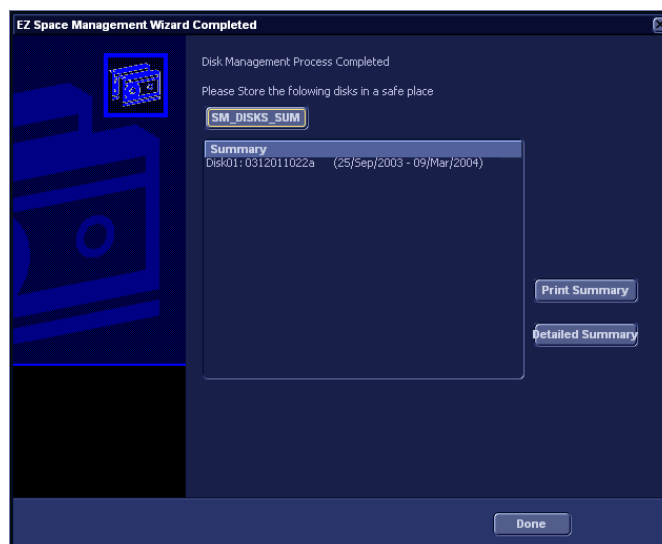


Figure 8-54: The summary window

- Select **Print summary** to print the list for archiving purpose.
 - Select **Detailed summary** to display the list of the patient records copied.
9. Make sure that all media are physically labeled 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.

10. 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 hard drive at least **once a week**.



DANGER

GE Medical Systems 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 removable MOD or to a network shared folder using the Disk management procedure (see page 220).



CAUTION

DO NOT use the local hard drive for long-term image storage.

The backup of the patient archive on the hard drive and the system configuration is done from the configuration management package as described on page 227.

Data from Backup/Restore disks may be restored to the local hard drive using the Restore procedure as described on page 230.

Only users with administration rights (see page 331) have access to the backup/Restore function.

Backup procedure

1. Press **PATIENT** on the control panel, then select **Patient list**. The *Operator login* window is displayed.
2. Select the operator with administration rights, enter the password and press **Log on**. The *Search/Create patient* window is displayed.
3. In the *Search/Create patient*, select the dataflow **Local Archive - Int. HD** (Figure 8-55).



Figure 8-55: Dataflow selection for backup

4. Press **CONFIG**.
5. Select the category **Admin**.
6. Select the **Backup** sheet (Figure 8-56).

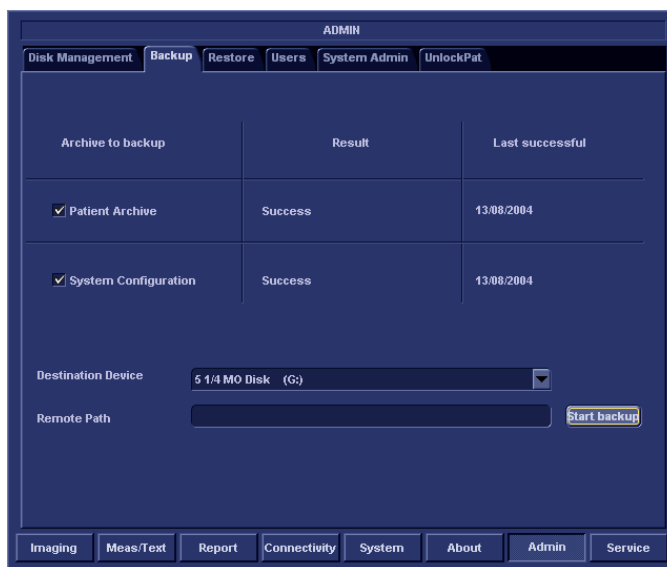


Figure 8-56: The Backup sheet

7. In the *Backup sheet*, select one of the following options:
 - **Patient archive:** to backup the patient records.
 - **System configuration:** to copy system settings and user presets.

*To be able to select a shared network folder, the path (of type: \\server-name\share-name) must be entered once in the **Remote Path** field.*

8. Select a removable media or a shared network folder as destination.
9. If the backup is done to a removable media, insert a dedicated media in the drive.
10. 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 (Figure 8-57) prompting the user to insert a media.



Figure 8-57: Insert media prompt

Insert the media and select **OK**.

- The system is checking if the media needs to be formatted. If yes, the media is automatically formatted. An *Information* window is displayed (Figure 8-58) showing the media label.



Figure 8-58: Media formatted with label

Write down the label and select **OK**.

- The system is checking if there is already a backup copy on the media. If yes, a dialogue window is displayed (Figure 8-59) asking the user if the backup should be replaced.

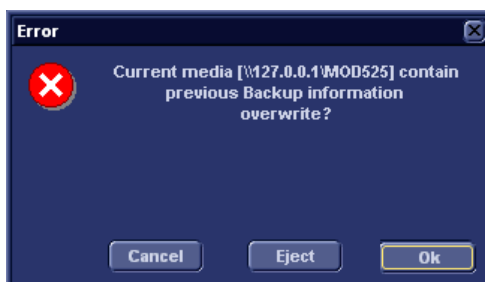


Figure 8-59: Replace backup prompt

When this prompt appears, select one of the following options:

- Select **OK** to replace the existing files and begin backup.
 - Select **Eject** to replace media and resume backup.
 - Select **Cancel** to abort backup.
11. During backup, *Progress* windows are displayed (Figure 8-60), showing the current operation being performed.

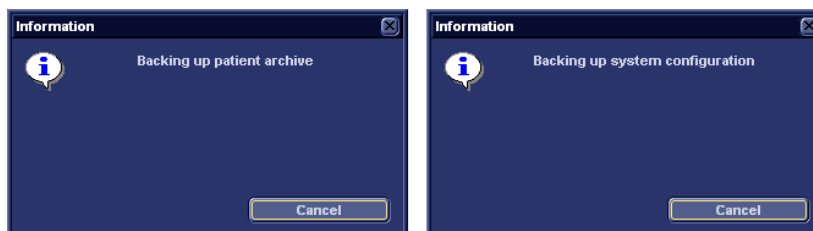


Figure 8-60: Backup progress windows

12. At the end of the process, the media is ejected and the *Backup completed* window (Figure 8-61) is displayed.

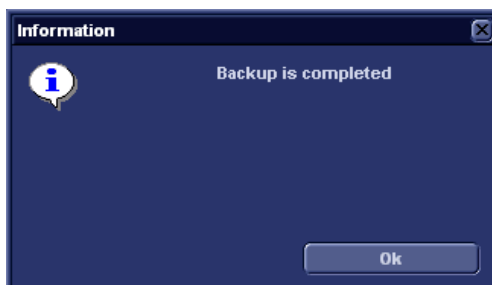


Figure 8-61: Backup completed window

Select **OK**.

The Backup result is displayed on the *Backup sheet* (Figure 8-62).

Archive to backup	Result
<input checked="" type="checkbox"/> Patient Archive	Completed
<input checked="" type="checkbox"/> System Configuration	Completed

Figure 8-62: Backup result

13. 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 **CONFIG**.
2. Select the category **Admin**.
3. Select the **Restore** sheet (Figure 8-63).

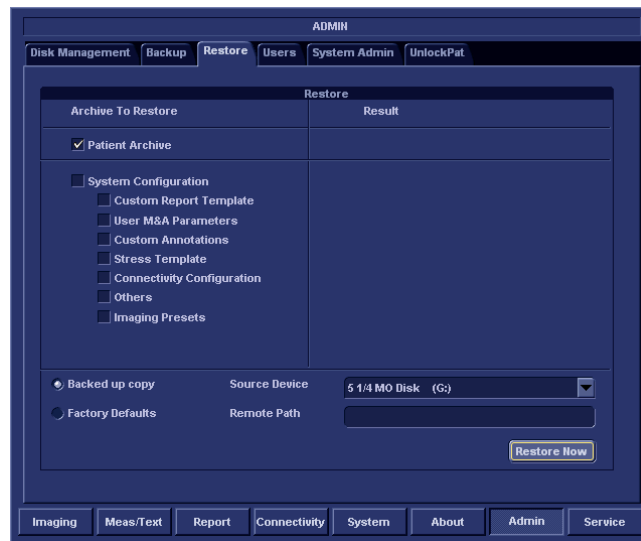


Figure 8-63: The Restore sheet

4. In the *Restore sheet*, select one of the following options:
 - **Patient archive:** to restore the patient records.
 - **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 8-63).
5. Make sure that **Backed up copy** is selected.
 6. Select the appropriate **Source device**.



CAUTION

The Restore procedure OVERWRITES the existing data on the local hard drive. Make sure to select the correct device.

7. If restore is done from a backup on a removable media, insert the media in the drive.
8. Select **Restore now**.
Depending on the selection, one or two *Restore confirmation* windows are displayed (Figure 8-64):

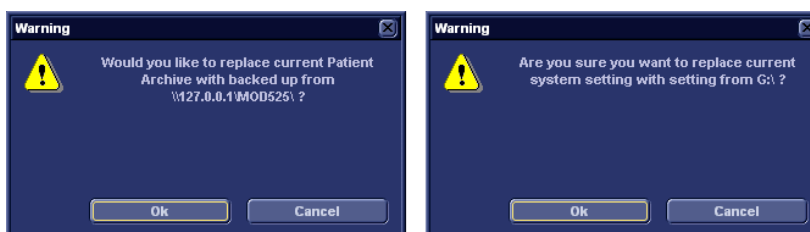


Figure 8-64: Restore confirmation windows

9. Ensure that the correct source is selected and select **OK**. The selected items are copied to the systems. If items from the system configuration are restored the system needs to be rebooted. The *Reboot system* window is displayed (Figure 8-65).

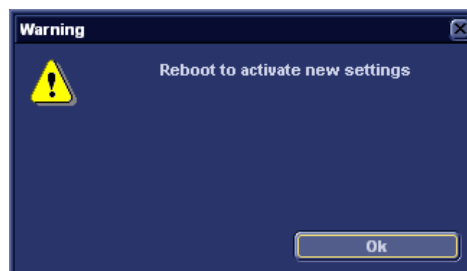


Figure 8-65: Reboot system prompt

10. Select **OK** to reboot the system.

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 windows* 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.

The job's status displayed in the *DICOM spooler window* can be:

- **Pending:** the job is complete, waiting to be active.
- **In hold:** the job is incomplete, waiting for more images.
- **Append:** the job is connected to the destination device but is 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 while.

Starting the DICOM spooler

1. On the alphanumeric keyboard, press and hold down the ALT key and press S.
The *DICOM spooler window* is displayed (see Figure 8-66).

The *DICOM spooler window* is automatically updated every minute. Press **Refresh** to update the information displayed at any time.

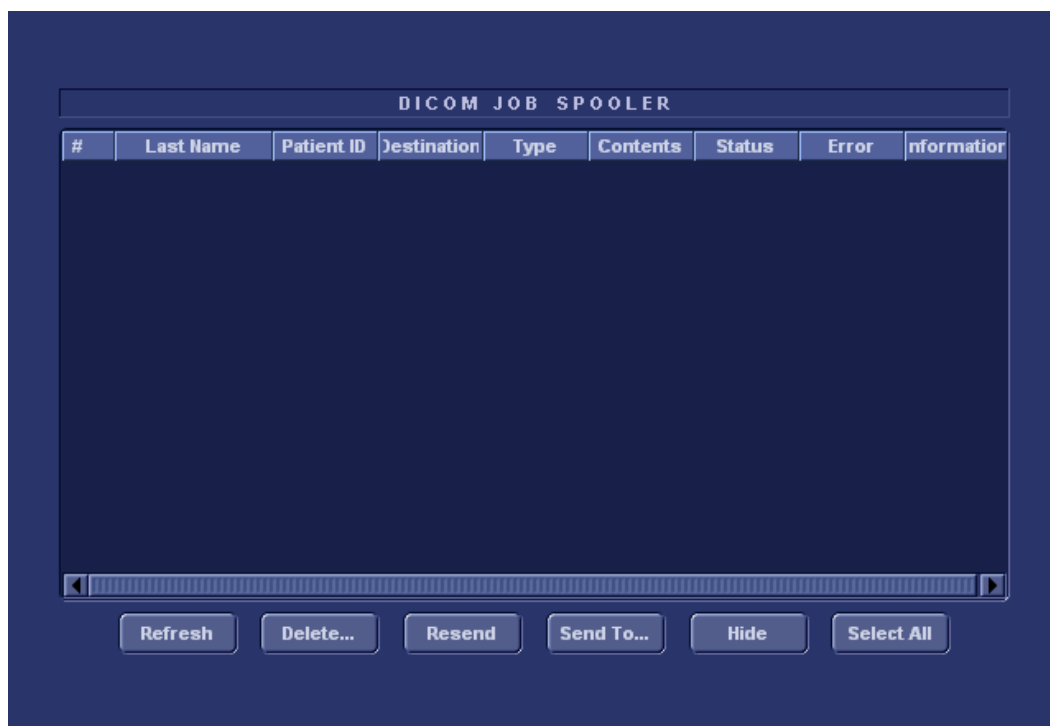


Figure 8-66: The DICOM job spooler window

Deleting a job

Only non-active jobs can be deleted.

1. Trackball to the job to delete in the *DICOM job spooler window*.
2. Press SET.
3. Trackball to **Delete**.
4. Press SET.

Resending a job

Only jobs that failed or are in hold can be resent.

1. Trackball to the job to re-send in the *DICOM job spooler window*.
2. Press SET.
3. Trackball to **Resend**.
4. Press SET.

Only jobs that failed or are in hold can be sent to a new destination.

Sending a job to a new destination

1. Trackball to the job to send in the *DICOM job spooler window*.
2. Press SET.
3. Trackball to **Send to....**
4. Press SET.
A dialogue window is displayed.
5. Select the new destination from the *Destination popup menu*.
6. Trackball to **Send**.
7. Press SET.

Chapter 9

Report

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Introduction

The Vivid *i* 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 be carefully reviewed before the report is saved. Use the worksheet (see page 147) to facilitate the review and adjustment of data before generating a report. The final report can be printed on a regular laser printer.

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* and the *Worksheet screen*.

Working with the report function

1. Press **REPORT**.

The default template for the current examination is displayed (see Figure 9-1). The information entered during the examination is automatically filled out (e.g. demographic, Diagnosis, Comments etc.)

Report



1. Assigned keys

- Print
- Store
- Retrieve
- Template
- Designer
- MORE menu
- Save as
- Delete

Figure 9-1: The Report screen and assigned keys

The Template selection menu can be configured to display only the templates of interest (see page 259).

To choose another report template


1. Press the assignable TEMPLATE.
The *Template selection menu* is displayed showing the available report templates organized by application.
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.

Note: From a sub-menu, select **Back** to return to the current application template list.

The selected template is displayed on the screen.

Note: After selecting a different report template the selected template becomes the default template which will be selected next time

To change patient information

1. Trackball to heading of the information to change.
The trackball marker is changed to a hand with pointing finger .
2. Press SET on the *Trackball area*.
The original location of the data is displayed.
3. Change the information entered if required.
4. Press REPORT when completed.

To add an image to the report

Images are inserted in the report by dragging a selected image from the clipboard into an *Image container* in the report.

1. Trackball to the Image of interest in the *Image clipboard*.
2. Press and hold down the SET key, and using the trackball, drag the selected image in the *Image container* in the report.
3. To move images between image containers, press and hold down the SET key, and using the trackball, drag the selected image to the new location.
4. To remove an image from the report, press and hold down the SET key, and using the trackball, drag the selected image back to the clipboard.

To print a report

Only members of the user group "Cardiologist" are allowed to print a report (see page 331).

1. Press **PRINT**.
The report is printed on the default printer. A status window is displayed showing the printing process.
For printer configuration, see Chapter 11, "Peripherals" on page 279 .

To store a report

Only members of the user group "Cardiologist" are allowed to store a report (see page 331).

1. Press **STORE**.
The report is stored in the Report archive.
A confirmation window is displayed when completed.
2. Press **OK**.

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 (not available on EchoPAC PC).
1. Press **MORE**.
The additional controls are displayed (Figure 9-1).
 2. Press **SAVE AS**.
The *Save as dialogue window* is displayed.
 3. Select the destination folder from the *Save in pull down menu*.
The default location is the *Export folder*.
The *Report archive folder* is selected by default.
The default name for the report is of type:
<exam DICOM UID>
 4. Select **PDF** or **CHM** format from the *Save as type pull down menu*.
 5. 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>
To display the current report, select **Show active exam**.
2. Trackball to the report to retrieve.
3. Press SET.

Deleting an archived report

Only members of the user group “Cardiologist” are allowed to store a report (see page 331).

1. Press MORE.
The additional controls are displayed (Figure 9-1).
2. 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>
3. Trackball to the report to delete.
4. Press SET.

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 **UPDATE MENU**.
2. Select **Direct report** (see Figure 9-2).
3. In the *Direct report* screen, select the comment type.
4. Type your comments in the *Text field*.
5. To add a measurement in the comment, double-click a measurement in the *Measurement overview* field.

1. Open Direct report
2. Select the type of information
3. Create/insert pre-defined text
4. Text field
5. List of measurements completed
6. Exits the Direct report

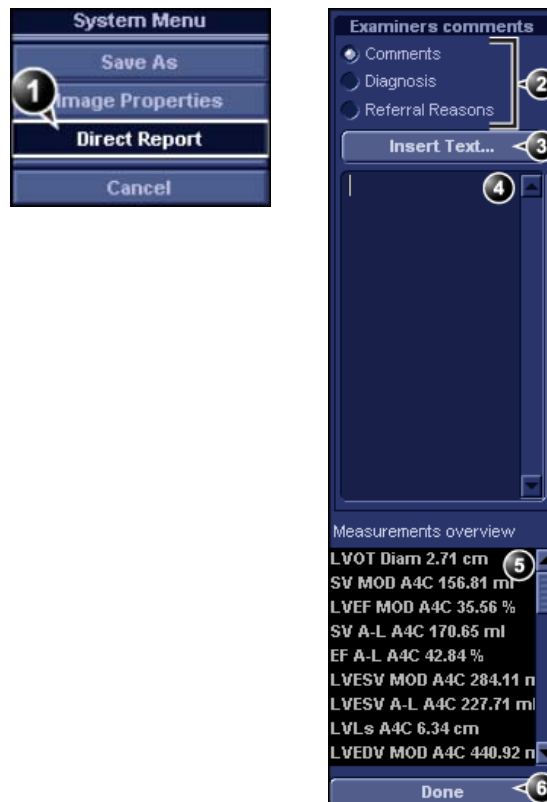


Figure 9-2: The Direct report

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 9-3).

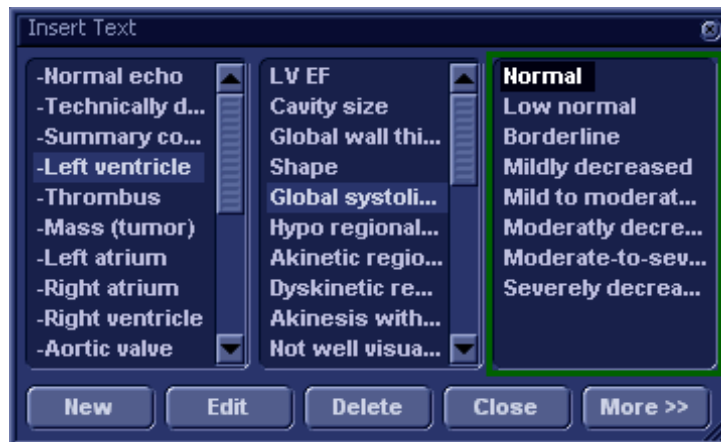


Figure 9-3: The Insert text window

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 "The Comment texts sheet" on page 306.

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.
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 9-4).

Report designer overview

1. Menu bar
2. Report template design area

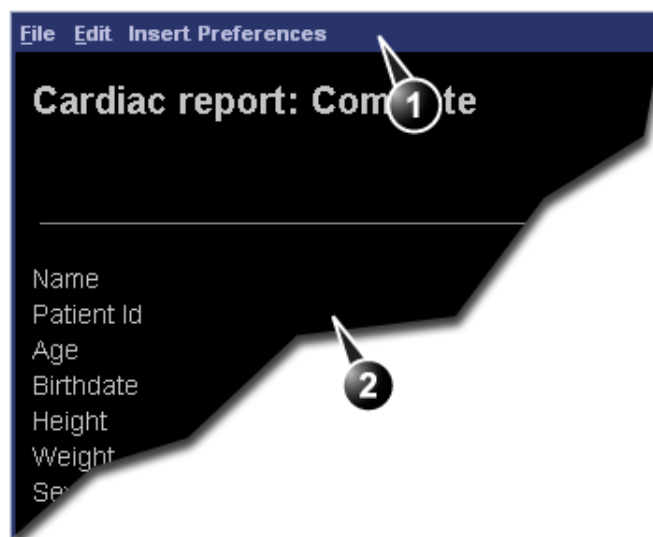


Figure 9-4: The Report designer screen

The menu bar

The File menu

Menu	Description
	<ul style="list-style-type: none">• 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.

The Edit menu

Menu	Description
	<ul style="list-style-type: none">• Delete: remove the selected object from the report template.• Undo: restore the previous state of the report template.

The Insert menu

Menu	Description
	<ul style="list-style-type: none">• 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:<ul style="list-style-type: none">Patient informationExam informationSite 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).• 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.

The Preferences menu

Menu	Description
	<ul style="list-style-type: none">• 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 244).
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 **Customize** 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 256.

Inserting an information container in the report template body

The different type 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. Press the **Left mouse button** 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 9-5).
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.

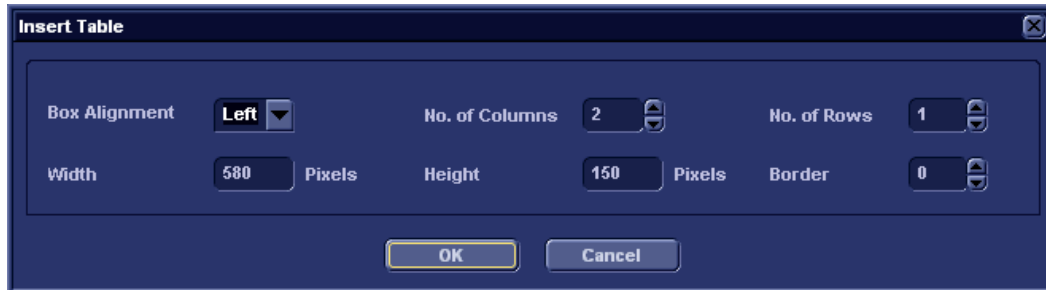


Figure 9-5: The Table properties window

Inserting a logo

1. Provide the hospital logo in JPEG or Bitmap format onto a CD or MO disk.
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.

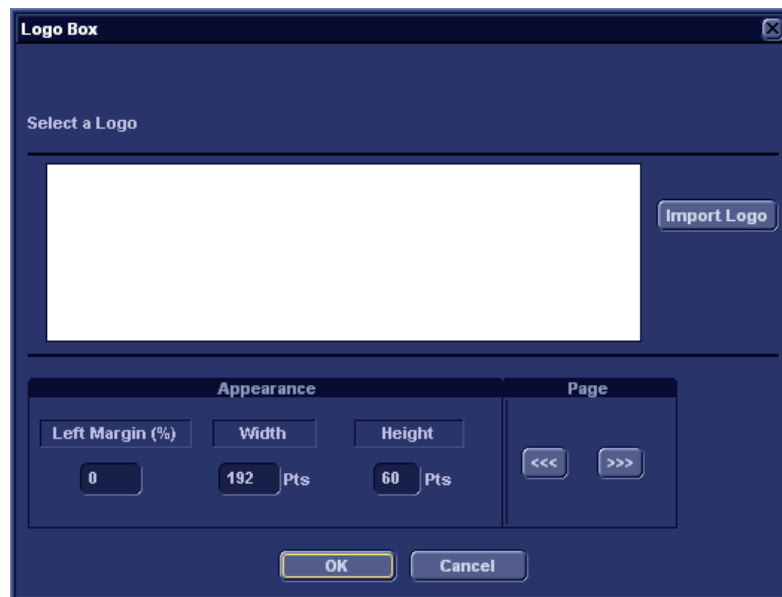


Figure 9-6: The Logo box

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.

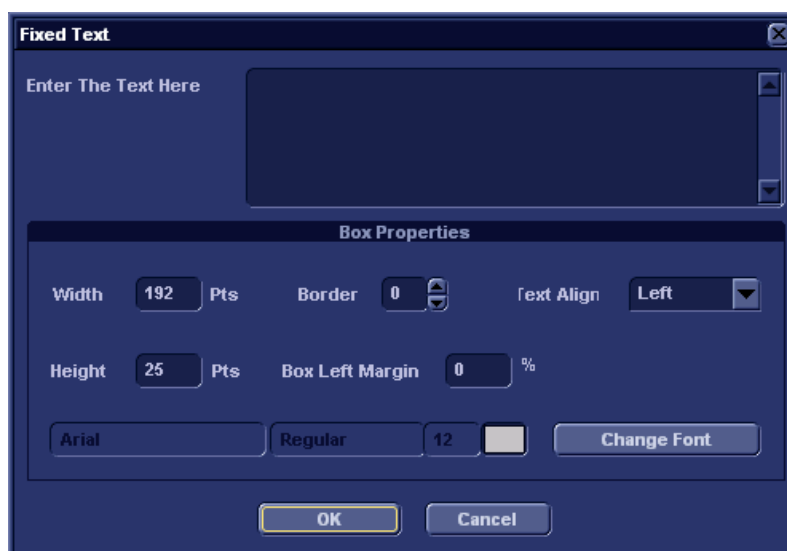


Figure 9-7: The Fixed text box

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.

The screenshot shows the 'Archive Information Box' dialog. It has a title bar with a close button. Below the title bar are two input fields: 'Heading' and 'Heading Link' (which is set to 'None'). To the right of these fields is a 'Box Properties' button. The main area of the dialog is divided into three columns: 'Patient Information', 'Exam Information', and 'Site Information'. Each column contains a list of items with checkboxes. In the 'Patient Information' column, 'Name', 'Patient Id', 'Birthdate', 'Height', 'Weight', 'Sex', and 'Address' are checked. In the 'Exam Information' column, 'Date', 'Operator Name', 'Diagn.Phys.', and 'Diagn.Phys. Name' are checked. In the 'Site Information' column, 'Site Name', 'Ward', and 'E-mail' are checked. At the bottom of the dialog are 'OK' and 'Cancel' buttons.

Figure 9-8: 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

1. Select the location where to insert the fixed text (a table cell or directly in the report template).
2. Select **Insert** and **Image**.
The *Ultrasound image box* is displayed.



Figure 9-9: The Ultrasound image box

3. If desired, enter a heading, set the container size and specify the text appearance.
4. Select **OK**.

Inserting measurement containers

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 *Measurement box* is displayed.

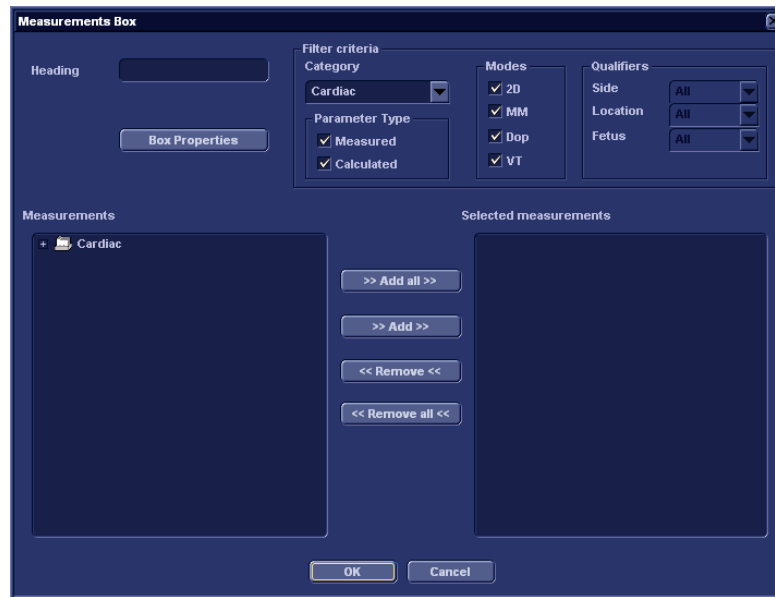


Figure 9-10: The Measurements box

4. Enter a heading (e.g. 2D).
5. Using the *Filter criteria*, define the type of measurements to be entered (e.g. Cardiac, 2D, measured and calculated). 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 9-11: The Text field box

3. Enter a heading.
4. From the *Display field*, select one of the following options:
 - **Referral reasons:** displays the information entered in the Direct report (see page 242) or in the *Examination list window*.
 - **Comments:** displays the information entered in the Direct report (see page 242) or in the *Examination list window*.

- **Diagnosis:** displays the information entered in the Direct report (see page 242) 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.

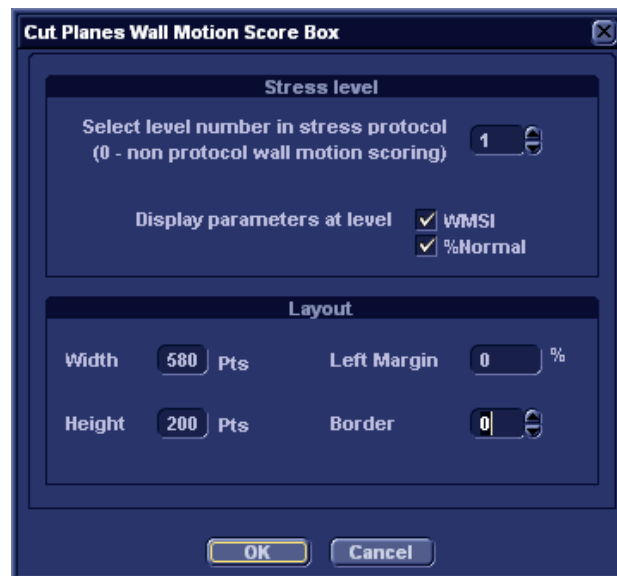


Figure 9-12: The Wall motion scoring box (Cut planes)

3. Adjust the parameters and select **OK**.

The scoring diagrams are inserted in the report template.

Inserting Wall motion scoring diagrams 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.

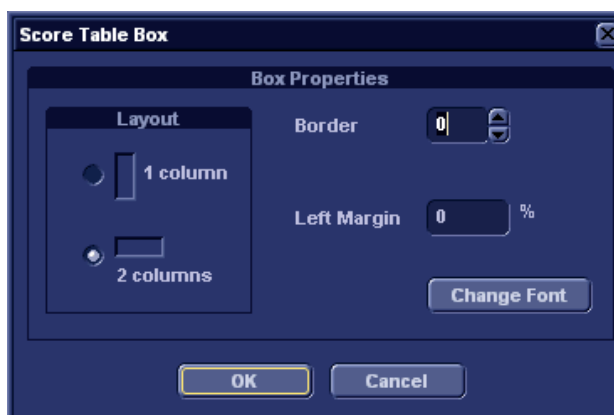



Figure 9-13: The Score table box

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 **Mouse cursor** over the border of the container to resize.
The mouse cursor is changed to a cross .
2. Press **Left mouse button** once.
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

Modifying the container's specific properties

1. Move the **Mouse cursor** over the border of the container to edit.
The mouse cursor is changed to a cross .
2. Double-click on the **Left mouse button**.

The *Container box* is displayed.

3. 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. In the template, position the Mouse cursor at the insertion point.
2. Press the **Left mouse button**.
3. 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.

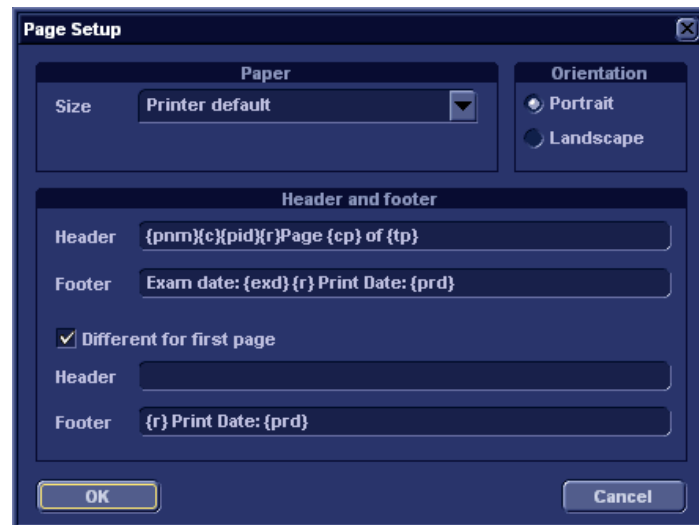


Figure 9-14: The Page setup box

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.

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 9-15: 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 one of the following:
 - **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 **CONFIG** and select the **Report** category.
The *Report category sheet* is displayed.




Figure 9-16: The Report template 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 Templates selection menu

1. Press **CONFIG** and select **Report**.
The Report template sheet is displayed (Figure 9-16)
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 *Available template field* will also insert the template in 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**  .
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 9-16).
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 (Vivid *i* / EchoPAC PC).

Export of Report templates

1. Insert a removable media into the drive.
2. Press **CONFIG** and select **Report**.
The Report template sheet is displayed (Figure 9-16, page 259).
3. Select **Export Templates**.

The available user-defined templates are displayed in the *Export template dialogue window*.

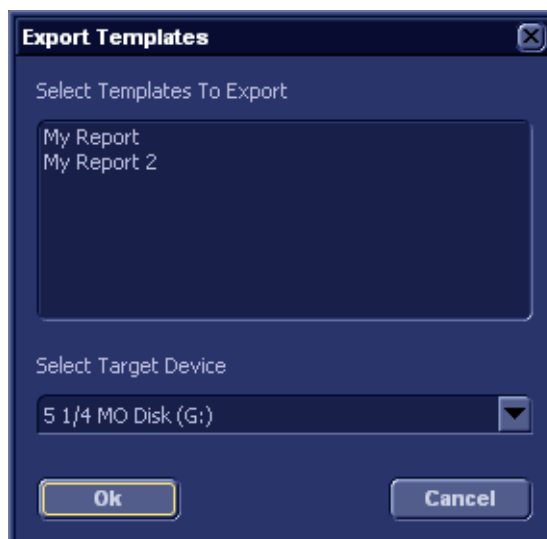


Figure 9-17: The Export template dialogue window

4. Select the templates(s) to export. Multiple selection can be done using SHIFT or CTR key.
5. Select the desired removable media under *Select target device*.
6. Press **OK**.
A Confirmation window is displayed.
7. Press **OK**.
The selected template(s) are exported to the removable media.
8. Press ALT + E and select the media to eject.

Import of Report templates

1. Insert the removable media with the report template(s) to import.
2. Press CONFIG and select **Report**.
The Report template sheet is displayed (Figure 9-16, page 259).
3. Select **Import Templates**.
The *Import template window* is displayed.

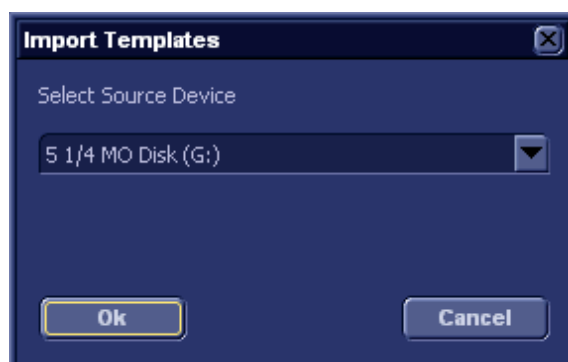


Figure 9-18: The Import template window

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 **ALT + E** and select the media to eject.

Chapter 10

Probes

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Probe overview

The Vivid *i* ultrasound unit supports four types of probes:


- Phased Array Sector
- Linear Array
- Curved Array (Convex)
- Continuous Wave Doppler

Supported probes


Phased Array Sector probes

Probe	Mode	Intended use	Technical data	Image
3S-RS	2D mode M-Mode Color Flow CW Doppler PW Doppler	Cardiology Coronary Transcranial Abdomen	Frequency: 1.5– Foot print: 3.6 MHz 18 x 24 mm	
7S-RS	2D mode M-Mode Color Flow CW Doppler PW Doppler	Cardiology Pediatric heart Coronary Neonatal head Abdomen Obstetrics	Frequency: 3.0– Foot print: 8.0 MHz 15 x 21 mm	
10S-RS	2D mode M-Mode Color Flow CW Doppler PW Doppler	Cardiology Pediatric heart Coronary Neonatal head	Frequency: 4.0– Foot print: 12.0 MHz 10 x 14 mm	


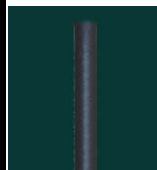
Linear Array probes

Probe	Mode	Intended use	Technical data	Image
8L-RS	2D mode M-Mode Color Flow CW Doppler PW Doppler	Peripheral vascular Small parts	Frequency: 3.2–7.5 MHz Foot print: 17 x 58 mm	


Curved Array (Convex) probes

Probe	Mode	Intended use	Technical data	Image
3C-RS	2D mode M-Mode Color Flow CW Doppler PW Doppler	Abdomen Aorto-Iliac Fetal Heart Obstetrics Pelvic Renal	Frequency: 2.2–6.0 MHz Foot print: 15 x 62 mm FOV: 58 degrees	

Doppler probe

Probe	Mode	Intended use	Technical data	Image
2D (P2D)	CW Doppler	Cardiology	Frequency: 2.0 MHz	
6D (P6D)	CW Doppler	Vascular	Frequency: 6.0 MHz	

Multiplane Transesophageal Phased Array probe

Probe	Mode	Intended use	Technical data	Image
6T-RS	2D mode M-Mode Color Flow CW Doppler PW Doppler	Transesophageal Cardiology	Frequency: 2.9–6.7 MHz	

Probe orientation

Some probes are provided with a green light (LED) orientation marking near their head (see Figure 10-1). 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.

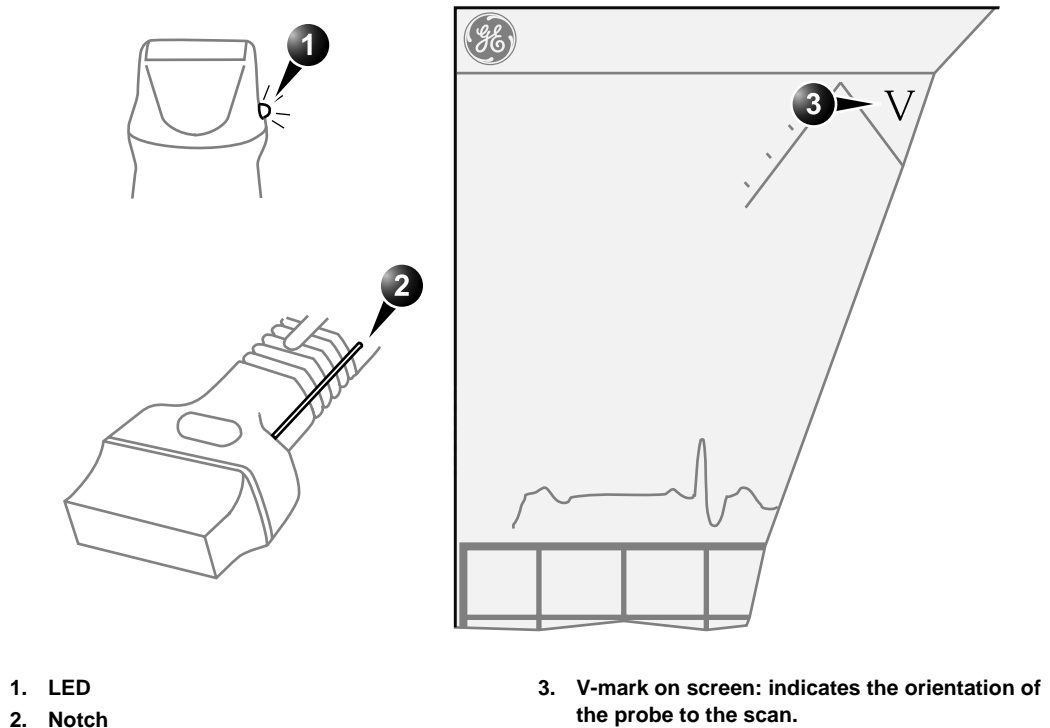


Figure 10-1: Orientation marking on probe and on screen

Probe labelling

Each probe is labelled with the following information:

- Name of distributor and manufacturer
- Operating frequency
- Model number
- Probe serial number
- Year of manufacture

The probe name displayed on the probe housing.

1. CE mark
2. Probe name



Figure 10-2: Probe labelling (examples)

Probe Integration

This section covers:

- Connecting the probe
- Activating the probe
- Disconnecting the probe

Connecting the probe

Probes can be connected at any time, whether the unit is on or off.



CAUTION

Do not allow the probe head to hang freely. Impact to the probe head may result in irreparable damage.



WARNING

Do NOT touch the patient and any of the connectors on the ultrasound unit simultaneously, including ultrasound probe connectors.

To connect a probe:

1. Hold the probe connector horizontally with the cable pointing towards you.
2. The lever on the Vivid *i* should be *down* all the way.
3. Align the connector with the probe port and carefully push into place.
4. Lift the lever on the Vivid *i* *up* all the way.
5. Position the probe cable so that it is not resting on the floor.



CAUTION

Take the following precautions with the probe cables:

- Keep free from the wheels.
- Do not bend cable sharply.

Activating the probe

When a probe is connected to the unit it is automatically detected.

To select a probe and an application:

1. Press **APPLICATION** on the control panel. A list of the connected probes will pop up. The list will contain the name of the probe in the main connector and the name of the CW pencil probe connected to the small connector.
2. Trackball to the desired probe.
An application menu for the desired probe is then listed.
3. Trackball to the desired application
4. Press **SET** to launch the application.



CAUTION

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 (see "Thermal Index" on page 353). TIB must be displayed when a fetal application is selected.

Disconnecting the probe

To disconnect probes:

1. Push the locking lever on the Vivid *i* all the way *down*.
2. Remove the connector from the port.
3. Ensure that the probe head is clean before placing the probe in its storage case.

The probes that are not connected to the unit should be stored in their storage case.

Care and Maintenance

This section covers:

- Planned maintenance
- Probe inspection
- Probe cleaning
- Probe disinfection

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 and intraoperative 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 10-3).
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 10-3).
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

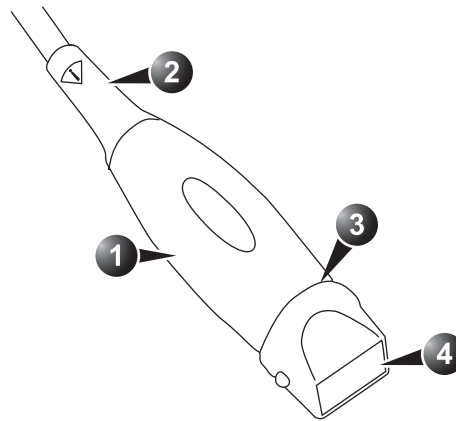


Figure 10-3: Probe parts



CAUTION

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 °F/27 °C).
4. Wipe the probe and cable with a soft cloth moisten in clean water (<80 °F/27 °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 Medical Systems 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://www.gemedicalsystems.com/rad/us/probe_care.html" 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 (TV,TR,TE) probes after contact with mucosal membrane.

High-level disinfection procedure

1. Prepare the germicide solution according to the manufacturer's instructions.

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.

Do not immerse the probe in liquid beyond the level specified for that probe (see Figure 10-4).

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. In addition TE probes must not be immersed in solutions containing 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.



WARNING

1. Fluid level
2. Contact face with patient environment

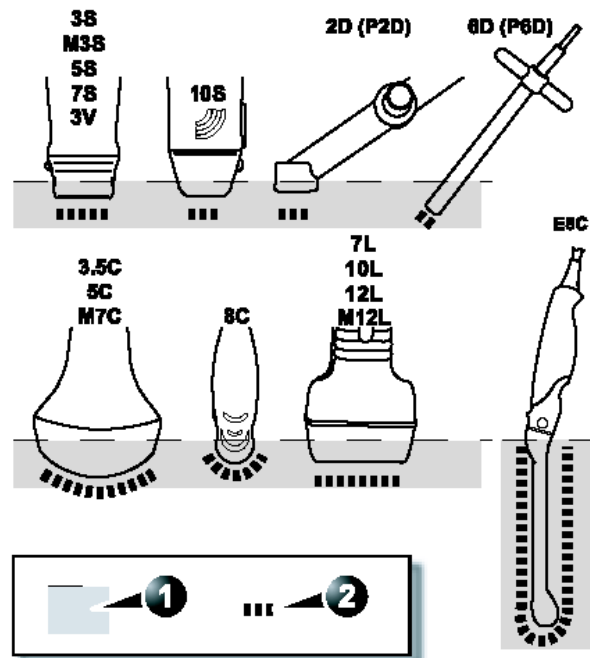


Figure 10-4: Probe immersion levels

Probe safety

This section includes information on hazards to both the user and the equipment, as follow:

- Electrical hazards
- Mechanical hazards
- Biological hazards

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 10-4. 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 272, 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 §19.

Mechanical hazards

Take precaution to avoid mechanical hazards.



WARNING

Observe immersion levels as displayed in Figure 10-4, page 275.

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



CAUTION

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 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.

Chapter 11

Peripherals

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- **Specifications for peripherals 282**

Introduction

This chapter provides information on peripherals that can operate with the Vivid *i* ultrasound unit, as follows:

- VCR
- Color Thermal Video Printer
- Black & White Thermal Video Printer



CAUTION

Use only GE Medical Systems 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 60601-1-1 (2000) must be verified.

All devices meeting IEC60950 must be kept outside of the patient environment, as defined in IEC60601-1-1 (2000), unless it, according to IEC60601-1-1 (2000), 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 UL2601-1 and IEC60601-1 standards for electrical leakage.



WARNING

When using peripheral device, observe all warnings and cautions given in peripheral operator manuals.

Printing

The Vivid *i* ultrasound unit can support a color and a black & white thermal video printer. The printer devices are controlled from the **PRINT** key on the control panel.

The **PRINT** key can also be configured to perform alternative storage (i.e. storage to DICOM media or secondary capture). See page 318 for configuration of the **PRINT** key.

To print an image

1. Press **PRINT** on the Control panel.
The image displayed on the screen is printed on B&W or Color printer, depending on the key assignment configuration (see page 318).

For details on the Thermal video printers operation, consult the manufacturer operator manual provided with the printer.

Specifications for peripherals

Please refer to the documentation accompanying the peripherals.

Chapter 12

Presets and System setup

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Introduction

This chapter describes the configuration management package of the Vivid *i* ultrasound unit. The Vivid *i* configuration package enables users to customize the global configuration for the unit and the application-specific settings.

In addition, users with administration rights have access to the local archive backup function, local archive restore function and creation of users.

The configuration management package consists of a *Setup dialogue window* divided in different setup categories with sublevels.

The table below summarizes the contents and access rights of the different categories and sublevels of the Vivid *i* configuration package:

Category and sublevel	Description	access	Refer to
Imaging			page 289
• Global	Sets the cineloop controls and display. Sets the patient information display. Sets the scan information displayed on the video record.	All	
• Application	Configures the probe and application specific settings.	All	
• Application menu	Configures the <i>Application menu</i> .	All	
Measure / Text			page 296
• Measurement menu • Advanced • Modify calculations	Configures the <i>Measurement menu</i> by selecting and defining the sequence of the measurements and calculation to perform. Creates user-defined measurements Configures vascular Doppler calculations to be performed.	All	

Category and sublevel	Description	access	Refer to
<ul style="list-style-type: none"> • Annotation • Customize 	Configures the Annotation menu and create pre-defined annotation.	All	
Report			page 304
<ul style="list-style-type: none"> • Templates 	<ul style="list-style-type: none"> • Configures the <i>Report templates menu</i> by selecting and ordering the templates to show in the menu. 	All	
<ul style="list-style-type: none"> • Diagnostic codes 	Create or delete pre-defined text input for the referral reasons and diagnosis.	All	
<ul style="list-style-type: none"> • Comment texts 	Create or delete pre-defined text input for the comments.	All	
Connectivity			page 309
<ul style="list-style-type: none"> • Dataflow 	Create new dataflows or configure existing dataflows.	Admin	
<ul style="list-style-type: none"> • Additional outputs 	Configure the PRINT key.	Admin	
<ul style="list-style-type: none"> • Tools 	Formats removable media.	All	
<ul style="list-style-type: none"> • Formats 	Configures the <i>Examination list window display</i> and other options related to the patient management.	All	
<ul style="list-style-type: none"> • TCPIP 	Sets the Transmission Protocol/Internet Protocol.	Admin	
System			page 327
<ul style="list-style-type: none"> • Settings 	Sets the date and time format, language and units.	Admin	
<ul style="list-style-type: none"> • Test 	Enables testing of the different parts of the unit.	Admin	
About	Displays information about the software, hardware and probes.	All	page 329
Administration			page 330

Presets and System setup

Category and sublevel	Description	access	Refer to
• Backup	Local archive and system configuration backup.	Admin	
• Restore	Restore local archive and system configuration from a backup.	Admin	
• Users	Operator and referring staff registration, operator's rights settings.	Admin	
• Unlock patient	Unlock patient records that were not properly finished.	Admin	
Service	This sheet is for service staff only. Deals with printer definition and keyboard configuration.	Admin	

Starting the Configuration package

To access the Configuration package the user has to log on as a specific user (see page 331). This ensures user-specific and user-defined settings and presets to be used.

The access to the entire configuration package is user configuration dependent (see page 331).

To open the Configuration package

1. Press **CONFIG** on the alphanumeric keyboard.
The *Log In window* is displayed asking for operator ID and password (see Figure 12-1).
2. Select **Log on** when completed.
The *Setup dialogue window* is displayed (see Figure 12-2).

1. Select the operator
2. Type password



Figure 12-1: The Operator login window

Overview

The configuration management package consists of a *Setup dialogue window* divided in different setup categories with sublevels (sheets labelled with tab).

The functionality of each configuration category and associated sublevels are described on the following pages.

1. Sublevel tabs for the selected Setup category.
2. Setup categories
3. Selected Setup category

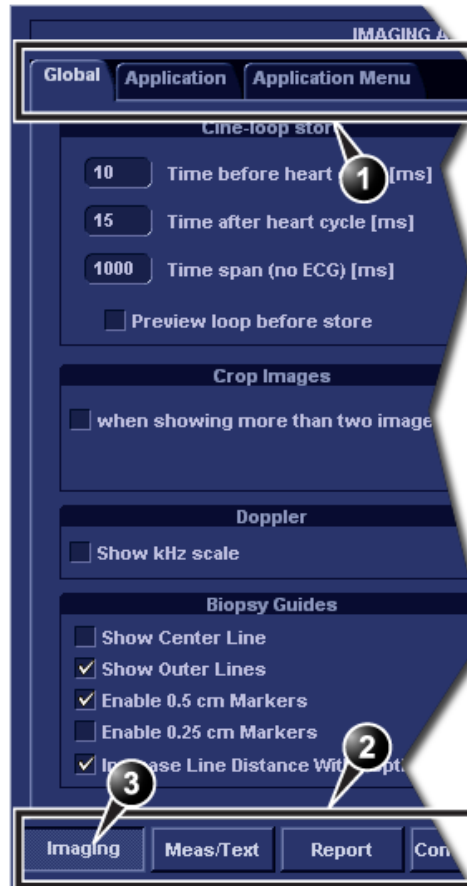


Figure 12-2: The Setup dialogue window structure

Imaging

- **Global:** enables the user to configure display-related settings.
- **Application:** enables configuration of the probe and application specific settings.
- **Application menu:** enables configuration of the Measurement menu.

The Global setup sheet

IMAGING AND ANALYSIS - GLOBAL LEVEL

Global Application Application Menu

Cine-loop store

10 Time before heart cycle [ms]

15 Time after heart cycle [ms]

1000 Time span (no ECG) [ms]

☐ Preview loop before store

Patient Info

Titlebar Line 1 Last, FirstName

Titlebar Line 2 Birth date

☐ Anonymous patient

Crop Images

☐ when showing more than two images

Doppler

☒ Show kHz scale

Biopsy Guides

☐ Show Center Line

☒ Show Outer Lines

☒ Enable 0.5 cm Markers

☐ Enable 0.25 cm Markers

☒ Increase Line Distance With Depth

Scan Info

☐ (T)Octave ☐ (C)Freq. ☐ (P)SVD

☐ (T)Freq. ☐ (C)SV

☐ (T)Proc. ☐ (C)LVRej

☐ (A)Power ☐ (D)Scale

☐ (A)FPS ☐ (D)LVRej

☐ (T)Depth ☐ (D)Freq.

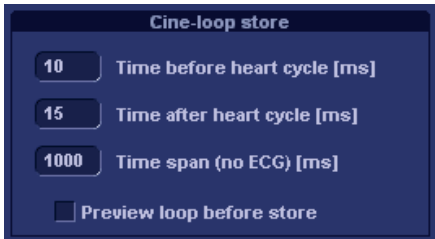
☐ (C)Gain ☐ (D)Proc.

☐ (C)Scale ☐ (P)SV


Imaging Meas/Text Report Connectivity System About Admin Service

Figure 12-3: The Global setup sheet


Cineloop store

Parameter	Description
	<p>Cineloop store:</p> <ul style="list-style-type: none"> • 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.

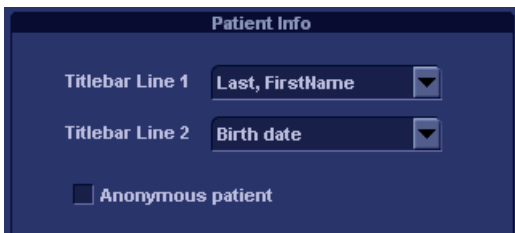
Crop images

Parameter	Description
	<p>Crop images:</p> <p><input checked="" type="checkbox"/>: In the <i>Analysis screen</i>, removes top and bottom of the image when more than two images have been selected.</p>

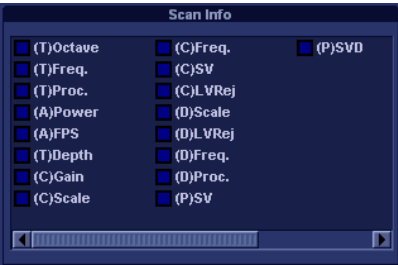
Doppler

Parameter	Description
	<p>Doppler:</p> <ul style="list-style-type: none"> • Show KHz scale: when selected, displays the KHz scale on the left side of the Doppler spectrum (see page 94).

Patient Info

Parameter	Description
	<p>Patient Info:</p> <ul style="list-style-type: none"> • Title bar Line 1 & 2: selects from the pop-up menu the patient information to display on the scanning screen's <i>Title bar</i> (see page 45). • Anonymous patient: when checked, no patient information is displayed on the scanning screen's <i>Title bar</i>.

Scan Info

Parameter	Description
	Scan Info: <ul style="list-style-type: none"> selects scan information on the video record.

Application

The Application category enables the configuration of probe/application specific settings (presets). The application-specific settings can be stored and used as default presets with this probe.

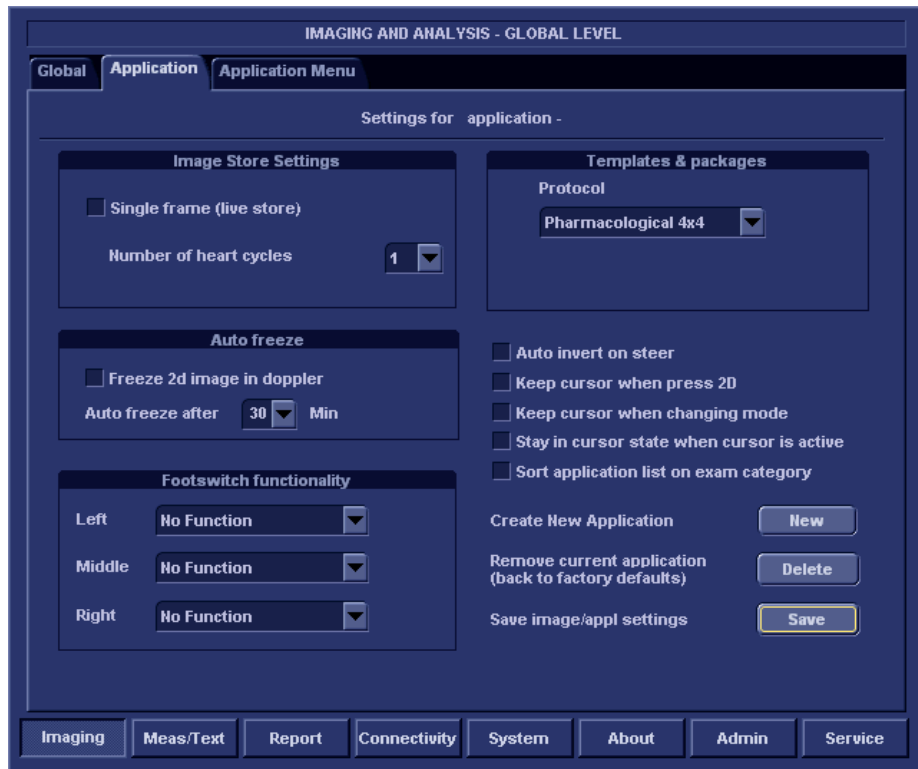
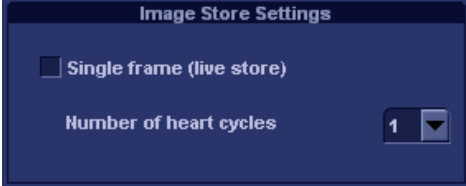


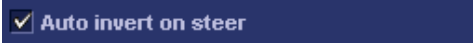



Figure 12-4: The Application setup sheet (example)

The Probe/application configuration parameters

Parameter	Description
	<p>Image Store settings:</p> <ul style="list-style-type: none"> • Single frame (live store): <ul style="list-style-type: none"> <input type="checkbox"/>: Store cineloop. <input checked="" type="checkbox"/>: Store single frame image only. • Number of heart cycles: <p>Select the number of heart cycles to store (Single frame must be unchecked).</p>
	<p>Auto freeze:</p> <ul style="list-style-type: none"> • Freeze 2D image in Doppler: the last 2D or color flow image is displayed when entering in Doppler mode. • Auto freeze after: sets the time after which the system enters in freeze when not in use.
	<p>Templates and Packages:</p> <p>Defines the default stress protocol associated to the application.</p> <p>Select the default Protocol to be associated to the selected application from the <i>pop-up menu</i>.</p>
	<p>Auto invert on steer:</p> <p>In Color flow, the color bar is inverted when steering the color flow sector angle.</p>

Parameter	Description
 <p>The screenshot shows a dark blue control panel with three buttons. The first button is labeled 'New', the second 'Delete', and the third 'Save'. To the left of each button is a text label: 'Create New Application' for 'New', 'Remove current application (back to factory defaults)' for 'Delete', and 'Save image/appl settings' for 'Save'.</p>	<p>Create new application: Press New to create a new Application. A dialogue window is displayed where the operator is asked to give a name to the new application.</p> <p>Remove current application: Press Delete to remove the current application. Factory Application settings cannot be deleted.</p> <p>Save image/appl. settings Press Save to store the changes applied to the current setting. Not applicable on factory application settings.</p>

Create a new Application

The application created is probe dependant. Select the desired probe before configuring a new application.

1. Press **APPLICATION** on the Control panel.
2. Trackball to **Preset...** in the *Application pop-up menu*.
The *Application setup sheet* (see Figure 12-4) is displayed.
3. **Adjust** the parameters as desired (see page 292).
4. Press **New**.
A *Dialogue window* is displayed.
5. **Enter** a name for the new application.
6. Press **OK**

To edit an application

1. Press **APPLICATION** and select the application to edit.
2. Press **APPLICATION** again.
3. Trackball to **Preset...** in the *Application pop-up menu*.
The *Application setup sheet* (see Figure 12-4) is displayed.
4. Change the parameters as desired (see page 292).
5. Press **Save** to store the changes.
Applicable only on user-defined applications.

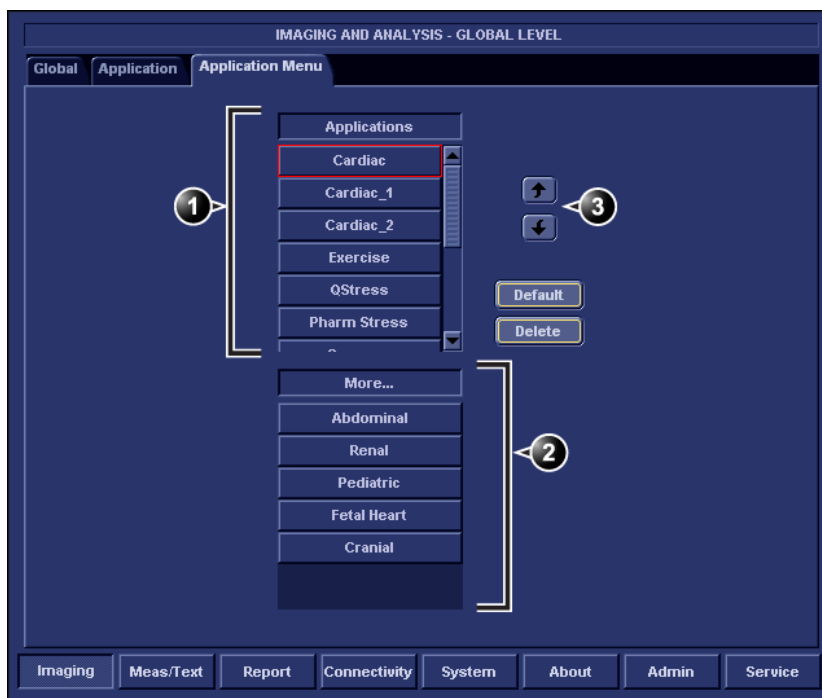
Deletion of an Application

1. Press **APPLICATION** and select the application to delete.
2. Press **APPLICATION** again.
3. Trackball to **Preset...** in the *Application pop-up menu*.
The *Application setup sheet* (see Figure 12-4) is displayed.
4. Press **Delete** to remove the selected application.

Application menu

The Application menu category enables rearrangement of the the *Application menu* 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. First menu level
2. Second menu level



3. Moving tools

Figure 12-5: The Application menu setup sheet (example)

Configuration of the Application menu



The Application menu can be configured by moving the applications up and down inside the pop-up menu and from one level to the other.

To move an application inside one level

1. Trackball to the application to move.
2. Press **SET**.
3. Press .
The application is moved one step up.
4. Press .
The application is moved one step down.

Press **Default** to
get factory setting.

To move an application from one level to the other

1. Trackball to the application to move.
2. Press **SET**.
3. Press as many times as necessary:
 -  if the application to move is in the *More menu*
 -  if the application to move is in the *Applications menu*till the application has moved to the other menu.

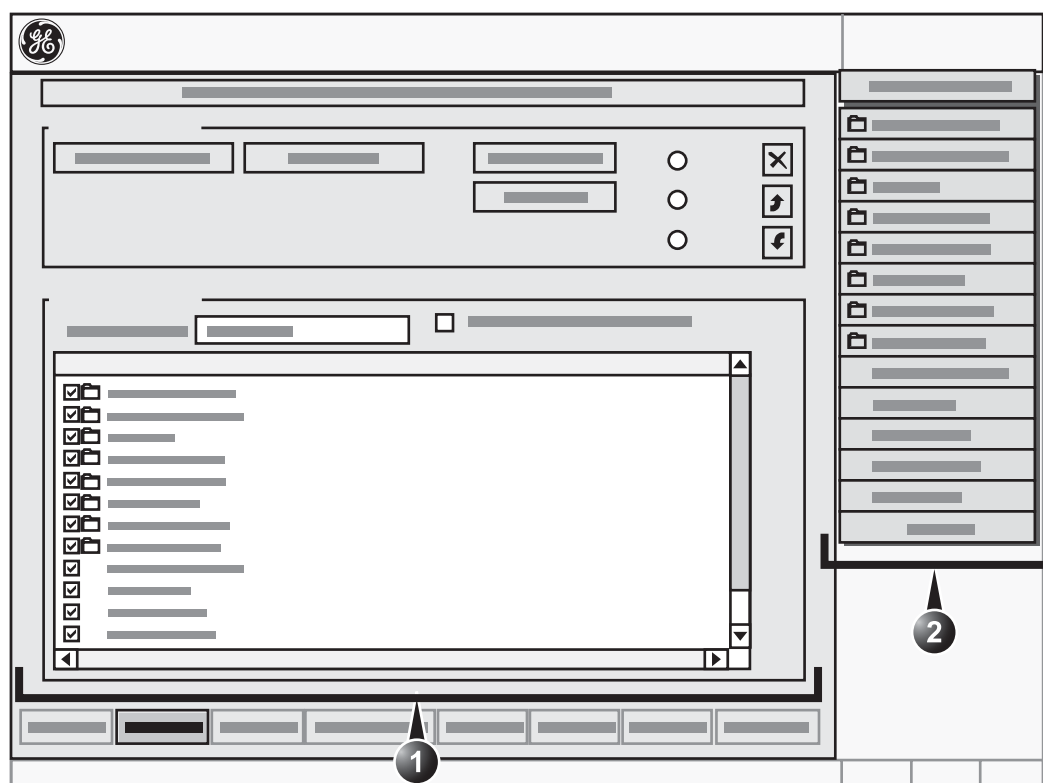
Measure Text

The Measure/Text category deals with the following:

- Configuration of the *Measurement menu* (see page 300)
- Creation of user-defined measurements (see page 137)
- Configuration of Measurement tools (see page 302)
- Configuration of the vascular Doppler calculation (see page 303)
- Configuration of the Annotation function (see page 71)

The measurement menu sheet

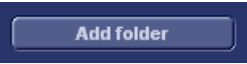






The *Measurement sheet* enables the organization of the Factory default *Measurement menu* and the creation of user-defined Measurements.

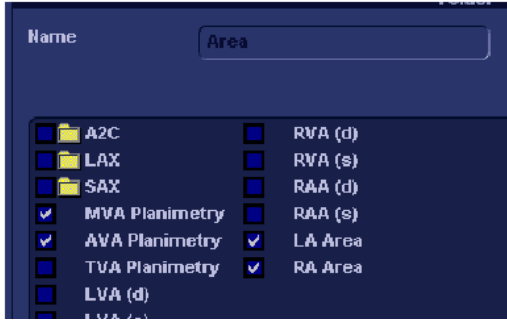
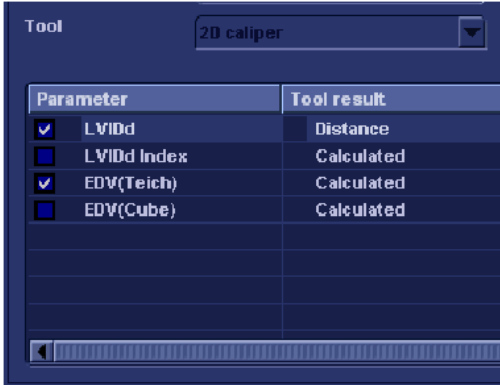
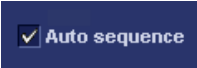


1. Configuration window (see next pages for details)
2. The measurement menu (displays updated configuration)

Figure 12-6: The Measurement menu setup sheet

Parameter	Description
	Add measurement: Create or select from the pop-up list a measurement to be added to a folder (see page 135).

Parameter	Description
	<p>Add folder:</p> <p>Enables the user to create its own folder with the desired measurements. The folder is displayed the <i>Measurement menu</i>.</p>
	<p>M&A Categories:</p> <p>Enables selection of the measurement categories to display in the Measurement menu. Only checked items will be displayed.</p> <ul style="list-style-type: none"> • Create Copy: Enables copy of a selected measurement category (selection is done by selecting the category name). • Delete: enables deletion of user-defined measurement categories. • Factory Default: restores factory display.
	<p>2D, MM and Dop. radio buttons:</p> <p>Enables the display of mode related <i>Measurement menu</i> in the configuration window.</p>
	<p>Configuration tools:</p> <p> Deletes selected entry (folder or measurement) in the <i>Measurement menu</i>. The factory entries cannot be deleted.</p> <p> Moves selected measurement or folder up or down inside the <i>Measurement menu</i>.</p> <p></p>

Parameter	Description
	<p>Folder:</p> <p>Displayed when a folder is selected in the <i>Measurement Menu</i>.</p> <p>Shows the entire contents of a selected folder.</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/>: the items is displayed in the <i>Measurement menu</i>. <input type="checkbox"/>: The item is hidden from the <i>Measurement menu</i>.
	<p>Measurement:</p> <p>Displayed when a measurement is selected in the <i>Measurement Menu</i>.</p> <p>Shows all the parameters related to the selected measurement.</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/>: the items is displayed in the <i>Measurement menu</i>. <input type="checkbox"/>: The item is hidden from the <i>Measurement menu</i>. <p>Only checked parameters will be displayed in the <i>Measurement result window</i>, the worksheet and the report.</p>
	<p>Auto sequence:</p> <p><input checked="" type="checkbox"/> Prompts the next measurement in the folder.</p>

Configuration of the Measurement menu

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 (see also "Measurement package configuration" on page 134).

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 (see page 298).
2. Check the categories to be displayed.
Uncheck the categories to hide.

To copy a Measurement category

1. Press **M&A categories** in the *Configuration window*.
The M&A categories are displayed in a pop-up window (see page 298).
2. Move the trackball marker over the M&A category name.
3. Press **SET** to highlight the category.
4. Press **Create copy**.
A copy of the selected measurement category is displayed in the *Measurement menu*.

Factory Measurement categories cannot be renamed.



To rename the Measurement category:

1. Select the Measurement category in the *Measurement menu*.
2. **Enter** a new name in the Measurement field.

Selection of a Measurement category


1. Trackball to the Measurement menu heading.
2. Press **SET**.
The measurement categories are displayed in a sub-menu.
3. Trackball to the measurement category of interest.
4. Press **SET**.
The measurement category is displayed.

Moving an item in the Measurement menu

1. Trackball to the entry to move into the *Measurement menu*.
2. Press **SET**.
3. 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. Trackball to the entry to delete in the *Measurement menu*.
2. Press **SET**.
3. 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*.

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. Select the new folder and **Enter** the folder name in the *Name text field*.

Adding a measurement to a folder

The user can either add a pre-defined measurement or create a new measurement with user-defined parameters to a folder (see page 135 for more information).

The Advanced sheet

The *Advanced sheet* enables further configuration of the Measurement function. The settings are divided into application specific parameters and global parameters.

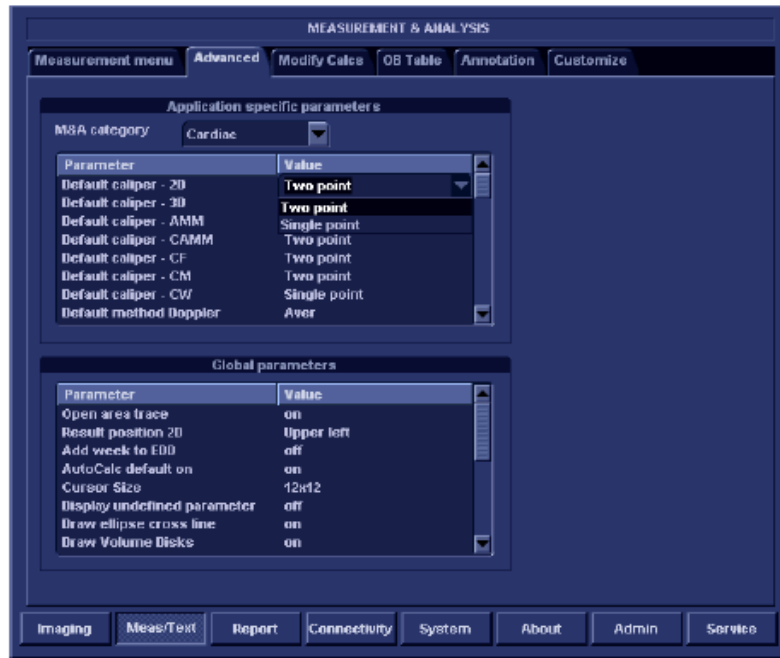


Figure 12-7: The Advanced sheet

Parameter configuration:

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 (see Figure 12-7).
3. Select a new value from the pull-down menu.

When pointing at a parameter an explanation label is displayed.

The Modify Calculations sheet

The *Modify Calculations sheet* is used to configure the calculations to be performed when doing a Doppler vascular measurements.



Figure 12-8: The Modify Calculations sheet

Parameter configuration:

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**.

Report

The *Report configuration category* is divided in three sheets:

- **Templates:** enables the configuration of the *Template selection menu* and the export/import of user-defined templates. See "Report templates management" on page 258 for more information.
- **Diagnostic codes:** enables the creation of pre-defined text inputs to be used in the *Diagnosis information field* in the *Examination list window* (see Figure 8-14, page 172).
- **Comment texts:** enables the creation of pre-defines text inputs to be used in the *Comment information field* in the *Examination list window* (see Figure 8-14, page 172).

The diagnostic codes sheet

This sheet enables the creation (and deletion) of text inputs that can be used when entering diagnostic codes in the *Examination list window* (see Figure 8-14, page 172).



1. List of text inputs
2. Text input name

3. Text input display area (free text area)
4. Create a text input

Figure 12-9: The Diagnostic codes sheet

Creating a diagnostic codes

1. Select **New text** to create a new diagnostic code (see Figure 12-9).
2. In the *Code field* enter a name for the diagnostic code.
3. Trackball to the *Text input display area*.
4. Press SET.
5. Enter the text.

To add a diagnostic code to an examination refer to "Diagnosis code" on page 174

Deleting a diagnostic code

1. In the *Code list field*, trackball to the diagnostic code to delete (see Figure 12-9).
2. Press SET.
3. Trackball to **Delete**.
4. Press SET.

The Comment texts sheet

This sheet enables the creation (and deletion) of text inputs that can be used when entering comments in the *Examination list window* (see Figure 8-14, page 172).



Figure 12-10: 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 pre-defined text input

First level

1. Select the first level.
2. Press **New**.

The *Enter new text window* is displayed.

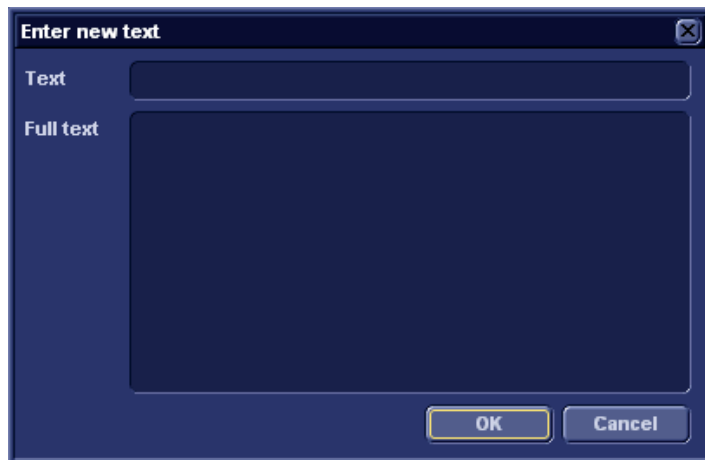


Figure 12-11: The Enter new text window

3. Enter a title in the *Text field*.
Enter the pre-defined text in the *Full text field*.
4. Press **OK**.

Second and third level

1. Select an item in the first column.
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. Press **New**.
The *Enter new text window* is displayed (Figure 12-11).
4. Enter a title in the *Text field*.
Enter the pre-defined text in the *Full text field*.
5. Press **OK**.

Editing a pre-defined text input

1. Select the term to edit in one of the columns.
2. Press **Edit**.
3. The *Edit text window* is displayed.

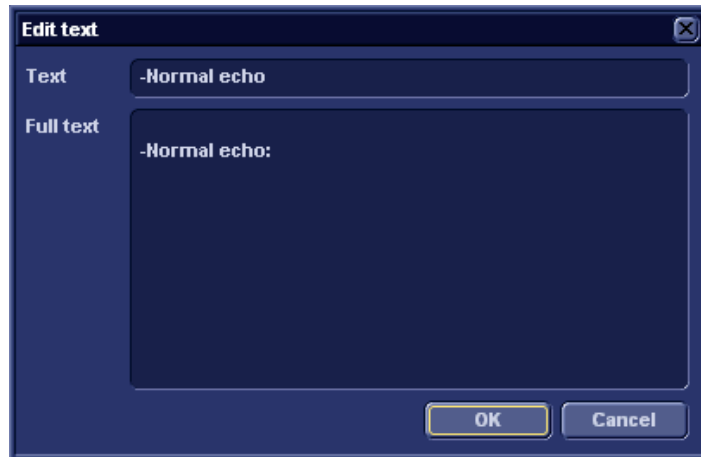


Figure 12-12: The Edit text window

4. Edit the text in both the *Text* and *Full text fields*.
5. Press **OK**.

Deleting a pre-defined text input

1. Select the item to delete in one of the columns.
2. Press **Delete**.
3. A *Confirmation window* is displayed.
4. Press **Yes**.
The selected text input is deleted including the belonging text inputs.

Connectivity

This configuration setup category deals with:

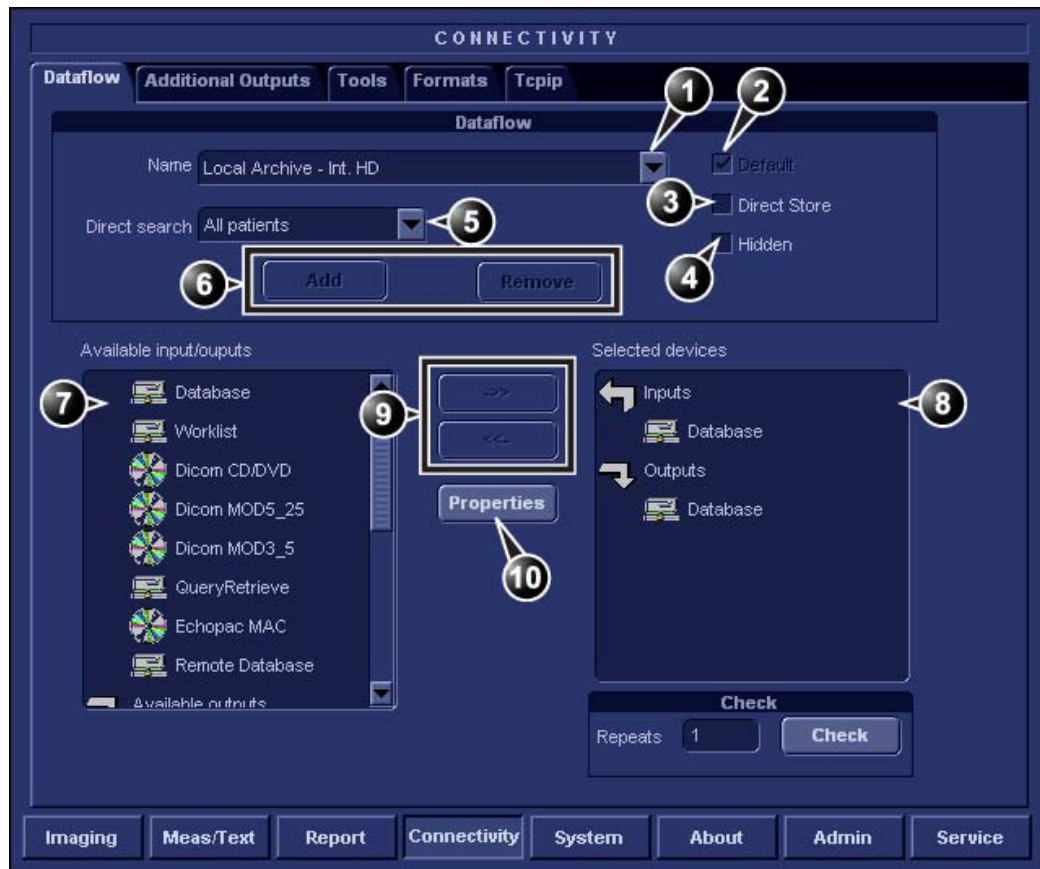
- **Dataflow:** connection and communication setup of the ultrasound unit with other devices.
- **Additional output:** configuration of the PRINT and ALT keys on the control panel.
- **Tools:** formatting of removable media
- **Formats:** configuration of the *Examination list window* and other tools related to patient management.
- **TCPIP:** internet protocol configuration

Dataflow

Communication between the Vivid *i* 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 are configured in the *Dataflow sublevel sheet* in the *Connectivity setup category* as described below. The *Dataflow sublevel sheet* is only available to users with administration rights.



1. **Select a dataflow to edit**
Factory defined dataflows cannot be edited.
2. **Use selected dataflow as default**
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. **Add/Remove a user-defined dataflow**
7. **Available input/output devices that can be assigned to the current dataflow**
8. **Input/output devices assigned to the current dataflow**
9. **Add/remove selected device to/from the current dataflow (user-defined dataflows only)**
10. **Adjust the settings for the selected assigned device**

Figure 12-13: The sublevel Dataflow (example)

Dataflows available

A set of pre-defined dataflows is available on the unit as listed in the table below. Input/output devices cannot be added/removed to/from the pre-defined dataflows. However the settings for the devices can be adjusted (see page 316).

	Dataflow	Description
	No Archive	Enables to perform an examination without storing the data to the archive.
	LocalArchive-Int.HD	Local archive internal harddrive The local database is used for patient archiving. Images are stored to internal harddrive.
	LocalArchive-MOD	Local archive Magneto Optical Disk (MOD) The local database is used for patient archiving. Images are stored to a MOD. 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/MOD	Local archive internal harddrive and Magneto Optical Disk The local database is used for patient archiving. Images are stored to the internal harddrive and to a MOD as DICOM Media. The stored image files, both to internal harddrive and to the MOD, will consist of both DICOM (multi-frame if cineloop) and raw data.
	Local Archive - 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 202)

	Dataflow	Description
	RemoteArch-RemoteHD	Remote archive remote harddrive A remote database (either on EchoPAC workstation or on EchoServer) is used for patient archiving. Images are stored to a network image volume (either internal HD on EchoPAC workstation or EchoServer volume).
	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 202)
This dataflow cannot be used with an ImageVault 3.0 server.	RemoteArchive-MOD	Remote archive Magneto Optical Disk A remote database (either on EchoPAC workstation or on EchoServer) is used for patient archiving. Images are stored to a MOD.
WL-LA-DServ: the local database is not searched, only the DICOM Modality Worklist.	Worklist/LocalArchive-DICOMServer/Int.HD	Modality Worklist local archive DICOM server and local harddrive 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 hard drive. Some of the measurements are stored if DICOM SR is turned on (see page 202)

	Dataflow	Description
	Worklist/RemoteArchive-DICOMServer/RemoteHD	Modality Worklist remote archive DICOM server and remote harddrive 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.
	Worklist/Remote Archive - Remote Storage	This dataflow is used in a network environment that includes Vivid HL7 Gateway. The patient list in the <i>Search/Create Patient window</i> is coming from Vivid HL7 Gateway through DICOM Modality Worklist. All patient data and images are stored to EchoServer.
	Raw DICOM MOD	Raw image format to/from a DICOM Magneto Optical Disk Read/Write images in raw format from/to a DICOM formatted 5.25" MO-disk.
	DICOM MOD	Pure DICOM image format to/from a DICOM Magneto Optical Disk Read/Write images in "pure" DICOM format from/to a DICOM formatted 5.25" MO-disk.
	DICOM CD read	DICOM CD read Read DICOM Media from the CD-drive.
	DICOM Server	DICOM server Store pure DICOM images to a DICOM device.
	DICOM Print	DICOM Print Send images to a DICOM printer.

	Dataflow	Description
	Query Retrieve	Query Retrieve Retrieve images from a DICOM server

To select the default dataflow

1. Select the dataflow in the *Name drop-down menu*. (see Figure 12-13).
2. **Check** the *Default box*.
The dataflow will be selected by default when restarting the unit.
3. **Check** the *Direct Store box* to have data stored automatically to the archive (no buffer storage).

To create a new dataflow

1. Press **Add**.
The *Add dataflow window* is displayed.



Figure 12-14: The Add dataflow window

2. Enter a name for the new dataflow.
3. Press **OK**.
4. Select an **Input device** in the *Available inputs/outputs field* and press the **Right arrow button** to assign the service to the dataflow.
5. Repeat step 4 to assign input/output devices as desired.
Most dataflows consist of one input device and one or several output devices. However in two cases it is possible to have two input devices, when defining a dataflow with DICOM Worklist or DICOM Query/Retrieve in combination with a database.
6. Adjust the device's parameters as described below.

7. To remove a device from the dataflow, select the device in the *Selected devices field* and press the **Left arrow button**.

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
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.

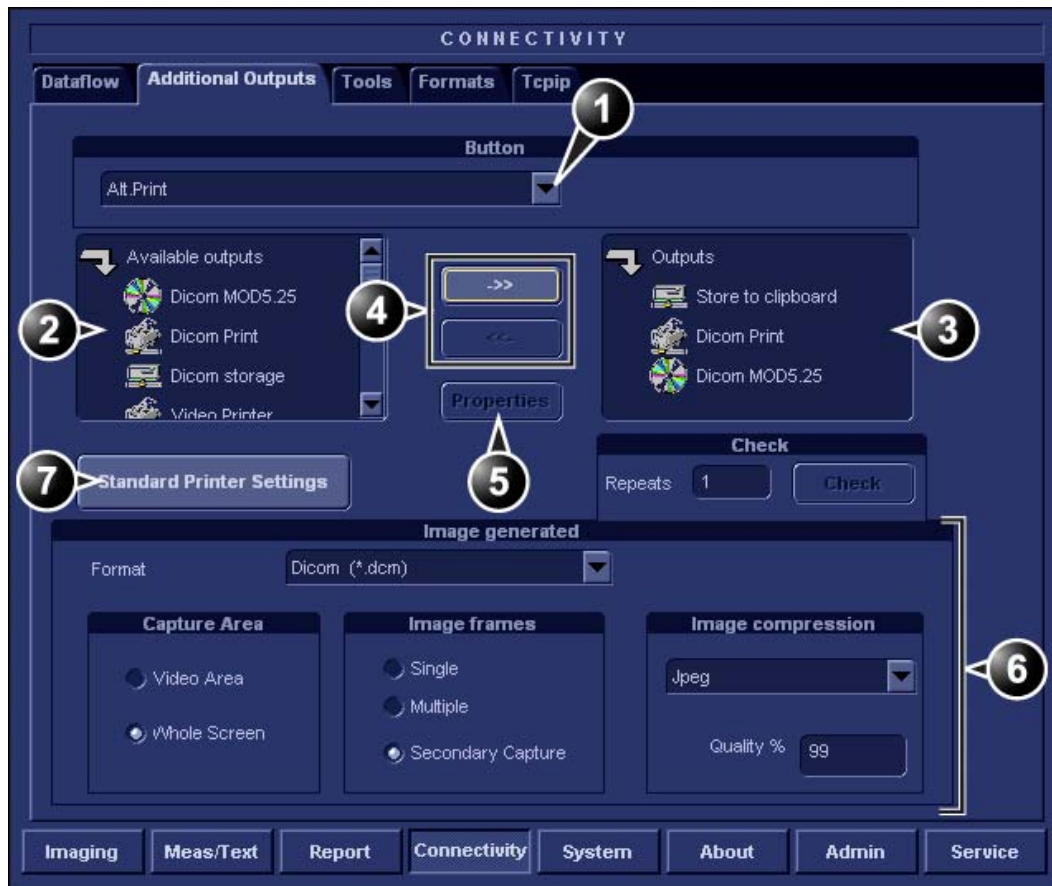
Image settings	Definition
Allow raw data	<input checked="" type="checkbox"/> : save data in both raw and DICOM format. <input type="checkbox"/> : save data in DICOM format only.
Max Framerate	Select 25, 30 or Full from the pop-up menu. Full (original acquisition) is default.
Compression	Select compression 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	<input checked="" type="checkbox"/> : allow cineloop storage.

Connection settings	Definition
Retry	Set maximum number of connection tentatives, time interval between tentatives and time-out.

DICOM settings	Definition
AE Title	The Application Entity Title is set during DICOM configuration. Refer to the network specifications.
Port	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.

Additional outputs

The *Additional outputs sheet* deals with configuration of the PRINT and ALT keys on the control panel. Several outputs (e.g. Video Print, Laser print, DICOM storage...etc.) can be associated to the keys (i.e. hitting PRINT can result in printing a Color video print and storage to a DICOM media).



1. Select between PRINT and ALT keys.
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 page xx)

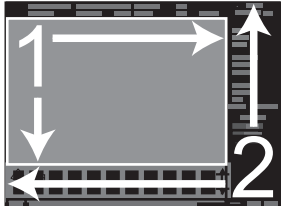
Figure 12-15: The sublevel Additional outputs (example)

The image configuration parameters

The table below gives a list of the configuration parameters.

To configure the Print or Alt. Print key

1. In *Button field* select **Print** or **Alt. Print**.
2. Select an **output device** in the *available outputs field* and press the **Right arrow button** to assign the service to the dataflow.
3. Press **Properties**.
The *Properties window* is displayed.
4. Adjust the device specific parameters as desired.
Some of the settings can be changed directly in the *Image to Produce field* in the sublevel Additional outputs.

Configuration parameter	
Format	Select between: <ul style="list-style-type: none"> • Raw DICOM • DICOM • AVI • JPEG
Image frames	Select between: <ul style="list-style-type: none"> • Single: stores single frame only • Multiple: stores cineloop • Secondary Capture: screen shot
Image compression	Select compression mode from the pop-up menu.
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.
Capture Area	Select between: <ul style="list-style-type: none"> • Video Area (1) • Whole Screen (2) 

To remove a device, select the device in the *Selected devices field* and press the **Left arrow button**.

Tools

The *Tools sublevel sheet* deals with:

- formatting of removable media (MO disk, CD-R, DVD-R).
- Creation or re-creation of a DICOM directory on a removable media containing DICOM images.
- Enter a remote path of a network shared folder (\\server-name\share-name) for:
 - Export of system error log file
 - Save as function for images

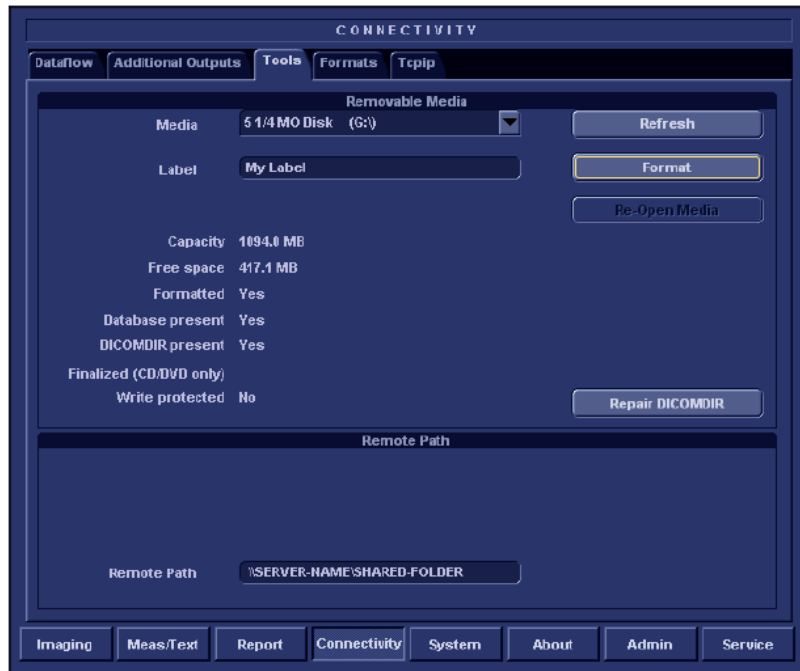


Figure 12-16: The sublevel Tools

Creation of a DICOM directory

1. Insert the media in the drive.
2. Select **Repair DICOM DIR**.
Wait for the display of the *Information window* indicating that the process is completed.

Formats

The *Formats sublevel* enables configuration of the *Examination list window* (see Figure 8-14, page 172) and other tools related to patient management, as described below.



Figure 12-17: The sublevel Formats (example)

Configuration of the Examination list window

The user can configure the examination list displayed in the *Examination list window* (see Figure 8-14, page 172) by deleting, adding columns and change the information type displayed in each column.

Column configuration

1. Trackball to the column to edit.
2. Press the **SET** key in the trackball area.
A sub-menu is displayed (see Figure 12-18).
3. 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.

To adjust column width, select and drag column heading border.

1. Insert new column to the left of the selected column
2. Delete selected column
3. Select column heading

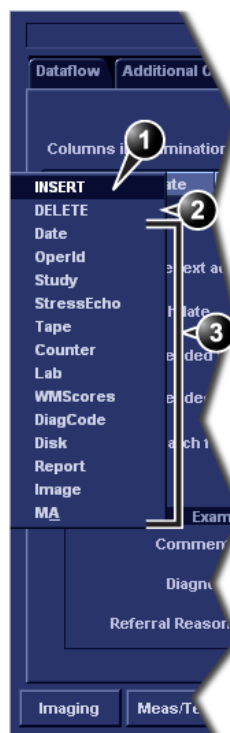
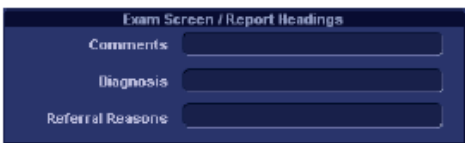



Figure 12-18: Configuration of the Examination list window

Other configuration settings

Parameter	Description
<input checked="" type="checkbox"/> Use free text addresses	<p>Use free text addresses:</p> <p>In the <i>Patient information window</i> (see page 45),</p> <p><input checked="" type="checkbox"/>: The address information (e.g. street, city...etc.) is entered in type-specific fields.</p> <p><input type="checkbox"/>: The address information is entered in a single field (free text).</p>
<input checked="" type="checkbox"/> Use birthdate	<p>Use Date of birth:</p> <p>In the <i>Patient information window</i> (see page 45), enter either the patient age or the birth date:</p> <p><input checked="" type="checkbox"/>: Enter age (Date of birth field not available)</p> <p><input type="checkbox"/>: Enter Date of birth, the age is calculated.</p>
<input checked="" type="checkbox"/> Use extended search dialog	<p>Use extended patient dialog:</p> <p>In the <i>Patient information window</i> (see page 45),</p> <p><input checked="" type="checkbox"/>: The entire patient information data is displayed.</p> <p><input type="checkbox"/>: Patient information data displayed is restricted to a minimum (e.g. name and Patient ID). When unchecked, press More to display the entire patient information data.</p>
<input checked="" type="checkbox"/> Use extended search dialog	<p>Use extended search dialog:</p> <p>In the <i>Search/Create Patient window</i> (see page 44, page 169 and page 171),</p> <p><input checked="" type="checkbox"/>: All the searching filters are displayed as default.</p> <p><input type="checkbox"/>: The searching criteria are restricted to a minimum. When unchecked, press More to display all the searching filters.</p>

Parameter	Description
<input type="checkbox"/> Auto search for patient	<p>Auto search for patient:</p> <p>In the <i>Search/Create Patient</i> window (see page 44, page 169 and page 171),</p> <p><input checked="" type="checkbox"/>: The system searches automatically through the patient archive selected while entering patient information.</p> <p><input type="checkbox"/>: The system searches through the patient archive after pressing SET.</p>
<input checked="" type="checkbox"/> Predefined text directory	<p>Pre-defined text directly:</p> <p>In the <i>Examination list</i> window (see page 172),</p> <p><input checked="" type="checkbox"/>: the Insert text key launches pre-defined text input.</p> <p><input type="checkbox"/>: the Insert text key open the extended text field.</p>
<input checked="" type="checkbox"/> Examination List on Archive button	<p>Examination list on Archive button</p> <p>When a patient is selected, pressing ARCHIVE will:</p> <p><input checked="" type="checkbox"/>: open the <i>Examination list</i> window for the selected patient.</p> <p><input type="checkbox"/>: open the <i>Patient Information</i> window for the selected patient.</p>
<input checked="" type="checkbox"/> Automatic generation of patient ID	<p>Automatic generation of patient ID:</p> <p>In the <i>Search/Create Patient</i> window (page 44),</p> <p><input checked="" type="checkbox"/>: Patient ID is not required when entering a new patient in the archive. The system generates automatically an ID number.</p> <p><input type="checkbox"/>: Patient ID is required when entering a new patient in the archive.</p>
<input type="checkbox"/> Request acknowledge of End Exam action	<p>Request acknowledge of End Exam action:</p> <p><input checked="" type="checkbox"/>: The user is asked to confirm action when ending an examination.</p>

Parameter	Description
<input checked="" type="checkbox"/> Go directly to scanning from search	<p>Go directly to scanning from search:</p> <p><input checked="" type="checkbox"/>: The unit goes directly to the <i>Scanning screen</i> after selecting/creating patient record.</p> <p><input type="checkbox"/>: The unit displays the <i>Patient information window</i> after selecting/creating patient record for further information entry. The user must press Begin Exam to enter the <i>Scanning screen</i>.</p>
<input type="checkbox"/> Save all images on end exam	<p>Save all images on end exam:</p> <p><input checked="" type="checkbox"/>: 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:</p> <ul style="list-style-type: none"> • Store all images • Select images to store • Store no images
	<p>Exam screen/Report headings:</p> <p>Enter user-defined headings for Comments, Diagnosis and Referral reasons fields.</p>
	<p>DICOM images:</p> <p><input checked="" type="checkbox"/>: Displays patient information (name, date of birth and ID) on DICOM images.</p>

TCP/IP

This configuration category enables the user with administration rights to set the Transmission Protocol/Internet Protocol for the system and connected remote archive.

The screenshot shows the 'CONNECTIVITY' configuration window. The 'Tcpip' tab is selected. The 'Computer Name' section has fields for 'Computer Name' (VIVID_I-001234), 'AE Title' (VIVID_I-001234), and 'Port No' (104). The 'IP settings' section has fields for 'IP-Address' (3 222 22 87), 'Subnet Mask' (255 255 252 0), and 'Default Gateway' (3 222 23 254). The 'Remote Archive Setup' section has fields for 'Remote Archive IP-Addr' (3 222 23 74) and 'Remote Archive Name' (ECHO SRV7-000777). There are also checkboxes for 'Detailed DICOM Log' and buttons for 'Save settings' and 'Advanced settings'. Numbered callouts 1 through 5 point to specific fields and buttons.

1. Computer name: device's name of type VIVID_I-00nnnn or ECHOPAC7-00nnnn, where "nnnn" is the system's serial number. Do not change the computer name.
2. IP settings: system IP settings
3. Remote archive setup: remote archive IP address and name (EchoPAC PC or EchoServer)
4. Save TCP/IP settings. The changes will be effective after the system is rebooted.
5. Advanced DICOM log: creates a detailed DICOM related report log. Should be used only if DICOM issues are registered (see page 341 about report log generation).

Figure 12-19: The sublevel TCP/IP

System

This configuration category is divided in two sheets:

- **System Settings:** enables the user to set the date and time, choose the measurement unit and language for the system and enter basic information about the organization, such as the institution name and department.
- **Test:** enables testing of the different parts of the unit.

This sheet is accessible to users with administration rights only.

The system settings

SYSTEM (location setup/date-time/formats)

Settings **Test**

Location

Hospital
GE Vingmed Ultrasound

Department
Development

Date and Time

20/08/2004 10:13:20

Time Format 24

Date Format EU

Default Century 1900

Language
ENG

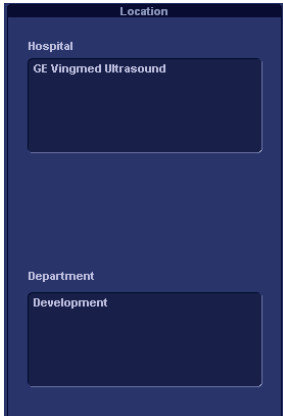
Manual Language
JPN

Units
Metric

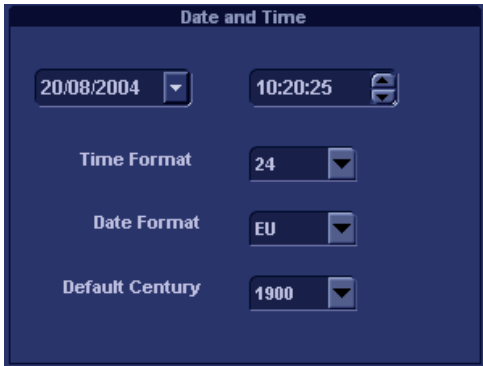
Imaging Meas/Text Report Connectivity **System** About Admin Service

Figure 12-20: The System settings setup sheet


Location

Parameter	Description
	<p>Location:</p> <ul style="list-style-type: none">• Hospital: Enter the hospital name (up to 64 characters). This information is displayed on the scanning screen's <i>Title bar</i> (up to 24 characters) and on the image properties of all saved images.• Department: Enter the department name (up to 64 characters). This information is displayed on the image properties of all saved images.


Date and Time

Parameter	Description
 <p>Changes done on the date or time format will be effective only after rebooting the system.</p>	<p>Date and Time:</p> <ul style="list-style-type: none">• Date: sets the date. Select the correct date from the pop-up window.• Time: sets the time. Press the arrow head buttons to set the time (hour, min, sec).• Time Format: select the desired format (24 or 12 AM/PM) from the pop-up menu.• Date Format: select the desired format (EU or US) from the pop-up menu.• Default Century: select the desired format (1900, 2000 or None) from the pop-up menu.<ul style="list-style-type: none">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: four digits must be typed when entering the patient year of birth.

Languages

Parameter	Description
	<p>Language: Select the desired language for the system from the pop-up menu.</p> <p>Manual language: Select the desired language for the Online manual. If not available the English manual will be displayed as default.</p>

Units

Parameter	Description
	<p>Units: Select the desired units (Metric or US) from the pop-up menu.</p>

About

The About sheet gives informations about the ultrasound unit concerning:

- software
- hardware
- Probes

Administration

Only users with administration rights have access to this setup category (see page 331).

The Admin. category deals with the following:

- **Disk management:** enables the management of the hard disk space while maintaining the patient database on the system (see page 223).
- **Backup:** enables the backup procedures for local patient, and report archives as well as system and user-defined configuration (see page 227).
- **Restore:** enables data retrieving of patient and report archives as well as system and user-defined configuration (presets) from a backup (see page 230).
- **Users:** deals with operators registration, operator's rights setting and registration of staff related to an examination (e.g. referral doctors, sonographers...etc.).
- **System Administration:** keeps track of all the options implemented in the unit.
- **Unlock patient:** enables to unlock patient records that were not properly terminated (see page 334).

Users

The *Users sheet* deals with operators registration, operator's rights setting and registration of referring members related to examinations (e.g. referring and diagnosing physicians).

Figure 12-21: The Users setup sheet

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

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

Presets and System setup

Table 12-1: The User groups

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

The rights associated to the user groups are:

Right	Definition
Create and delete	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Print a report
Store report	<ul style="list-style-type: none">• Store a report
Admin	<ul style="list-style-type: none">• System administration
Service	<ul style="list-style-type: none">• Access to the service platform

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)*.



CAUTION

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

Editing an 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 logoff

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.
 - **A specific user**: select one of the users to be the default user when logging on.

Auto logoff

1. Set the time span (from 10 min) for the system to automatically log off when not in use.

Unlock Patient

If for any reason an examination is not properly finished, the patient record is locked and cannot be opened again unless it is unlocked.

Last Name	First Name	Patient ID	Birthdate	Last Exam
30MA		dfyt		03/05/2004
MPTest		test2		22/08/2004
Stress test		Stress		28/06/2004

Figure 12-22: The Unlock Patient sheet

To unlock patient records:

1. Press **CONFIG**.
2. Select the category **Admin**.
3. In the *Admin category*, select the sheet **Unlock patient**.
4. In the *Unlock patient sheet*, select the patient records 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 13

User maintenance

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System Care and Maintenance

Having been determined by GE Medical Systems engineers that your Vivid *i* system has no high-wearing components likely to fail due to frequent use, no Periodic Maintenance Inspections are mandatory. However, some Customer Quality Assurance Programs may require additional tasks and/or inspections to be performed at periods of frequency different from those listed in this manual.



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 (1988).

Only trained persons are allowed to perform the safety inspections mentioned above.

Technical descriptions are available on request.

To ensure that the Vivid *i* 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



CAUTION

If any defects are observed or malfunctions occur, DO NOT operate the equipment, and inform a qualified service person.

Monthly

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 for defects



WARNING

To avoid electrical shock hazard, do not remove panels or covers from the unit.

Virus Protection

To minimize virus vulnerability Vivid *i* is configured with a minimal set of open ports and with all network services not actively used by the system closed down. This significantly reduces the risk of a virus attack on Vivid *i*. GE is continuously judging the need for additional actions to reduce vulnerability of equipment, this includes vulnerability scanning of our products and evaluation of new security patches for the 3rd party technology used. Microsoft (and other) security patches that addresses serious issues with Vivid *i* will be made available to customers after GE verification of those patches.

Cleaning the unit

General Cleaning

Frequent and diligent cleaning of the Vivid *i* ultrasound unit reduces the risk of spreading infection from person to person, and also helps to maintain a clean working environment.



CAUTION

When performing Cleaning Procedures, to prevent the risk of system damage, always observe the following precautions:

- Use only cleaning materials and solutions recommended in the procedures described in Table xx on page xx.
- Do not use any solutions or products not listed in the Vivid *i* User Manual.
- Do not spray any liquid directly onto the Vivid *i* covers, LCD Display or keyboard!
- Do not allow any liquid to drip or seep into the system.
- Prior to cleaning, turn OFF power to the system.

LCD Display Cover

On a weekly basis, moisten a soft, non-abrasive folded cloth or sponge with a mild, general purpose, non-abrasive soap and water solution. **Do not use any solution containing abrasive powder or strong chemicals such as acid or alkaline.**

Squeeze excess liquid from the cloth/sponge, then wipe down the top, front, back and both sides of the unit. ***Do not spray any liquid directly onto the unit!***

1. Rinse the cloth/sponge with clean running water and wipe the unit surfaces again.
2. Use a dry, soft, lint-free cloth to dry the unit surfaces.

3. Wait for the unit surfaces to dry completely.

Note: In the event that disinfection is required or any stubborn stains remain, remove them with a soft, dust-free cloth on which a small quantity of isopropyl rubbing alcohol has been absorbed, as described below for cleaning the Keyboard.

LCD Display

On a weekly basis, gently wipe the LCD Display with a dry, soft, lint-free non-abrasive folded cloth.

Note: In the event that you see a scratch-like mark on the LCD Display, this may be a stain transferred from the Keyboard or Trackball when the LCD Display Cover was pressed from the outside. Proceed as follows:

Wipe or dust the stain gently with a soft, dry cloth. If the stain remains, moisten a soft, lint-free 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 Display again. ***Do not let any liquid drip into the computer!***

Be sure to dry the LCD Display before closing the cover.

Control Panel and Keyboard

Control Panel:

On a weekly basis, moisten a soft, non-abrasive folded cloth or sponge with a mild, general purpose, non-abrasive soap and water solution or general purpose disinfectant. **Do not use any solution containing abrasive powder or strong chemicals such as acid or alkaline.**

Squeeze excess liquid from the cloth/sponge, then wipe down the Control Panel.

Do not spray any liquid directly onto the Control Panel!

1. Rinse the cloth/sponge with clean running water and wipe the Control Panel again.
2. Use a dry, soft, lint-free cloth to dry the Control Panel.
3. Wait for the Control Panel surfaces to dry completely.

Keyboard:

Clean the keyboard as described (above) for cleaning the Control Panel.

Note: 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 keycaps with the cloth, making sure that no liquid drips on or between the keys. Allow to dry.

Magneto Optical Disk (MOD)

Clean the drive head and media with the vendor-supplied cleaning kit. Advise to repeat this often, to prevent future problems. MOD disks must be stored away from dust and cigarette smoke. Do not use alcohol or benzene to clean the MOD cartridge.

DVD - CDRW Drive

Clean the drive head and media with the vendor-supplied cleaning kit. Advise the user to repeat this often, to prevent future problems. CDs must be stored away from dust and cigarette smoke. Do not use alcohol or benzene to clean the CD drive.

Peripherals

Clean the peripherals in accordance with the respective manufacturer's directions.

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 Vivid *i* 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 scanner operation.

System malfunction

In the event of error or system malfunction the user may generate and export a log file to a removable media as described below and contact authorized service personnel.

Generating a logfile

1. Press **ALT** - **D** on the alphanumeric keyboard.
The *Problem description dialogue window* is displayed (see Figure 13-1).
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. Press **Save** to create a logfile.

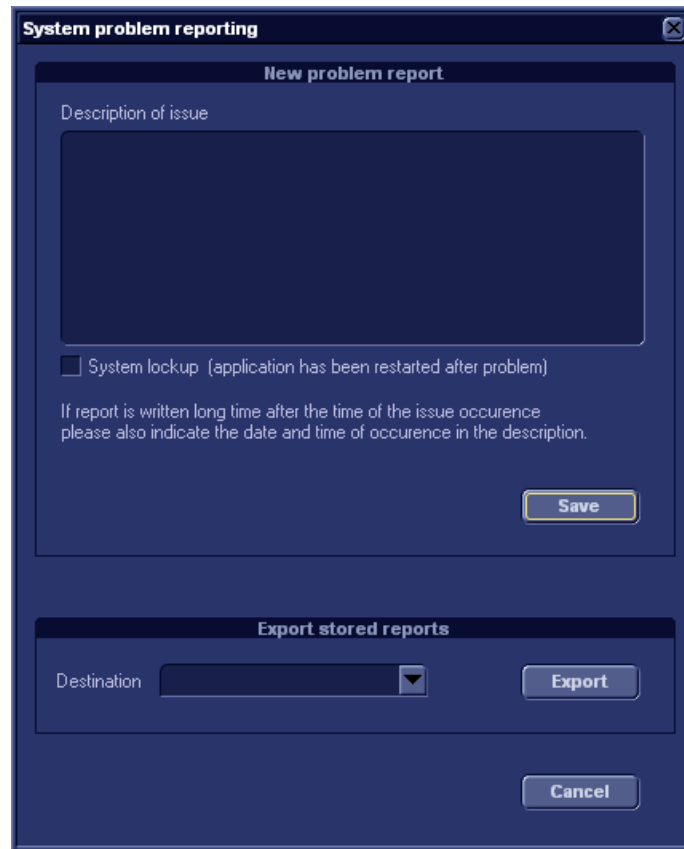


Figure 13-1: The Problem description dialogue window

Exporting the logfile

1. Press **ALT** - **D** on the alphanumeric keyboard to display the *Problem description dialogue window* again.
2. Select the destination where to export the logfile (MOD or CD-R).
3. Press **Export**.
A Zip file (named "logfile_<date>_<time>.zip") is copied on to the selected removable media.

Chapter 14

Safety

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Introduction

This section describes the important safety measures which should be taken before operating the Vivid *i* 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



Marks sections or chapters in the user manual which give information related to components on the ultrasound unit or to accessories marked with this same label (see also page 350).

Other precautions or prudent-use recommendations are indicated in the note sections in the left column. These are:

- Use of the Vivid *i* ultrasound unit as a prescription device, under the order of a physician.
- Maintaining an optimum unit environment.
- Reference to the User's Manual.

Owner responsibility



CAUTION

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 Vivid *i* 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.

Important safety considerations

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.

The equipment is not suitable for use in the presence of flammable anesthetic mixture with air or with Oxygen or Nitrous Oxide.

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.

Regulatory information

The GE Vingmed Ultrasound product families are tested to meet all applicable requirements in relevant EU Directives and European/International standards. (See “Standards used” below.) Any changes to accessories, peripheral units or any other part of the system must be approved by the manufacturer: GE Vingmed Ultrasound. **Ignoring this advice may compromise the regulatory approvals obtained for the product.**

Please consult your local GE Vingmed Ultrasound representative for further details.

Standards used

The Vivid *i* ultrasound unit is a Class I device, type BF, according to Sub-clause 14 of IEC 60601-1 (1988). To fulfill the requirements of relevant EC directives and/or European Harmonized/International standards, the following documents/standards have been used:

Standard/Directive	Scope
93/42/EEC	Medical Devices Directive (MDD)
EN 55011/CISPR 11/ 3.1991	Emitted noise according to Class B requirements + Electromagnetic Susceptibility
IEC 60601-1 (1988) EN 60601-1 (1990) UL 2601-1/ 8 (1994)	Medical Electrical Equipment, Part 1; General Requirements for Safety “CLASSIFIED BY UNDERWRITERS LABORATORIES INC WITH RESPECT TO ELECTRICAL SHOCK, FIRE AND MECHANICAL HAZARDS ONLY IN ACCORDANCE WITH UL2601-1 AND CAN/CSA C22.2 NO.601.1”
IEC 1157/ EN 61157/ (1994)	Requirements for the declaration of the acoustic output of medical diagnostic ultrasonic equipment.
EN 60601-1-2 (2001)	Medical Electrical Equipment - part 2. Collateral standard: Electromagnetic compatibility - Requirements and tests.
EN 60601-1-2-37 (2001)	Medical Electrical Equipment - part 2: "Particular requirements for the safety of ultrasound medical diagnostics and monitoring equipment", (2001).

IEC 60601-2-27	Medical electrical equipment - Part 2: Particular requirements for the safety of electrocardiographic monitoring equipment.
IEC 60601-1-4	Medical electrical equipment: Part 1-4: General requirements for collateral standard: Programmable electrical medical systems
ISO 10993-1	Biological evaluation of medical devices
ISO 13485	Quality management standards for medical devices
93/42/EEC	Medical Devices Directive


Note: Any rest energy within our scanners or their components will be below 60 V DC or 2 mJ.












Device labels


Label Icon Description

The following table describes the purpose and location of safety labels and other important information provided on the equipment.

Label	Purpose	Location
Identification Plate	Manufacturer's name and address Model Electrical ratings Device Listing/Certification Labels	Bottom of unit
	Equipment Type BF, in which protection against electric shock does not rely on basic insulation only. Provides additional safety precautions such as double insulation or reinforced insulation, because there is no provision for protective earthing or reliance upon installation conditions.	Probe connectors.

Safety

Label	Purpose	Location
	Equipment Type CF, indicates equipment having a floating applied part having a degree of protection suitable for direct cardiac contact.	ECG connector
		Bottom of unit.
	Alternating current	Various
	This symbol indicates that the waste of electrical and electronic equipment must not be disposed 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.	Bottom Cover
	Protective earth (ground)	Internal
	Earth (ground)	Internal
	Equipotentiality: indicates terminal to be used for connecting equipotential conductors when interconnecting (grounding) with other equipment.	Bottom of unit
	Attention - Consult accompanying documents: alerts the user to refer to the user documentation when complete information cannot be provided on the label.	Various
	CAUTION - Dangerous voltage: used to indicate electric shock hazards.	Various

Label	Purpose	Location
	Apply a short push on the ON/OFF button to shut down the system.	Keyboard

Classifications

Type of protection against electric shock:

- Class I Equipment—AC Adapter (*1)
- Class II Equipment—Vivid-*i* Console (*2)

Degree of protection against electric shock:

- Type BF Applied part (*3) (for Probes marked with BF symbol)
- Continuous Operation
- System is Ordinary Equipment (IPX0)
- Probes are IPX1

***1. Class I Equipment**

EQUIPMENT in which protection against electric shock does not rely on BASIC INSULATION only, but includes a protective earth ground. This additional safety precaution prevents exposed metal parts from becoming LIVE in the event of an insulation failure.

***2. Class II Equipment**

EQUIPMENT in which protection against electric shock does not rely on BASIC INSULATION only, but in which additional safety precautions such as DOUBLE INSULATION or REINFORCED INSULATION are provided.

***3. Type BF Applied Part**

TYPE B APPLIED PART providing a specified degree of protection against electric shock, with particular regard to allowable LEAKAGE CURRENT.

Table 14-1: Type BF Equipment

	Normal Mode	Single Fault Condition
Patient Leakage Current	Less than 100 microA	Less than 500 microA

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

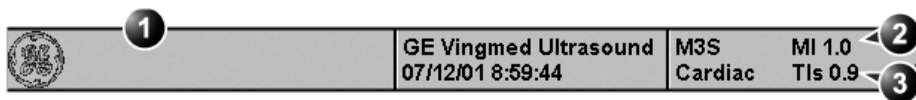
MI is the estimated likelihood of tissue damage due to cavitation. The absolute maximum limits of the MI is 1.9 as set by the FDA 510(k) guidance of 1997.

Ispta

The Ispta is the Spatial Peak Temporal Average Intensity. The absolute maximum limit of Ispta is 720 MW/cm² as set by the FDA 510(k) guidance of 1997.

Acoustic output and display on the Vivid i

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 *i* 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.

The Vivid *i* has an internal limit of 4.0 on TI. IEC87 has suggested some time dependent thresholds that are partly implemented on the Vivid *i* as color-coding of the thermal index. The color-coding scheme together with the thermal exposure times in the table below are not meant as limits on TI or exposure time, but as an aid for the operator. Note that the Vivid *i* does not monitor the thermal exposure time. The displayed TI is coded as follow:

TI	Color	Recommended thermal exposure time
0.0–0.4	Dimmed	-
0.4–1.5	White	-
1.5–2.0	White	< 12 h
2.0–3.0	White	< 1 h
3.0–4.0	Red	< 15 min.

The maximum possible MI and Ispta on the Vivid *i* is within the limits set in Track 3 in the FDA 510(k) guide of 1997, MI < 1.9 and Ispta < 720 mW/cm².

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 Ultrasound sales representative for training assistance.

Safety statement

GE Vingmed Ultrasound safety statement

Although no harmful biological effects have been demonstrated for ultrasound frequencies, intensities and exposure times used in examination with the GE Vingmed Vivid *i* system, GE Vingmed Ultrasound 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 46, 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 Chapter 3, "Scanning Modes" on page 75, 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.

Patient safety

Patient identification



WARNING

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 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.



CAUTION

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.

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 use and care precautions described in Chapter 10, "Probes" on page 263.

Personnel and equipment safety



DANGER

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



WARNING

The internal circuits of the unit use high voltages, capable of causing serious injury or death by electrical shock.

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.

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 10, "Probes" on page 263, 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

Device classifications

The Vivid *i* ultrasound unit is a Class I device, type BF, according to Sub-clause 14 of IEC 60601-1 (1988).

Internally connected peripheral devices

The system, together with peripheral devices, such as video tape recorders and printers, meets UL2601-1 and IEC 60601-1 (1988) 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.

Internally connected battery

Remove the primary battery if the internal battery is not likely to be used for some time.

External Connection of other peripheral devices



CAUTION

External devices can be used only if CE marked and in compliance with related standards (EN 60601-1 or EN 60950). Conformance to EN 60601-1-1 (2000) must be verified.

External devices meeting EN 60950 should be kept outside of the patient environment, as defined in IEC 60601-1-1 (2000).

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 UL2601-1 and IEC 60601-1 (1988) 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 (2001) (IEC 60601-1-2 (2001)).

All 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 EMC can cause distortion, degradation, or artifacts in the ultrasound image which could potentially obscure diagnostic information.

There is no guarantee that interference will not occur in a particular installation. If this equipment is found to cause or respond to interference, which may be determined by turning equipment on and off, qualified service personnel should 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.

Do not use devices which intentionally transmit RF signals, for example, cellular phones, transceivers, or radio controlled products, in the vicinity of this equipment as it may cause performance outside the published specifications. Keep the power to these types of devices turned off when near this equipment.

Environmental protection

System disposal

To be added

Battery disposal

To be added

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